

P r o c e e d i n g s
The 6th Joint Symposium
between
Kagawa University
and
Chiang Mai University
-Healthy Aging and Sustainable Society-

August 27-30, 2016
Kagawa University
Kagawa, Japan

Organized by
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Chiang Mai University

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Welcome Message

It is with great pleasure for us at Kagawa University to once again, welcome our friends from Chiang Mai University to the Joint Symposium.

This year, we at Kagawa University, are honored to be hosting the 6th CMU-KU Joint Symposium. This symposium has come a long way since CMU launched the 1st Symposium at Chiang Mai in 2007. This means that we are celebrating the 10th year since the start of this endeavor. This event also offers us an opportunity to reiterate the preeminent position of CMU in the scheme of international relations at KU.

For this symposium, we are delighted to have almost 50 delegates coming from CMU, headed by President Niwes. Of these, about 40 delegates, including 10 graduate students, shall be actively presenting in their respective fields. From KU side, we have about 70 delegates, including 25 graduate students, presenting their research.

The overall theme for the symposium is “Healthy Aging and Sustainable Society” while the five sub-themes are Social Environment Studies for Sustainability, Social Economic and Business Studies for Sustainability, Aging and Lifestyle Related Diseases, Applied Science and Engineering, and Agriculture and Biotechnology. In addition, there shall also be a session for posters with submissions from both CMU and KU students.

The pre-symposium excursion offers our friends from CMU to visit three facilities that Kagawa Prefecture is well known for. There are glove making, yellowtail fish farming, and sweets manufacturing using cane sugar.

This symposium shall also witness the signing and renewal of the Memorandum of Understanding originally signed in 1990 by the Presidents of CMU and KU.

In closing, I hope that the CMU delegates will find this symposium to be as enjoyable and fruitful as the previous ones. We look forward to further strengthening our ties with CMU in the future.



Seigo Nagao, M.D., Ph.D.

President

Kagawa University



Message from the CMU President



On behalf of Chiang Mai University, I would like to thank Kagawa University for its warm welcome and hosting the 6th Joint Symposium between Kagawa University and Chiang Mai University, 28-30 August 2016 at Kagawa University, Japan.

Chiang Mai University, represented by 44 delegates, including 31 oral presentations, from 12 faculties, is honored to join the 6th Joint Research Symposium, with its focus on “Healthy Aging and Sustainable Society” through five sub-themes: Social Environment Studies for Sustainability, Social Economic and Business Studies for Sustainability, Aging and Lifestyle Related Diseases, Applied Science and Engineering, and Agriculture and Biotechnology.

In addition, this symposium also provides an opportunity for our two universities to renew and update our Memorandum of Understanding (MOU), first signed in 1990.

We would also like to acknowledge and honor the long-term collaboration between our two faculties of medicine, which have been working closely together for 10 years.

This symposium is an excellent forum for discussing both the results of our joint research and proposals for future collaboration, as well as to begin preparations for our 7th symposium to be held in Chiang Mai, Thailand.

I sincerely hope that this symposium will increase the interaction and cooperation between our two universities in research, knowledge, and experience.

N. Nantachit

Clinical Professor Niwes Nantachit, M.D.
President of Chiang Mai University

Congratulatory Message from Mr. Shinya Aoki,
Consul-General of Japan in Chiang Mai

On the occasion of the opening ceremony of the 6th Joint Symposium
between Chiang Mai University and Kagawa University in August 2016

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Sawadee khrap! It is my great honor to deliver this message on the occasion of the 6th Joint Symposium between Kagawa University and Chiang Mai University.

Chiang Mai University (CMU) is one of the most prestigious universities in Thailand and the academic hub of the north region. For more than 50 years, CMU has produced many graduates of talent in the various fields and contributed to internal and regional development.

The Consulate-General of Japan in Chiang Mai, as the representative of the Japanese Government, has a close relationship with CMU and cooperates together to expand academic exchanges and the cultivation of human resources. One of our recent cooperation activities was the “Project for Improvement of Facilities of Japanese Studies Center of CMU in FY 2014”. This project, funded by a grant from the Japanese Government (Grant Assistance for Cultural Grassroots Projects) Scheme, enabled the rehabilitation of the Japanese Studies Center. The grant amount was 3 million Baht, about 9.54 million Yen. We expect that this center will be further used for academic exchanges and the development of Japanese studies in the future.

I recognize that the relationship between CMU and Kagawa University is the one of the most successful cases, because this cooperation has extended not only to the exchange of human resources but also to international collaboration and partnerships between the public and private sectors. The project for the introduction of new medical technology, which is a JICA scheme, is highly valued and has received favorable attention from both the Thai Government and Japanese residents in Chiang Mai. I have heard that another project, “Rare sugar research,” is also going well.

At the end of last year, the ASEAN Economic Community (AEC) was launched. The northern region of Thailand is expected to be international gateway linking to Myanmar, Laos and the southern part of China. In this context, the academic

relationship between the universities in both countries becomes more mutually beneficial, and I believe, the relationship between CMU and Kagawa University is a successful model of the “Win-Win relationship.”

Finally I would like to express my sincere thanks to both Universities for holding this symposium and hope that the close relationship and cooperation of both universities will be further developed. I wish everyone continued good health, prosperity, and further success.

Welcome Address from the Organizing Committee Chair

On this auspicious occasion, it is with great pleasure and honor for us to welcome such a big delegation from Chiang Mai. Let me first offer my sincere appreciation to Chiang Mai University (CMU) for the long friendship which began in 1990 when our two institutions signed the Memorandum of Understanding. I am also delighted to note that this year, we have reached a milestone in celebrating the 10th Anniversary of the Joint Symposium.

Kagawa University (KU) has over 80 partnership programs with universities around the world. At KU, we place CMU as one of the most important partner universities. Along this line, KU and CMU have been collaborating in multi-disciplinary education and research since 2005.

This collaboration led us to launch the inaugural Joint Symposium in 2007 in Chiang Mai. CMU continued on to host the 3rd symposium in 2010, and the 5th symposium in 2014. Meanwhile, KU hosted the 2nd symposium in 2008, and the 4th symposium in 2012. At a personal level, I was fortunate enough to be able to participate in all the previous 5 symposiums. At this point of time, I think we can proudly announce that our collaboration has been markedly developed and expanded compared to the situation 10 years ago. This is manifested by the frequent mutual visits of researchers and students from both our institutions. Without doubt, these movements consequently contributed in no small way to strengthen our relationship.


For the current Joint Symposium at Kagawa, we try our utmost best to provide a pleasant ‘homely’ atmosphere to make CMU delegates feel as relaxed as possible. We urge all CMU and KU delegates to take advantage of the opportunities available, and to get acquainted with as many potential collaborators as possible. This is a great chance for all of us to discuss how to further cultivate and enhance our win-win partnership for the coming decade.

We made a ‘symposium badge’ as a souvenir for all delegates. The badge features the well-known ‘Seto-Ohashi’ (Bridge) in Kagawa. We would like to imagine that this bridge symbolizes the strong and close relationship between CMU and KU, as well as representing the connection between the past and the future.

In addition to the sessions, we hope all CMU delegates can enjoy the other activities such as the excursion tour to Higashi Kagawa City, and the performances and local cuisines at the Welcome and Farewell Banquets. CMU delegates who have an inclination for artwork may wish to visit the Takamatsu ‘Sunport’ area whereby the International Art Festival “Setouchi Triennale 2016” is held.

Finally, please do not hesitate to consult us should you need help or advice. We shall do our best to help make your stay comfortable and productive.




Masaaki Tokuda, M.D.
Vice President, Kagawa University

KAGAWA UNIVERSITY COMMITTEES

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Ms. Priraya Rithaporn	Coordinator, Research Administration Center

PROGRAM

The 6th Joint Symposium between Kagawa University and Chiang Mai University
27th- 30th August, 2016

27 August, 2016 (Sat)

For CMU Delegates:

- 12:00-17:00 **Field Trip to Higashi-Kagawa City**
- 17:30-19:30 **Dinner at Tamoya On'na-dojō**

28 August, 2016 (Sun)

Venue: FL1, North Block, Kagawa University

- 9:00-9:30 **Registration / Poster Set-up**
- 9:30-9:40 **Orientation for Poster Presenters (Room E)**
- 9:40-12:30 **Poster Presentation (Room D1, D2)**
- 12:30-13:30 **Lunch at Cafeteria**

Venue: Multi-Purpose Hall, FL2, Olive Square, Kagawa University

- 13:30-14:30 **Opening Ceremony**
 Opening Remarks
 Prof. Masaaki Tokuda, M.D.
 Vice President, Kagawa University
- Welcome Address**
 Prof. Seigo Nagao, M.D.
 President, Kagawa University
- Keynote Address**
 Clinical. Prof. Niwes Nantachit, M.D.
 President, Chiang Mai University
- Congratulatory Message from Mr. Shinya Aoki, Consul-General of**
 in Chiang Mai
- Ceremony for Signing of Memorandum of Understanding**
- Group Photograph Session**

Special Session

Venue: Multi-Purpose Hall, FL2, Olive Square, Kagawa University

14:30-15:30 SESSION 1a - 10th Anniversary (Medicine)

Introduction of Guests of Honor

Opening Remarks

Prof. Katsumi Imaida

Dean, Faculty of Medicine, Kagawa University

Congratulatory Address

Prof. Watana Navacharoen

Dean, Faculty of Medicine, Chiang Mai University

Reflection of the past 10 years

Prof. Masaaki Tokuda

Vice President, Kagawa University

Prof. Siwaporn Chankrachang

Former Vice Dean for Foreign Affairs, Chiang Mai University

Speeches by Representatives of

Kagawa University and Chiang Mai University Students

Signing "10th Anniversary Declaration"

Group Photograph Session

Research Presentation

Venue: FL1, North Block, Kagawa University

14:30-15:30 Parallel sessions

SESSION 1b - Engineering 1 (Room B)

SESSION 1c - Social Sciences & Humanities 1 (Room C)

15:30-15:50 Break

15:50-18:00 Parallel sessions

SESSION 2a - Medicine & Nursing 1 (Room A)

SESSION 2b - Agriculture 1 (Room B)

SESSION 2c - Economics & Business 1 (Room C)

18:30-20:30 Welcome Reception at Hanajukai, Takamatsu

Souvenir Presentations

Ceremony for the donation to Chiang Mai University

by Takamatsu Chuo Rotary Club

29 August, 2016 (Mon)

Research Presentation

Venue: FL1, North Block, Kagawa University

09:00-10:20

Parallel sessions

SESSION 3a - Medicine & Nursing 2 (Room A)

SESSION 3b - Engineering 2 (Room B)

SESSION 3c - Economics & Business 2 (Room C)

10:20-10:40

Break

10:40-12:00

Parallel sessions

SESSION 4a - Medicine & Nursing 3 (Room A)

SESSION 4b - Agriculture 2 (Room B)

SESSION 4c - Economics & Business 3 (Room C)

12:00-13:00

Lunch at Cafeteria

13:00-15:00

Parallel sessions

SESSION 5a - Medicine & Nursing 4 (Room A)

SESSION 5b - Engineering 3 (Room B)

SESSION 5c - Social Sciences & Humanities 2 (Room C)

15:00-15:20

Break

15:20-18:00

Parallel sessions

SESSION 6a - Medicine & Nursing 5 (Room A)

SESSION 6b - Agriculture 3 (Room B)

SESSION 6c - Social Sciences & Humanities 3 (Room C)

18:30-20:30

Farewell Dinner at Rehga Hotel Zest, Takamatsu

"Best Poster Presentation" Award

30 August, 2016 (Tue)

Venue: Multi-Purpose Hall, FL2, Olive Square, Kagawa University

9:00-11:00

Panel Discussion

**Title: Celebrating Ten Years of the KU-CMU Joint Symposium
- Reflections of the past and recommendations for the future -**

Moderator: KU - Prof. Lrong Lim, International Office

Panelist Presentations

KU

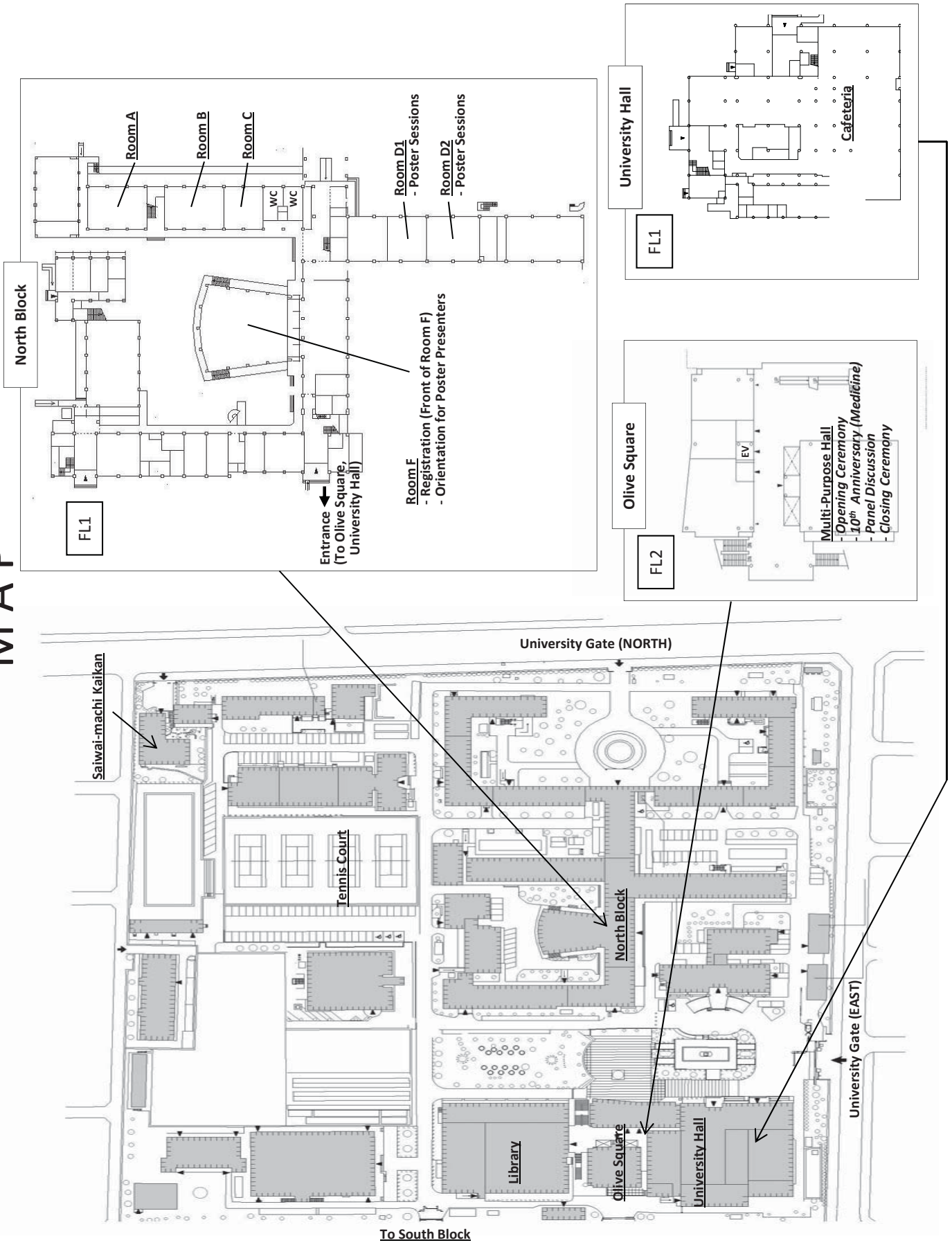
1. Reflection of KU-CMU collaborations in the last 10 years;
research, education and more
by Prof. Masaaki Tokuda, Vice President International Affairs
2. The present and future of the globalization on research and education
in agricultural and food science
by Prof. Hirotooshi Tamura, Faculty of Agriculture
3. Collaboration and possible Academic Exchanges in Business and
Economics with a special emphasis on Tourism
by Prof. Ravindra Ranade, Faculty of Economics
4. Collaboration in the Engineering Field
by Prof. Hiroyuki Tarumi, Faculty of Engineering

CMU

1. Symposium Assessment and Joint Research Possibilities
by Associate Professor Dr. Avorn Opatpatanakit, Vice President
2. Rare Sugar and Related Enzyme Collaboration
by Professor Dr. Saisamorn Lumyong, Faculty of Science
3. Social Sciences and Humanities in the Future Collaboration
by Assistant Professor Narong Sikhiram, Faculty of Humanities
4. Next Decade of Research Collaboration
by Professor Dr. Kom Sukontason, M.D., Faculty of Medicine

11:00-11:20	Break
11:20-12:00	Closing Ceremony Closing Address by Prof. Masaaki Tokuda, M.D.
12:00-13:00	Lunch at Cafeteria
13:30-17:30	Shopping at YouMe Town Takamatsu
17:30	Depart for Kansai International Airport

MAP



The 6th Joint Symposium between KU and CMU

28 August, 2016 (Sun)

SESSION 1a - 10th Anniversary (Medicine)

Venue: Multi-Purpose Hall, FL2, Olive Square

SESSION 1b - Engineering 1

Venue: Room B, FL1, North Block

Chair Persons: Hiroyuki Tarumi, KU

Chayanon Hansapinyo, CMU

14:30-14:50	Preparation of Barium Lithium Titanate Ternary Compound and Its Dielectric Properties	Hao Ma	KU
14:50-15:10	Hydrothermal Synthesis of [111]-faceted Anatase TiO ₂ Nanocrystals from Titanium(IV) Isopropoxide for High Performance Photocatalysts and Dye-sensitized Solar Cells	Linfeng Xu	KU
15:10-15:30	Fabrication and Characterization of Ferroelectric Mesocrystalline BaTiO ₃ -Bi _{0.5} Na _{0.5} TiO ₃ Nanocomposites	Wenxiong Zhang	KU

SESSION 1c - Social Sciences & Humanities 1

Venue: Room C, FL1, North Block

Chair Persons: Toru Terao, KU

Narong Sikhiram, CMU

14:30-14:50	Living Spaces in Comparative Perspectives	Satoshi Murayama	KU
14:50-15:10	The discussion on community-led approach in conservation management: case study; Pai, Thailand	Piyadech Arkarapoti Wong	CMU
15:10-15:30	An Overview of Legal Developments in Community-Based Fisheries Co-management in Early Modern and Modern Japan	Hiroko Nakamura	KU

SESSION 2a - Medicine & Nursing 1**Venue: Room A, FL1, North Block**Chair Persons: Masaaki Tokuda, KU
Kom Sukontason, CMU

16:00-16:30	Overview of JICA Grassroots Technical Cooperation Project Mobile CTG, diabetes mellitus and obesity control using rare sugars.	Masaaki Tokuda	KU
16:30-16:50	Effects of D-allulose (psicose) with sucrose beverage on glucose tolerance and insulin levels	Supawan Buranapin	CMU
16:50-17:10	Perinatal Telemedicine in Remote area in Chiangmai Province	Supatra Sirichotiyakul	CMU
17:10-17:30	Study of hepatitis B vaccination to students whom firstly demonstrated anti-HBs negative or titer < 10 mIU/ml	Prapan Jutavijittum	CMU

SESSION 2b - Agriculture 1**Venue: Room B, FL1, North Block**Chair Persons: Osamu KAWAMURA, KU
Saisamorn Lumyong, CMU

15:50-16:10	Functional Food Properties of Edible Wild Mushroom	Saisamorn Lumyong	CMU
16:10-16:30	The effect of temperatures on phase diagram and the low-energy nano-emulsification of the water/polyoxyethylene (20) sorbitan monostearate (Tween60)/vegetable oil system	Waraporn Prasert	KU
16:30-16:50	Application of Plot Database for Assessment of Soil Nutrient Balance in Farming System of Agricultural Resource System Research Station	Tupthai Norsuwan	CMU
16:50-17:10	Evaluation of liquid-liquid extraction method for Tom Yum flavor	Isnaillaila Paramasari	KU
17:10-17:30	Effects of Recombinant <i>Saccharomyces cerevisiae</i> on Ruminal Degradability of Napier and Ruzi in Thai Native Cattle	Soparak Khemarach	CMU
17:30-17:50	Occurrence of Microcystis in ponds of Kagawa (2015)	Osamu Kawamura	KU

SESSION 2c - Economics & Business 1**Venue: Room C, FL1, North Block**

Chair Person: Ravindra Ranade, KU

15:50-16:10	Gandhi's Theory of Trusteeship	Kazuya Ishii	KU
16:10-16:30	The Contribution of International Organization Policies to the Globalization of Higher Education	Masaru Fujikawa	KU
16:30-16:50	Stakeholders Treatment and Long-run Returns of Initial Public Offering Firms in The Stock Exchange of Thailand	Ariyapong Panstriwong	CMU
16:50-17:10	Innovation and Creativity Cultural Capital on Wellness Knowledge in Thailand for Sustainable Tourisms	Ploykwan Jedeejit	CMU
17:10-17:30	Analysis of Spatial Impact of the Setouchi International Art Festivals	Deokkyum Kim	KU
17:30-17:50	Sustainability in Chiang Mai's Maize Production Management: A Holistic Approach	Supalin Saranwong	CMU

29 August, 2016 (Mon)**SESSION 3a - Medicine & Nursing 2****Venue: Room A, FL1, North Block**Chair Persons: Akram Hossain, KU
Supanimit Teekachunhatean, CMU

9:00-9:20	Critical role of proteinase-activated receptor 1 in pathogenesis of pulmonary hypertension	Katsuya Hirano	KU
9:20-9:40	Responses of renal hemodynamics and functions to acute administration of a SGLT2 inhibitor in anesthetized rats	Ansary Tuba	KU
9:40-10:00	Internal Consistency and Inter-rater Reliability of The Functional Test for Hemiplegic Upper Extremity in Persons with Hemiplegia-Thai Version	Pheangrawee Pingmuang	CMU
10:00-10:20	Reconstruction of Input Function for Ultra Rapid PET CBF and CMRO ₂ Examination	Nobuyuki Kudomi	KU

SESSION 3b - Engineering 2**Venue: Room B, FL1, North Block**Chair Persons: Hiroyuki Tarumi, KU
Chayanon Hansapinyo, CMU

9:00-9:20	Classification and Dynamic Analysis of Historic Pagodas in Chiangmai	Chayanon Hansapinyo	CMU
9:20-9:40	Prediction model of deterioration process of concrete structure subjected to Chloride induced damage	Manabu Matsushima	KU
9:40-10:00	Study on Regional Characteristics of Wall Clay for Mud Walls	Mitsuhiro Miyamoto	KU
10:00-10:20	Forest burning prevention for Asia sustainability	Nobutaka Ito	CMU

SESSION 3c - Economics & Business 2**Venue: Room C, FL1, North Block**

Chair Person: Roengchai Tanuschat, CMU

9:00-9:20	The relationship between auditor communication style, psychological comfort and trust of Thai listed company	Naruanard Sarapaivanich	CMU
9:20-9:40	New Business Development Processes of Market Oriented Companies in the Japanese Apparel Industry	Kazutaka Komiya	KU

SESSION 4a - Medicine & Nursing 3**Venue: Room A, FL1, North Block**Chair Persons: Kimie Tanimoto, KU
Pratum Soivong, CMU

10:40-11:00	Changes of memory function and resting electroencephalography by various aromatic stimulation	Tetsuo Touge	KU
11:00-11:20	Association between daily life activities and blood pressure increase : Three-year longitudinal study in Japanese male employees living in suburban cities	Takako Ichihara	KU
11:20-11:40	Prevalence and Risk of Poor Outcomes in Elderly Patients with Hemorrhagic Stroke in Maharaj Nakorn Chiang Mai Hospital, Chiang Mai, Thailand	Rujee Rattanasathien	CMU
11:40-12:00	Non-cognitive skills and health problems for junior high school students in Japan	Hiromi Suzuki	KU

SESSION 4b - Agriculture 2**Venue: Room B, FL1, North Block**Chair Persons: Kazuya Akimitsu, KU
Wasu Pathom-Aree, CMU

10:40-11:00	Rare Sugar: A New "Signal" in Plant Signal Transductions	Kazuya Akimitsu	KU
11:00-11:20	Plant growth promoting actinomycetes from mycorrhiza spores	Wasu Pathom-Aree	CMU
11:20-11:40	Retarding activity of 6-O-decanoyl-2-deoxy-D-allose on plant growth	Md. Tazul Islam Chowdhury	KU
11:40-12:00	Selection of <i>Cordyceps militaris</i> Isolates for Rice-based Medium Cultivation	Naradorn Chui-Chai	CMU

SESSION 4c - Economics & Business 3**Venue: Room C, FL1, North Block**

Chair Person: Ravindra Ranade, KU

10:40-11:00	The Optimum Portfolio of ASEAN Stock Markets using GARCH-EVT Copula Model	Roengchai Tansuchat	CMU
11:00-11:20	Theory and Application of the Wald Test of One-way Effect Causal Measure	Feng Yao	KU
11:20-11:40	Unimodal Income Distribution, Marginal Utility of Money Income And Indices of Happiness	Ravindra Ranade	KU

SESSION 5a - Medicine & Nursing 4**Venue: Room A, FL1, North Block**Chair Persons: Kenji Wada, KU
Supawan Buranapin, CMU

13:00-13:20	Introduction of the preventive measures against Lifestyle-related diseases with Specific Health checkups and Specific counseling guidance in Brunei Darussalam	Takeshi Yoda	KU
13:20-13:40	Migraine, metabolic syndrome and obesity: A cross-sectional study	Surat Tanprawate	CMU
13:40-14:00	Stage of Readiness to Perform Health Behaviors among Older Adults with Diabetes Mellitus	Pratum Soivong	CMU
14:00-14:20	Effect of rare sugar D-allulose (D-psicose) on established diabetes in OLETF rats	Akram Hossain	KU

14:20-14:40	Telemedicine and Healthcare System Integration Projects in Kagawa	Hideto Yokoi	KU
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SESSION 5b - Engineering 3

Venue: Room B, FL1, North Block

Chair Persons: Hiroyuki Tarumi, KU
Chayanon Hansapinyo, CMU

13:00-13:20	Steel Corrosion Monitoring for RC Deck of Open Type Wharf by embedded sensor	Shinichiro Okazaki	KU
13:20-13:40	The optimal time to sterilize on Scalpel Handle by Dielectric Barrier Discharge Plasma Technique	Noppakran Ariyaphokhinan	CMU
13:40-14:00	Speech Performance of Fricative Sounds by the Talking Robot	Thanh Vo Nhu	KU
14:00-14:20	A Document Editor with Machine Learning and Language Processing Facilities for Risk Management Handling	Kyosuke Takahashi	KU
14:20-14:35	A Tool Supporting Shogi's Post-Game Discussion on the Internet	Ryo Miura	KU
14:35-14:50	Internet Streaming of Music Live Performance and Supports for Remote Audiences	Kei Miyazaki	KU
14:50-15:05	E-Learning system for scheduling algorithms visualization in JavaScript	Kyohei Nishiyama	KU

SESSION 5c - Social Sciences & Humanities 2

Venue: Room C, FL1, North Block

Chair Persons: Yumiko Takagi, KU
Rajchukarn Tongthaworn, CMU

13:00-13:20	Case study of a naturalistic learner of English with a focus on communication strategies	Paul Batten	KU
13:20-13:40	Learning Characteristics of Thai Elementary Students with Learning Disabilities in Inclusive Mathematics Classroom	Nutjira Busadee	CMU
13:40-14:00	Analyzing the Effects of ESL Communication Strategy Training	Gerardine McCrohan	KU
14:00-14:20	Inclusive Education Challenges for Students with Hearing Impairments: Case Study at Chiang Mai University	Rajchukarn Tongthaworn	CMU

14:20-14:40	Trial production of a motion sensor for supporting disabled people	Eiichi Miyazaki	KU
14:40-15:00	Happiness management and Caregiving management for elderly in Chiang Mai, Thailand	Narong Sikhiram	CMU

SESSION 6a - Medicine & Nursing 5

Venue: Room A, FL1, North Block

Chair Persons: Katsuya Hirano, KU

Prapan Jutavijittum, CMU

15:00-15:20	Evidence of absorption of 3,4-DHPEA-EDA, valuable ingredients in olive oil and fruit by free-moving rats.	Hirotoishi Tamura	KU
15:20-15:40	Effects of Kampo Medicine Rokumigan on the Pharmacokinetics of Soy Isoflavone Genistein in Postmenopausal Women	Supanimit Teekachunhatean	CMU
15:40-16:00	Role of (Pro)renin receptor in the pathogenesis of colon cancer.	Wang Juan	KU
16:00-16:20	Analysis of the regulatory mechanism of D-allose-inducible tumor suppressive factor TXNIP (thioredoxin interacting protein) for development of a new cancer therapy	Kazuyo Kamitori	KU
16:20-16:40	Preparation of ¹⁸ F-labelled rare-sugar D-allose for PET assessment of behavior <i>in vivo</i>	Hiroyuki Yamamoto	KU

SESSION 6b - Agriculture 3

Venue: Room B, FL1, North Block

Chair Persons: Takeshi Katayama, KU

Tri Indrarini Wirjantoro, CMU

15:20-15:40	Impregnation of lactobacilli in dried Hom Dok Mali rice	Tri Indrarini Wirjantoro	CMU
15:40-16:00	Recent advances in the research and development of pharmaceuticals and agrochemicals by utilizing bioactive substances of plants produced in South East Asia, and biomass utilization of fast-growing trees	Takeshi Katayama	KU
16:00-16:20	The identification of chemical compounds from <i>Lagerstroemia speciosa</i> L. Pers.	Krittalak Pasakawee	CMU

16:20-16:40	An Increase of Ferritin Expression from Iron-Induced Nitric Oxide in Senescence <i>Lotus Japonicus</i> Nodule	Mallika Duangkhet	KU
16:40-17:00	Effects of NaCl Stress on Growth and Proline Content in <i>Helianthus annuus</i> L. Seedlings.	Nonglak Ambos	CMU

SESSION 6c - Social Sciences & Humanities 3

Venue: Room C, FL1, North Block

Chair Persons: Paul Batten, KU
Nutjira Busadee, CMU

15:20-15:40	Creation of A Sustainable Asia-America Exchange Program - Consideration of the International Program	Yumiko Takagi	KU
15:40-16:00	Challenges of Thai Alphabets on the Students with Learning Disabilities in Thailand	Rajchukarn Tongthaworn	CMU
16:00-16:20	A Bridge to International Education: The International Exchange and Educational Program for Food Safety Internship	Toru Takamizu, Peter Lutes	KU
16:20-16:40	“Sanuki Program”: Introducing a Sustainable Japanese Language and Culture Program	Lrong Lim, Toru Takamizu	KU
16:40-17:00	Elderly Care: Lessons from the Special Nursing Homes in Sendai, Japan	Liwa Pardthaisong	CMU
17:00-17:20	Climate change of Asian monsoon and its impact on society and humanity	Toru Terao	KU
17:20-17:40	Literature as a World’s Healing Tool: Environmental Sustainability through Ecofeminist Perspectives in Louise Erdrich’s Selected Novels	Wanwisa Saojai	CMU

Oral Presentations

Engineering 1

- *Sustainable Technologies* -

Sunday 28 August, 2016

14:30-15:30

Room B, North Block

Preparation of Barium Lithium Titanate Ternary Compound and Its Dielectric Properties

Hao Ma and Qi Feng

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INTRODUCTION

The BaO–Li₂O–TiO₂ system ternary compounds are attractive materials due to their excellent stability and potential applications as electronic materials. Up to now, some lithium barium titanates, such as Ba₃Li₂Ti₈O₂₀ and Ba₂Li_{2/3}Ti_{16/3}O₁₃, have been synthesized by solid state reaction using Li₂CO₃, BaCO₃ and TiO₂ as starting materials and sol-gel method [1], and their structures have been studied also. However, only a few of studies have been carried out on the physical properties of the ternary BaO–Li₂O–TiO₂ system [2]. These ternary compounds appear to be ion-conductor with a low electronic conductivity [3]. The dielectric properties of this system compounds have not been reported yet. In the present research, we describe novel two-step soft chemical process for the synthesis of crystal-axis oriented Ba₃Li₂Ti₈O₂₀ (BLTO) plate-like particles, fabrication of the oriented BLTO ceramics, and characterization of the dielectric behaviors of the oriented BLTO ceramics.

EXPERIMENTAL PROCEDURE

To synthesize BLTO plate-like nanoparticles, firstly plate-like particles of a layered titanate K_{0.8}Ti_{1.73}Li_{0.27}O₄ (KTLO) with a lepidocrocite-like layered structure were partially reacted with Ba(OH)₂ under solvothermal conditions to obtain plate-like particles of KTLO-BTLO intermediate. In the second step, KTLO-BTLO plate-like particles were calcined to obtain BTLO plate-like particles. For the fabrication of oriented BTLO ceramics by RTGG process, plate-like particles of KTLO or H_{1.07}Ti_{1.73}O₄ (HTO) were used as temperate, and BaCO₃ and Li₂CO₃ were used as matrixes. The non-oriented BLTO ceramics were fabricated by normal solid-state reaction using Li₂CO₃, BaCO₃ and TiO₂ as starting materials.

RESULTS AND DISCUSSIONS

The structures of products were investigated as shown in **Fig. 1**. KTLO and HTO show typical lamellar structure characteristic peaks. KTLO-BTLO intermediate obtained by solvothermal treatment of KTLO in Ba(OH)₂ solution shows lower peak intensity. The single phase of BTLO (JPCDS:43-0189) was obtained after calcination treatment of KTLO-BTLO at 850 °C and also Li₂CO₃-BaCO₃-TiO₂ mixture at 950 °C. BTLO ceramics fabricated by calcination of Li₂CO₃-BaCO₃-TiO₂ mixture compact was single BTLO phase with low crystallinity.

We fabricated various BTLO ceramics by calcination of Li₂CO₃-BaCO₃-TiO₂ mixture compact using different calcination programs. The variations of permittivity with frequency for these BTLO ceramics are shown in **Fig. 2**. The results indicate that the temperature elevation rate strongly affect permittivity; the higher temperature elevation rate, the large permittivity. The BTLO ceramics show the middle values of permittivity but excellent stability with changing

frequency, which indicates the BLTO ceramics are expected as a promising candidate as microwave dielectric materials. The dielectric parameters of BLTO ceramics samples measured at 1 MHz are summarized in Table 1. These samples exhibit excellent dielectric parameters as microwave dielectric materials, which meet the requirements of International Technology Roadmap for Semiconductors (ITRS).

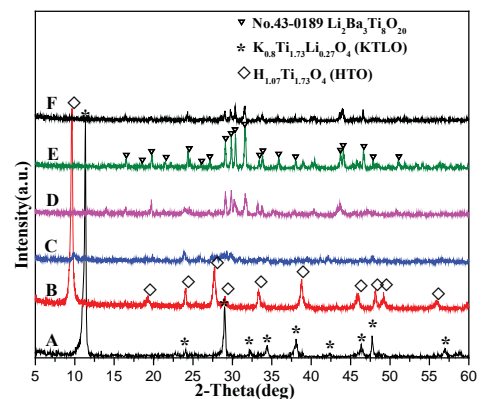


Fig.1. XRD patterns of (A) K_{0.8}Ti_{1.73}Li_{0.27}O₄ (KTLO) particles, (B) H_{1.07}Ti_{1.73}O₄ (HTO) particles, (C) KTLO-BTLO intermediate particles, (D) BTLO particles obtained by calcination of KTLO-BTLO at 850 °C, (E) BLTO particles obtained by calcination of Li₂CO₃-BaCO₃-TiO₂ mixture at 950 °C, (F) non-oriented BLTO ceramic fabricated by calcination of Li₂CO₃-BaCO₃-TiO₂ compact.

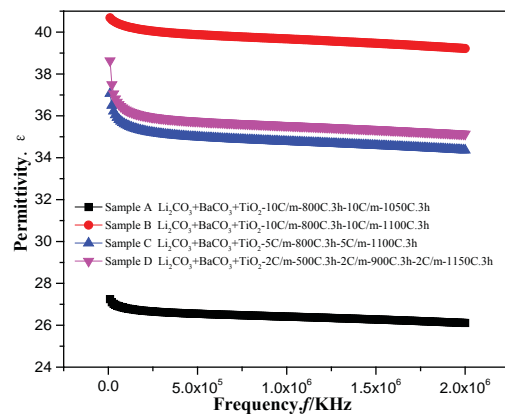


Fig.2. Permittivity versus frequency for Ba₃Li₂Ti₈O₂₀ ceramics fabricated using different calcination programs.

Table 1. Dielectric parameters of Ba₃Li₂Ti₈O₂₀ ceramics samples.

	Sample (A)	Sample (B)	Sample (C)	Sample (D)
Permittivity	26.4	39.7	34.8	35.5
Quality Factor	182	209	149	139
Cap Density (nF/m ²)	216	399	331	358

REFERENCES

- [1] X. Bokhimi, A. Morales, O. Novaro, T. Lopez, E. Sa´nchez, R. Gomez, J. Mater. Res., 10, 2788 (1995).
- [2] C. Suckut, R.A. Howie, A.R. West, L.M. Torres-Mart´inez, J. Mater. Chem., 2, 993 (1992).
- [3] L.M. Torres-Mart´inez, C. Suckut, R. Jimenez, A.R. West, J. Mater. Chem., 4, 5 (1994)

Hydrothermal Synthesis of [111]-faceted Anatase TiO₂ Nanocrystals from Titanium(IV) Isopropoxide for High Performance Photocatalysts and Dye-sensitized Solar Cells

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INTRODUCTION

TiO₂, as one of the most promising semiconductor materials, has become a topic of intense research due to its applications in a wide range of fields, such as photocatalysis, dye-sensitized solar cells, perovskite solar cells, gas sensing and so on. It has been reported that the main influencing factors on the photocatalytic activity are surface area, crystallinity, and crystal-facet on the surface. Most recently, intense attention has been paid to well-exposed high-surface-energy facets, such as {010}, {001} and [111] facets. Up to now, [111]-faceted TiO₂ nanocrystals are synthesized by hydrothermal reaction in hydrofluoric acid solution. In the present study, we report a facile one-pot synthesis of [111]-faceted anatase TiO₂ nanocrystals from titanium(IV) isopropoxide (TTIP) and tetramethylammonium hydroxide (TMAOH) without hydrofluoric acid.

RESULTS AND DISCUSSIONS

To synthesize anatase nanocrystals, TTIP was mixed with TMAOH aqueous solution (TMAOH/TTIP mole ratio=0.3) at room temperature to obtain a suspension solution. And then the sol solution was hydrothermally treated at 200 °C for 24h after adjusting to a desired pH value. The product is named 0.3-200-X (X: pH value of solution). The prepared anatase nanocrystals were characterized using XRD, FE-SEM, and TEM, their photocatalytic performance was investigated by degradation of MB solution under UV light irradiation conditions, and photovoltaic performance are investigated by construction of DSSCs.

The [111]-faceted anatase TiO₂ nanocrystals with different crystal sizes were synthesized by hydrothermal treatment of the suspension solution (Fig 1). The crystal size is strongly dependent on the pH value of reaction solution. The cuboidal anatase nanocrystals with uniform crystal size and [111]-facet on the surface can be synthesized easily by the hydrothermal treatment of the TMA-TTIP suspension solution in the pH range of 9-12 and their crystallinity increases with increasing pH value. The [111]-faceted cubic anatase single nanocrystals are formed by a three-step formation process. In the first step, layered titanate is formed and exfoliated to titanate nanosheets. In the second step, the small titanate nanosheets stack together and are assembled into triangular pyramid nanoparticles. In the final step, the titanate nanosheets are transformed to anatase nanocrystals and then these nanocrystals grow up to form the [111]-faceted cubic anatase single nanocrystals by dissolution-deposition reaction.

Table I shows the characteristics of [111]-faceted anatase nanocrystals and other two TiO₂ samples. The photocatalytic activity increases in an order of ST-20 < 0.3-200-11 < P25 <

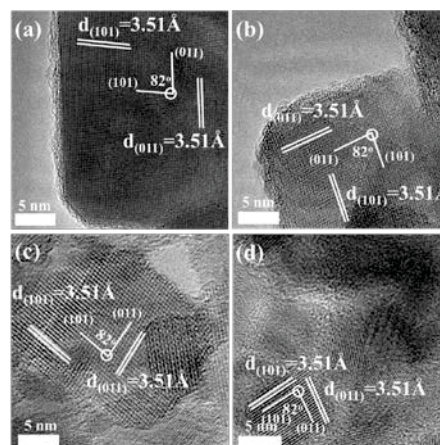


Fig. 1. TEM images of (a) 0.3-200-11; (b) 0.3-200-9; (c) 0.3-200-5; (d) 0.3-200-3 samples

0.3-200-9 < 0.3-200-5, which matches with the bandgap energy increasing order. We think higher bandgap energy of the [111]-faceted nanocrystal is a reason why it shows higher surface photocatalytic activity than that of non-faceted nanocrystal. The higher bandgap energy causes higher energy level of the lowest conduction band that can generate higher potential reductive electrons for the photocatalytic reduction reaction. The DSSCs results also reveal that the [111]-faceted anatase nanocrystals present a higher DSSCs performance than the non-faceted nanocrystals.

TABLE I. EXPOSED FACET, CRYSTAL PHASE, BANDGAP, CRYSTAL SIZE AND SURFACE AREA OF TiO₂ NANOCRYSTALS

Sample	Exposed facet	Crystal phase	E _g (eV)	Crystal size (nm)	S _{BET} (m ² /g)
0.3-200-5	[111]	Anatase	3.08	10	112.3
0.3-200-9	[111]	Anatase	3.06	20	56.3
P25	40% [111]	Anatase/rutile	3.04	20	54.6
0.3-200-11	[111]	Anatase	3.02	50	37.9
ST-20	Non-facet	Anatase	3.01	20	62.6

In conclusion, the [111]-faceted anatase TiO₂ nanocrystals can be synthesized from TTIP using the facile one-pot synthesis process. The [111]-faceted cubic anatase single nanocrystals shows high photocatalytic performance and dye-sensitized solar cells performance.

Fabrication and Characterization of Ferroelectric Mesocrystalline BaTiO₃-Bi_{0.5}Na_{0.5}TiO₃ Nanocomposites

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INTRODUCTION

Piezoelectric materials are commonly used in sensor, actuator, and transducer technologies due to their unique ability to couple electrical and mechanical-energy transformations. Although Pb-contained piezoelectric materials exhibit excellent piezoelectric performance, in recent years, lead-free piezoelectric materials have drawn extensively attentions due to the environmental protection. Bismuth sodium titanate (BNT) is a well-known ferroelectric material with a relatively large remnant polarization ($P_r = 38\mu\text{C}/\text{cm}^2$) and high Curie temperature ($T_c = 320^\circ\text{C}$). However, large coercive field and high conductivity of the un-doped BNT results in difficult poling, which then directs the exploration of BNT toward BNT-based materials. Barium titanate (BT) is also a ferroelectric material but with a low Curie temperature which restrains its application temperature ranges. Herein, an ingenious two-step method was employed to synthesize a BT-BNT nanocomposite with enhanced ferroelectric performance through the combination of two different kinds of ferroelectric materials.

RESULTS AND DISCUSSIONS

Firstly, a protonated titanate $\text{H}_{1.07}\text{Ti}_{1.73}\text{O}_4 \cdot n\text{H}_2\text{O}$ (HTO) crystal with a layered structure and a platelike morphology is reacted with $\text{Ba}(\text{OH})_2$ solution (Ti/Ba mole ratio = 2) under hydrothermal conditions to generate a platelike mesocrystalline BT-HTO nanocomposite [1]. Secondly, the mesocrystalline BT-HTO nanocomposite is mixed with stoichiometric Bi_2O_3 and Na_2CO_3 and then heated at a desired temperature to generate the mesocrystalline BT-BNT nanocomposite with platelike morphology. As far as we know, we are the first one who synthesized this kind of nanocomposite. The formation reaction, nanostructure, and morphology of the obtained mesocrystalline BT-BNT nanocomposites were characterized by XRD and TEM, and their dielectric, ferroelectric and piezoelectric behavior were characterized using an LCR meter, a ferroelectric testing system and SPM system, respectively.

TEM results indicate that the transformation process from HTO to mesocrystalline BT-HTO in the first step reaction is a topotactic reaction. XRD patterns of products obtained by annealing the mixture of (BT-HTO)- Bi_2O_3 - Na_2CO_3 in the second step reaction are shown in Fig. 1. All of BT-HTO, Bi_2O_3 and Na_2CO_3 phases disappeared after annealing at 600°C , and the main phase of the product was BT phase and a small amount of $\text{Bi}_{12}\text{Ti}_{20}$ phase was observed also. The BT and BNT phases were obtained at 700°C . The mixed BT and BNT phases were transformed gradually to $\text{Ba}_{0.5}\text{Bi}_{0.25}\text{Na}_{0.25}\text{TiO}_3$ (BBNT) solid solution phase with increasing temperature above 900°C , and completely to BBNT solid solution phase above 1000°C .

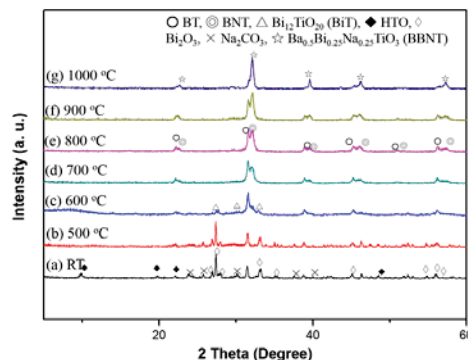


Fig. 1. XRD patterns of (BT-HTO)- Bi_2O_3 - Na_2CO_3 mixture and samples obtained by annealing the mixture at different temperatures for 3 h.

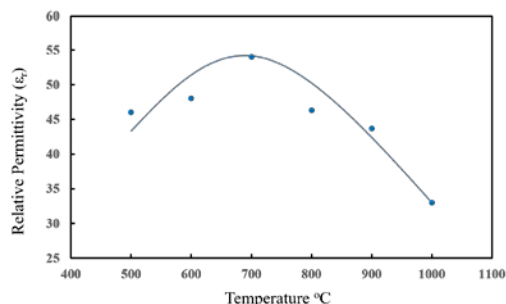


Fig. 2. Variation of dielectric constant (ϵ_r) for samples obtained by annealing (BT-HTO)- Bi_2O_3 - Na_2CO_3 mixture at different temperatures.

TEM nanostructural analysis results reveal that in the formation process of the BT-BNT nanocomposite a mesocrystalline BT- $\text{Bi}_{12}\text{Ti}_{20}$ (BT-BiT) intermediate is formed firstly by a reaction between BT-HTO and Bi_2O_3 , which followed by the reaction with Na_2CO_3 to generate the BT-BNT nanocomposite. The obtained BT-BNT nanocomposite is constructed from well-aligned BT and BNT nanocrystals in the same crystal-axis orientation, indicating formation of mesocrystalline BT-BNT nanocomposite.

Fig. 2 shows the dielectric constant ϵ_r of pellet samples obtained by annealing (BT-HTO)- Bi_2O_3 - Na_2CO_3 pellet at different temperatures. The ϵ_r value increases with increasing the annealing temperature, reaches the maximum at 700°C , and then decreases gradually. The ϵ_r value enhancing up to 700°C is due to formation of mesocrystalline BT-BNT nanocomposite, and the ϵ_r reducing above 700°C is due to transformation of BT-BNT nanocomposite to BBNT solid solution. This result suggests that ϵ_r can be enhanced by introducing the lattice strain at the heteroepitaxial interface between BT and BNT phases with little different lattice constants. The results of ferroelectric and piezoelectric study will be presented at the conference.

REFERENCES

- [1] D. W. Hu, H. Ma, Y. Tanaka, L. F. Zhao, Q. Feng, Chemistry of Materials. 2015, 27, 4983-4994.

Social Sciences and Humanities 1

- Social Science and Quality of Life -

Sunday 28 August, 2016

14:30-15:30

Room C, North Block

Living Spaces in Comparative Perspectives

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INTRODUCTION

The history of mankind is a history of addressing challenges of natural and social disasters [1][2]. After the Great East Japan Earthquake and the nuclear accident in Fukushima, responses among different countries were crucially varied. Germany regarded nuclear power issues a matter of ethics and declared nuclear phase-out, while Japan remains undecided in the aftermath of the disaster [3]. What lies behind these differences?

RESULTS AND DISCUSSIONS

This research project aims to take a mathematical-geographical approach to such “environmental decision-making” issues, which could be observed as population-related phenomena, instead of as political and scientific decisions, because historical demography, economic history and sociological family studies have revealed regional demographic diversity in early modern times and heterogeneous developments in the transition to modern uniformity [4][5]. Inspired from these studies, this project will pursue local/regional analyses in the long-term period from the 17th century to the present in order to propose new guidelines for the local/regional resolution of global environmental issues.

Considering multiple environmental history perspectives [6] on “living spaces”, comparative studies of Europe and Asia – Japan, in particular – have not conventionally explained the differences in the fundamental background of the “living spaces”: Europe experiences fewer volcanic eruptions and earthquakes than Japan does, and would never imagine exotic “typhoons” to come their way. However, for instance, its struggle with cold summers embracing hailstorms caused the diversion of potatoes from feed for horses to a staple food in the Czech Lands [7]. Europe had to resist cold and freezing winters. Conquering nature [8], especially cold winters and cold summers had been the primary challenge in Europe. Europe, especially Northwest Europe, might have found its solution in developing a modern economic society in accordance with “modern” (i.e. civilized, capitalized and rational) state building [9].

In contrast, Japan, located in monsoon Asia, suffers typhoons and other water crises, embraces a volcanic belt in the center and few plains as a result of its mountainous geography, and moreover sits in a seismic area under the influence of the Pacific plate. Even in modern times, many natural disasters can neither be overcome nor completely conquered. Historically, the Japanese people have endeavored to harness nature instead of conquering it, but in the process of modernization, a number of legislations were passed under the name of “conquering natural disasters” as European ideas of conquering nature were adopted as

guidelines for national development. In other words, modernization in Japan was a history of changing values – a transition from harnessing nature to conquering nature [5].

The way people live is more diversified than imaginable, not only on a global scale but also within nations and regions. While great urban agglomerations are formed in countries like Japan, the population is spatially dispersed in Germany. Such patterns of collective living iteratively change with the times and population shifts – as human weights on the Earth - can be understood in the context of temporal and spatial networks. Beginning with Fernand Braudel, and followed by Conrad Totman, renowned scholar of forest environment history, and Osamu Saito, who has pursued economic history studies of the environment [10], has indicated that human history is a history of people balancing the “weight of numbers” and the “riches of the Earth” [11]. However, the “weight of numbers” is not necessary evenly dispersed. The spatial concentration and dispersion of people has had a decisive impact on nature and has served as an important foundation in terms of social and cultural structure.

Where have florae, faunae, and humanity lived in the past? Where do they live today? Where will they live in the future?

ACKNOWLEDGMENT

This research project is supported by the Institute for Humanity and Nature, Kyoto.

REFERENCES

- [1] C. Mauch / C. Pfister, *Natural Disasters, Cultural Responses*, Lanham UK: Lexington Books, 2009.
- [2] G. Fouquet / G. Zeilinger, *Katastrophen im Spätmittelalter*, Darmstadt/Mainz: Philipp von Zabern, 2011.
- [3] S. Murayama, ‘A Narrative Approach to Local Environmental Histories,’ *Journal of Environmental Sociology*, 21 (2015): 122-128 (In Japanese).
- [4] R. Glaser, *Global Change*, Darmstadt: Primus Verlag, 2014.
- [5] S. Murayama, ‘Livestock and the “Industrious Revolution” in Tokugawa Japan (1603-1868),’ in Ts’ui-jung Liu(ed.), *Local Realities and Environmental Changes in the History of East Asia*, Abingdon: Routledge 2016: 27-48.
- [6] J. D. Hughes, *What is Environmental History?* Cambridge/Malden: Polity Press, 2016, 2nd Edition.
- [7] C. Pfister / R. Brázdil, ‘Social vulnerability to climate in the “Little Ice Age,”’ *Climate of the Past*, 2 (2006), 115-129.
- [8] Blackbourn, David, *The Conquest of Nature. Water, Landscape, and the Making of Modern Germany* (New York/London: W. W. Norton & Company, 2006).
- [9] M. Terao, ‘Der Einfluß politischer und gesellschaftlicher Institutionen auf dem Industrialisierungsprozess.’ *Von der Landwirtschaft zur Industrie. Wirtschaftlicher und gesellschaftlicher Wandel im 19. und 20. Jahrhundert.*, Paderborn; München, Wien & Zürich: Ferdinand Schöningh, 1996): 43-60.
- [10] O. Saito, *Kankyo no Keizaishi: Shinrin, Shijo, Kokka* [An Economic History of the Environment: Forests, Markets and the State], Tokyo: Iwanami Shoten, 2014. (In Japanese).
- [11] O. Saito, ‘Pre-Modern Economic Growth Revisited: Japan and the West.’ *Working Papers in Economic History*, No. 16/05. London School of Economics, June 2005.

**The Joint Symposium between KU and CMU
2016**

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**The discussion on community-led approach in
conservation management: case study; Pai,
Thailand**

ViengTai, Pai District, Maehongson Province, Thailand, the example of community-led approach Considering from the idea of the living heritage approach which allows a local community who is regarded in the living heritage site as “long term custodian” to lead policy-making in the participation process, it leads to a question that what is going to be in living heritage site when the community-led is applied. Vieng Tai, Pai District in Thailand is one of the clear example in decision-making of the local community. This town is the prime example of the community-led approach under the pressure of tourism development which occur in Thailand

ViengTai, Pai District in Thailand is one of the tourist attractions in Thailand. This site was recognized and rather popular with the tourists recently. This situation has caused the dramatic change of urban physical and social dimension of the town. It can be seen from the comprehensive view that there was the flow of the enormous amount of money in the tourism business to Pai during 2001 to 2004. These situations made difficult for resistance of the changing in Pai as well as the local young generation seemed to less concern about local heritage conservation but focused mainly on tourism development instead. The issue of decentralization to local authorities also created the counterbalance of three mentioned authorities (one central authority and two local authorities) in Pai. However, the Thailand Tourism Organization promoted Maehongson but was not concerned Pai since the beginning to be part of the tourism promoted plan. These made Pai has been lacked of long term plan for the town expansion. Meanwhile, the rest two local authorities, municipality and TAO which come from the local election also agreed with the approach of the local young generation of Pai which was more cherished the tourism development than the local heritage conservation. These perspective made Pai in present day facing with the urban physical environment changed. In the short future, Pai might probably change to be the tourism town which develop the urban activities to support the full-scale

of tourism business. In order to reduce the local conflict, it would rather better to provide an opportunity for local community or local representative to be a part of decision makers than allows only state to lead and make decision in town activities. However, the decision which has been made tending to gravitate to the needs of the local people, which in case of Pai instead of making it better, it turned to change the physical aspects of town. In the contrary, if the central government was coming back to control as before having the 1997 constitution, Pai has a tendency to become a rural town which was located in the remote area. Also, the living standard of people who lived in this town will stay below than standard when comparing with urban people. Even, the coming of government authority might assist to conserve the physical local heritage of Pai but it is not the sustainable way because it will cause the conflict with the local people who have their own needs which government policies cannot fulfill.

In conclusion, the research found out that in the collaboration process the encouragement of the local community participation is a way that could help to decrease the conflict between the conservation experts and community. It is the actual method which can respond effectively to the true needs of local communities and assist to drive the social mechanism in the appropriate direction. However, to be sustainable in the living heritage site, the role of stakeholders who join in the collaboration process should be in equal. Also, the heterogeneity of stakeholders who joins in should be high in order to gain more information and sources to solve more complex problems. If the local community was left alone to lead the decision-making it might encounter with the same problem as happened in Pai in Thailand because of the lack of negotiation process with other stakeholders who also take part in the collaboration process. The lead of the local community will respond only for the main interest of the local community but not concern for the needs of the other who also being one of the custodians in a heritage site.

Reference

- Lortanavanit, D. (2009). Decentralization, Empowerment and Tourism Development: Pai Town in Maehongson, Thailand. *Southeast Asian Studies*, 47(2).
- Sandstrom, A. (2008). *Policy Networks: The relation between sturcture and performance*. (Doctoral Thesis), Lulea University of Technology, Sweden.
- Sandström, A. C., & Rova, C. V. (2009). *The network structure of adaptive governance -A single case study of a fish management area* (Vol. 4).

Koornneef, F. (2012). *The influence of network structure on the adaptive capacity of collaborative arrangements in Dutch National Landscapes*. (Master degree Master thesis), Utrecht University, Utrecht.

An Overview of Legal Developments in Community-Based Fisheries Co-management in Early Modern and Modern Japan

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INTRODUCTION

Satoumi^a has gained interest within and outside Japan as an approach that supports sustainable ecosystem use and conservation of biodiversity [1]. An important feature of Japanese *satoumi* is community-based fisheries co-management, the success of which has been attributed to its institutional characteristics, key features among which are territorial use rights fisheries (TURFs) and Fisheries Cooperative Associations (FCAs) [2]. While Japan's sustainable resource management practices are sometimes believed to date back to early modern times [3,4], this paper attempts to reveal that the implementation of modern fishery laws marked the transition from a fisheries resource management regime based on a balance of power to modern community-based fisheries co-management led by FCSs, by overlooking historical institutional developments.

RESULTS AND DISCUSSIONS

The Meiji Fishery Law enacted in 1901 (and amended in 1910) was the first law in Japan to put fishery rights and licenses into statutory form. It provided for the allocation of fishery rights in coastal fisheries to be based on "customary practices" and some scholars have said that pre-modern customary practices were followed even after the Meiji period up until the present time [3,4]. However, historical records such as [5] reveal that during the Edo period fishermen were constantly engaged in conflict over access to fishing grounds and over fishing hours, which led to additional or renewed agreement among the stakeholders on spatial and temporal boundaries. Conflicts often occurred in accordance with technological changes [6]. This implies that in early modern times fisheries resource management regimes had been underpinned by a balance of power. In this context, the Meiji Fishery Law may only have acknowledged the local circumstances at the time of its enactment, thus hindering the flexible coordination of access to resources [7]. Shiomi analyzes that fishing villages were exploited for the purpose of re-production in the context of emerging Japanese capitalism. [8].

Today, under the current Fishery Law enacted in 1949, the co-management of Japanese coastal fisheries is carried out by FCAs [1]. Under the Meiji Fishery Law, fishery rights were granted to individuals and Fisheries Societies that later evolved into present-day FCAs. An overview of the

^a *Satoumi* is defined as a "coastal sea with high productivity and biodiversity with human interaction." [9]



Source: photo taken by author in April 2015

Fig. 1. Hinase, Okayama Prefecture: a renowned *satoumi* site in the Seto Inland Sea

development of FCAs hints that although local fishermen have constantly been the decision-makers in modern local fisheries in Japan, their governance arrangements did not always aim to serve the purpose of sustainable resource use. As [2] notes, the well-established characteristic of Japanese fisheries institutions should not be attributed to the historical development of fisheries management regimes during early modern times but rather to reinventions through a process of trial and error.

ACKNOWLEDGMENT

The author thanks Dr. Prof. Satoshi Murayama of the Faculty of Education at Kagawa University for his guidance in preparing this paper.

REFERENCES

- [1] J. Berque and O. Matsuda, "Coastal biodiversity management in Japanese *satoumi*," *Marine Policy* 39. 2013, pp.191-200
- [2] H. Uchida and M. Makino, "Japanese coastal fishery co-management: an overview", in *Case Studies in Fisheries Governance*, FAO Fisheries Technical Paper No. 54. Rome, pp. 221-230
- [3] N.Ninohei, *History of Fisheries Development during the Meiji Period (Meiji gyogo kaitaku-shi)*. Tokyo: Heibonsha, 1981 (in Japanese)
- [4] T. Akimichi, "Satoumi Ecosystems and a New Commons: Ecological and Institutional Linkages between Human and Nature," *Global Environmental Research*, Vol.16 No.2. Tokyo, 2012, pp.163-172
- [5] Hinase Fishery Cooperative Association, *A Copy of Old Documents on Fishing Grounds (Gyojo Kosho Ruisha)*. unknown
- [6] M. Sadakane, *A History of Early Modern Life and Culture: Local Issues (Kinsei no seikatsu bunka-shi: chiiiki no shomondai)*. Tokyo: Seibundo, 1999, p.336
- [7] M. Makino and H. Matsuda, "Co-management in Japanese coastal fisheries.: institutional features and transaction costs," *Marine Policy* 29. 2005, pp.441-450
- [8] T. Shiomi, *The history and nature of fishery laws in Japan (Nippon ni okeru gyogyouhou no rekishi to sono seikaku)*. Tokyo; Nippon Hyoron Sha, 1951
- [9] T. Yanagi, *Japanese Commons in the Coastal Seas: How the Satoumi Concept Harmonizes Human Activities in Coastal Seas with High Productivity and Diversity*. Tokyo: Springer Japan, 2006, p.1

Medicine and Nursing 1

- Aging and Lifestyle Related Diseases -

Sunday 28 August, 2016

16:00-17:30

Room A, North Block

Overview of JICA Grassroots Technical Cooperation Project Mobile CTG, diabetes mellitus and obesity control using rare sugars.

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We have been collaborating various projects under the support of “JICA Grassroots Technical Cooperation Project” from JICA (The Japan International Cooperation Agency) for three years from 2014 to 2016. This project supports the technology transfer from Japan to other countries to develop basic infrastructure or system to assist people to have better life or health. Faculty of Medicine (School of Medicine and School of Nursing), Kagawa University together with Kagawa Prefecture offered the proposal to Faculty of Medicine and Faculty of Nursing, Chiang Mai University and we decided to do a collaboration project to utilize benefits of ICT (Internet Communication Technology) and rare sugars to contribute to improvement of perinatal risks, diabetes and hepatitis risks which are not yet adequately provided to the people especially in rural areas.

1) Perinatal Control Project using Mobile CTG

For the control of perinatal risks, we will introduce mobile CTG (Cardio Toco-Gram) to enable monitoring of baby’s condition in uterus. The data can be transferred by internet or 3G/4G phones. We will also try to set up the electric record system “Hello Baby Program” to run the system better if the demands of CMU hospital meets well. The team led by Dr. Supatra Siricho, Department of Obstetrics and Gynecology, has selected 4 hospitals in Chiang Mai area, Chiang Mai University Hospital as the center and 3 rural ones, Mae Chaem Hospital, Hod Hospital and Dot Tao Hospital. In these hospital, MCTGs have been routinely used for monitoring in more than one thousand cases and diagnosis has been made. This system has been proven to be very useful in these rural areas and we further try to expand the system in the northern Thai area including mountain areas.

Frequency of the usage of Mobile CTG as of 2016.6.2

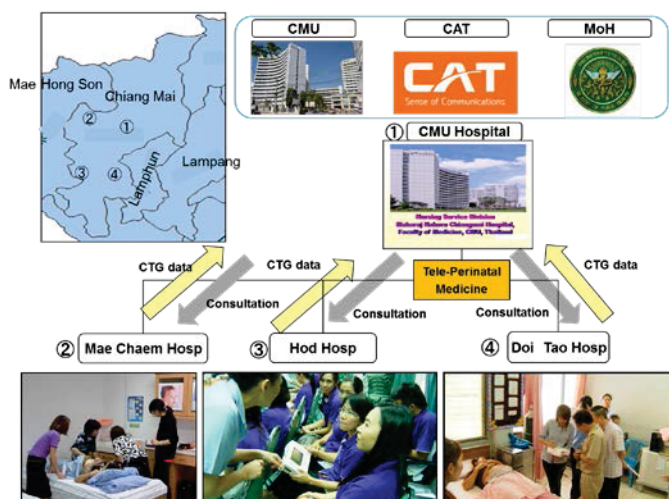
Year	Month	Chiang Mai University Hospital	DoiTao	Hod	MaeChae m	Pang hin Fonn	Total		
		3rd						2nd	1st
2014	9	23					23		
	10						0		
	11	12					12		
	12	39					39		
	Total	74	0	0	0	0	74		
2015	1	27					27		
	2						0		
	3	11	4	22	8		45		
	4	13	4	16	7		40		
	5	7	1	1			9		
	6	13	6	18	2		39		
	7	21	24	27	19		91		
	8	12	45	32	21		110		
	9	13	54	18	12		97		
	10	1	33	18	9		61		
	11	9	24	24	20		77		
	12	9	23	25	7		64		
Total	118	218	201	123	0	660			
2016	1	2	16	29	24		71		
	2	3	16	19	6	5	49		
	3		24	10	9	12	55		
	4		21	20	10	3	54		
	5		33	17	12	5	67		
	6			10			11		
	Total	5	110	105	61	26	307		
Total		197	328	306	184	26	1,041		
Start date		2014,9		2015,3		2016,2			

2) Diabetes mellitus and obesity control project.

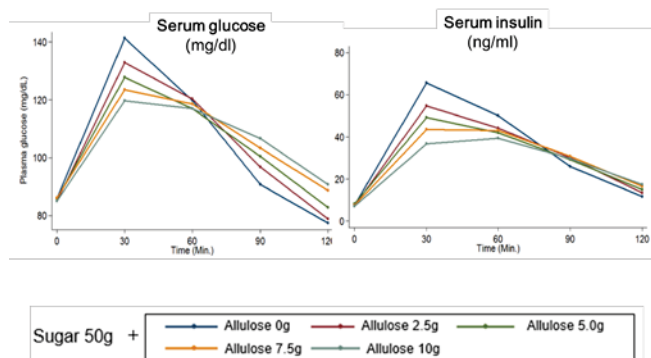
For the diabetes mellitus, we will try to set up the network system to connect between hospitals and clinics to share the data of diabetic patients and to assess their conditions in order for them to have appropriate and adequate control and treatment by appropriate doctors (generalists, specialists) and co-medicals such as nurses, pharmacists, nutritionists and social workers.

Another trial for diabetic and obesity people is to use D-allulose (also called as D-psicose), one of the rare sugars, to lower energy intake and reduce fat accumulation. The collaboration team led by Dr. Supawan Buranapin, Department of Endocrinology, Faculty of Medicine, started the clinical trial of the attenuation of serum glucose level by having Thai healthy volunteers. They were given 50g os sucrose together with various amount of D-allulose (0, 2.5, 5.0, 7.5 and 10.0g). The clear result of attenuation of serum glucose and subsequent attenuation of insulin in a dose-dependent manner were observed. This result was almost identical to what we observed among healthy Japanese volunteers.

Mobile CTG (Cardio-Tocogram)



D-allulose works well for Thai people in 50g sucrose tolerance test



This study elucidated that 2.5-10g of D-allulose to 50g sucrose has an effect on D-glucose elevation in serum. The mechanism of this attenuation can be the inhibitory effect of D-allulose on various digestive enzymes including sucrase (invertase). D-allulose also inhibits the transport of D-glucose and D-fructose through glucose transporters.

The second human trial will try to examine the anti-obesity effect of D-allulose for the obese volunteers whose BMI (body mass index) are greater than 25.

To make Thai functional foods and drinks using rare sugar syrup which has already been available in Japan. Thai custard and Thai tea are the examples to be tried in the near future.

3) Hepatitis B control project

For the hepatitis risks, the team led by Dr. Prapan Jutavijium, Department of Pathology, has tried to reduce the mother-baby transmission of Hepatitis B virus (HBV) and this will lead the safer deliveries. In the vaccination resistant cases, we will try to identify the subtypes of HBV to find an effective method to reduce these cases. It is also important to know how anti-HBV titer is maintained among vaccinated people.

Infant seroprofile	Mother HBeAg + N (%)	Mother HBeAg - N (%)
HBsAg+/anti-HBs-	10 (52.6%)	0 (0%)
HBsAg+/anti-HBs+	0 (0%)	0 (0%)
HBsAg-/anti-HBs+	8 (42.1%)	21 (75%)
HBsAg-/anti-HBs-	1 (5.3%)	7 (25%)
Total	19 (100%)	28 (100%)

Among 3000 pregnant women attending the antenatal clinic at the Mother and Child Hospital in Vientiane, Lao PDR, 174 (5.8%) were HBsAg positive. Out of 47 HBsAg positive mothers, 10 had infants aged 9-12 months who were HBsAg positive. All of the HBsAg positive infants were born to HBeAg positive mothers. Thus, overall 21% of infants born to HBsAg positive mothers or 52.6% of infants born to HBeAg positive mothers became HBsAg positive. This high rate of mother-to-child transmission of HBV in an endemic country is of concern.

4) Summary

JICA Grassroots Technical Cooperation Project has been progressing smoothly and producing good outcomes in all

three projects. It has to be emphasized that we will try to spread out these trials to surrounding countries such as Laos and Myanmar and that the Takamatsu Chuo Rotary Club kindly wishes to support our activities.

Effects of D-allulose (psicose) with sucrose beverage on glucose tolerance and insulin levels

Buranapin S¹, Kosachunhanan N¹, Nimsakul S¹, Likitekaraj V¹, Tokuda M², Yokoi H².

¹ Chiang Mai University, ² Kagawa University

D- allulose has glucose suppression effects in both animal and clinical studies. Mechanism of glucose suppression in animal is by the inhibition of α -glycosidase. D- allulose had similar behavior to D-fructose in its glucose uptake from liver. D- allulose significantly suppressed the blood glucose elevation in glucose loading study on healthy adults. Supplemental D- allulose in the diet reduced postprandial glycemic response and might have anti-diabetic effects.

Our hypothesis is “with D-allulose, subjects should have lowering postprandial plasma glucose levels than those without D-allulose in oral sucrose loading test”.

Aim of the study: To investigate the dose-response effects of D-allulose with sucrose beverage on glucose tolerance and on insulin levels.

Methods: Subjects had 5 oral sucrose tolerance test (OSTT) with varying dose of D-allulose (0, 2.5, 5, 7.5 or 10 gm) which is called product A, B, C, D and E, respectively, with 1 sucrose beverage in a random order once a week for 5 week in a roll. The subjects were asked to do 24-hour dietary record a day prior to each visit as well.

Results: Thirty subjects (11 men and 19 women) completed study and included in the analysis. There were no significant changes in BW, BMI, SBP, DBP and pulse rate during each visit. There was no significant difference in mean fasting plasma glucose or insulin levels among 5 study products. Mean plasma glucose and insulin levels were up to the maximum levels at 30 min after the OSTT in all 5 study products. However, the maximal glucose levels and maximal insulin levels were decreased from product A to product E. The minimal plasma glucose and insulin levels were at 120 min after OSTT in all 5 products and they were increased from product A to product E. Data from the 24-hour dietary record showed that there was no difference in carbohydrate intake, protein intake, fat intake, calories intake and calorie distribution from carbohydrate, protein and fat among each visit

Conclusions:

This study demonstrated that glucose and insulin response after OSTT was at the maximum levels at 30 min after sucrose ingestion. However the plasma glucose and insulin levels were decreased by adding D-allulose to the sucrose with the dose response effect. The more the D-allulose adding, the lower the glucose and insulin response. (**ClinicalTrials.gov ID:** NCT02455934)

Project Title: Perinatal Telemedicine in Remote area in Chiangmai Province

Authors : Supatra Sirichotiyakul, M.D., Assoc. Prof.
Suchaya Luewan, M.D.
Chanane Wanapirak, Assoc. Prof.

Objective :

1. To test the system for transmission of mobile cardiotocography (CTG) data from community hospitals in remote area to Chiang Mai University (CMU) hospital
2. To implement mobile CTG for pregnant women in remote area where there is no obstetrician available nearby and consult the obstetrician in central hospital via telemedicine

Outcomes :

1. Establishment of the transmission system via internet based
2. Identify possible obstacle for telemedicine
3. Evaluate the outcome of pregnant women who use the mobile CTG and tele-consultation
4. Evaluate the satisfaction of health care providers who use tele-consultation

Background

Chiang Mai is the largest city in Northern part of Thailand. Mountain area makes transportation quite difficult in some places. There are 23 community hospitals in Chiang Mai. Only 4 hospitals have obstetricians. High risk pregnancies who need special care will usually be transferred to tertiary care hospitals such as provincial hospital or Chiang Mai University (CMU) hospital. Telemedicine and teleconsultation would help health care providers in community hospitals taking care of their patients without the need to travel to the tertiary care hospital.

CTG is used for continuous monitoring of fetal heart rate (FHR), usually takes about 20-40 minutes, to check the fetal well-being or fetal surveillance. Pregnant women who are high risk usually need to have fetal surveillance testing once or twice a week depend on their risk. Using mobile CTG and teleconsultation to monitor the pregnant women in remote area where no obstetrician is available can help reducing the burden of traveling to tertiary care hospital. In this project, we proposed to use mobile CTG to test the communication system via the internet from the community hospitals outside the city to CMU hospital which is the tertiary care hospital.

Material and Methods

A server was set up at CMU hospital to receive the data from mobile CTG and transmit it to the designated nurses and doctors' email. Three community hospitals including Doi Tao hospital, Hod hospital, and Mae Chaem hospital where there is no obstetrician were selected. Mobile CTG supported by JICA funding were connected to the internet using pocket wifi. The equipments were used with pregnant women in these hospitals for fetal surveillance. The data were transmitted to doctors at CMU and at the same time to doctors and nurses at each community hospital. Then, the doctors at CMU would interpret the status of the fetuses and plan for further treatment if needed via LINE chat.

Results

Between January and December 2015, mobile CTG were used in 331 pregnancy (154 in Doi Tao, 99 in Hod and 78 in Mae Chaem hospital). All 3 hospitals are 1.30 to 3 hours from CMU hospital. Indications for fetal surveillance include gestational age > 34 weeks, decrease fetal movement, hypertension, gestational diabetes, nearly postterm, preterm labor, macrosomia, on admission for delivery. Mobile CTG were also used at Health Promotion Hospital (HPH) which were the smallest unit of health care system in Thailand. Mobile CTG were also used to monitor the patients during transfer in some patients.

Discussion

Using mobile CTG in pregnant women in remote area can help reducing the burden of travelling to see a specialist in tertiary care hospital. The patients can get fetal surveillance from the hospital near their home and receive proper care via teleconsultation with the specialist using various mode of communication such as phone call, LINE or email, depending on the urgency. Mobile CTG is also useful for mobile health unit. Setting up the network for teleconsultation help the health care providers in community hospitals taking care of their patients with more confidence and convenient. They can discuss management plan for their patients with the specialists in CMU hospital.

When using conventional CTG, graph will be interpreted directly from the screen or from the print out. Compare to the conventional CTG, the smaller screen of mobile CTG made it difficult for nurse/doctor on site to interpret the graph directly from the machine. To print out graph from mobile CTG, they would need to find a computer to access their email and print graph from their email. Furthermore, a hard copy of CTG record is still important for an evidence of fetal status in medical care system.

In Thailand, service plan for smart phone to access to the internet cost around 15-20 US\$ a month. Not everyone access to the internet or email from smart phone at all time. Therefore, some doctors and nurses may feel inconvenient to interpret the graph from their smart phones.

To use mobile CTG at the patients' home is difficult in some area in Chiang Mai, especially on the mountain, because there is no signal coverage for mobile phone, therefore no internet transmission. The limitation of mobile CTG is the need for internet access. It can not be used in the area that do not have internet connection. However, we can still bring it to use at the patients' home and interpret the data later when we get back to the area where the internet is available.

In conclusion, implementation of mobile CTG create a network for telemedicine and teleconsultation between health care personnels in 3 community hospitals and obstetricians in CMU hospital. This network promote the consultation system and reduce the burden of the patients to travel to big hospital.

Acknowledgment

This work was the collaboration between Kagawa university and Chiang Mai university, supported by funding from The Japan International Cooperation Agency (JICA). We would like to thank all health care providers and their patients who participate this project.

Study of hepatitis B vaccination to students whom firstly demonstrated anti-HBs negative or titer < 10 mIU/ml

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INTRODUCTION

In Thailand, nation-wide infant vaccination against hepatitis B (HB) virus started in 1992. HB vaccine was given along with other expanded program on immunization (EPI) vaccines at birth, 2 and 6 months of age. The overall coverage with the complete 3-dose course of HB vaccine after its integration into the EPI ranged from 71.2 to 94.3%, attaining an average of 82.3%.^[1] An antibody to HB surface antigen (anti-HBs) titer of ≥ 10 mIU/ml is considered to be protective. About 90% in healthy adults and 95% of infants, children, and adolescents developed anti-HBs titers ≥ 10 mIU/mL after completion of HB vaccination. Titres of anti-HBs after a complete vaccination schedule decline with time to low or undetectable levels.^[2]

This study aimed to know effectiveness of HB vaccination from the persons who birth at the starting time of the integration of HB vaccine into the EPI and to evaluate HB revaccination response of whom firstly demonstrated anti-HBs negative or titer < 10 mIU/ml.

MATERIALS AND METHODS

In 2013, first year students of Chiang Mai University were tested for the presence of HBsAg and quantitative levels of anti-HBs. 249 medical students and 159 nurse students are included in our study. They were 124 male and 284 female, age 17-19 year-old, mean age of 18.16 ± 0.44 years.

The students whom tested negative for HBsAg and anti-HBs negative or titer < 10.0 mIU/ml were called back for 3-dose course of HB revaccination and were asked to enroll in our study. Blood samples were taken at 8-10 months after the 1st dose of HB revaccination. The sera were tested by EIA methods for the presence of anti-HBc and quantitative levels of anti-HBs.

RESULTS AND DISCUSSIONS

Of 408 subjects, 3 (0.7%) were HBsAg-positive and 332 (81.4%) were anti-HBs negative or titer < 10 mIU/ml, and 76 (18.6%) were anti-HBs titer ≥ 10 mIU/ml.

2/248 (0.8%) of the enrolled students were test positive for anti-HBc.

These findings revealed that among persons who born short after adoption of universal neonatal HB immunization in Thailand; at least 0.8% were infected and recovered from HBV infection, 0.7% became HBsAg carriers, and at age 17-19 year-old 81.4% were anti-HBs negative or titer < 10 mIU/ml.

Dose-response of HB revaccination among the students whom firstly demonstrated anti-HBs negative or titer < 10 mIU/ml is shown as table 1.

TABLE 1 DOSE-RESPONSE OF HB REVACCINATION

HB revaccination	Anti-HBs titers	
	Negative or < 10 mIU/mL	≥ 10 mIU/mL
1 dose course	2/2 (28.6%)	0/2 (0%)
2 dose course	0/8 (0%)	8/8 (100.0%)
3 dose course	5/236 (2.1%)	231/236 (97.9%)
Total count	7/246 (2.8%)	239/246 (97.2%)

In this study, the young adults whom firstly demonstrated anti-HBs negative or titer < 10 mIU/ml required at least 2-dose course of HB vaccination to achieve protective levels of anti-HBs. Among the complete 3-dose course of HB revaccinated subjects, only 5/236 (2.1%) have failure to raise anti-HBs ≥ 10 mIU/ml.

Our data support the need of pre-booster check and HB revaccination to whom received neonatal HB vaccination if long time after that they have opportunities for HBV exposure, e.g., joining healthcare disciplines. We suggest the Ministry of Public Health should reconsider for booster of HB vaccine in practice.

REFERENCES

- [1] Jutavijittum P, Jiviriyawat Y, Yousukh A, Hayashi S, Toriyama K. Evaluation of a hepatitis B vaccination program in Chiang Mai, Thailand. *Southeast Asian J Trop Med Public Health* 2005; 36: 207-12.
- [2] FitzSimons D, Hendrickx G, Vorsters A, Van Damme P. Hepatitis B vaccination: a completed schedule enough to control HBV lifelong? *Vaccine* 2013; 31(4):584-90.

Agriculture 1

*- Agriculture, Bioscience, Food Science and
Environmental Science for a Healthy and
Sustainable Society -*

Sunday 28 August, 2016

15:50-17:50

Room B, North Block

Functional Food Properties of Edible Wild Mushroom

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Many wild mushrooms are food source and they are important in medicine due to antibiotic, antidiabetic, antioxidant, antipigment and anticancer properties. According to the local aging society will be increase every year, so food supplements from natural habitat are in demands. We are interested in wild mushrooms for their potential to use as cosmetics and functional foods especially for aging people. Antioxidant, antipigment and antidiabetic properties of four wild popular mushrooms, *Rugiboletus extremiorientalis*, *Russula emetica*, *Russula* sp. and *Phlebobopus portentosus* in northern Thailand were selected as model to demonstrate potential of alternative sources of food supplements for good quality of life. It was found water extraction of *R. extremiorientalis* contained high phenolic and flavonoid contents, and also exhibited the strongest antioxidant activities as well as significant antidiabetic activity. While methanol extract have the highest antipigment activity in *P. portentosus* case.

INTRODUCTION

The edible wild mushrooms are favorite food in northern Thailand. They produce the ground sporocarps in the wet season (June to September) and local farmers keep them for consumption and sale in the local, road-side or city markets. The preliminary investigations at small local markets reveal many wild mushrooms such as *Amanita*, *Astraeus*, *Cantharellus*, *Heimiella*, *Lactarius*, *P. portentosus*, *Termitomyces* and *Russula* are popular for local people [1, 2]. Their nutritional compositions were high in protein (14.0–24.2 %DW), carbohydrate (41.6–65.1% DW) and fiber (8.3–16.8% DW) contents, and low in fat (2.7–9.5% DW). Moreover, wild mushrooms are containing minerals e.g. phosphorus, potassium, manganese, iron and zinc [2]. This study aims to investigate the antioxidant, antipigment and antidiabetic properties of selected four wild popular mushrooms, *Rugiboletus extremiorientalis*, *Russula emetica*, *Russula* sp. and *P. portentosus* in northern Thailand.

RESULTS AND DISCUSSIONS

The effects of different extracts on the DPPH free radical scavenging ability of four wild edible mushrooms. The highest DPPH scavenging activity was achieved with the water extract of *R. extremiorientalis* (457.5 mg TEAC/ g DW), followed by its acidic extract (400.8 mg TEAC/ g DW) and the water extract of *Russula* sp. (343.3 mg TEAC/ g DW), respectively.

The tyrosinase inhibitory activity was only found in the methanolic extract of the *R. emetica*, *R. extremiorientalis* and *P. portentosus* mushroom species. The highest tyrosinase inhibitory activity was found in the *R. extremiorientalis* methanolic extract (0.17 mg KAE/ g DW). Moreover, *R. extremiorientalis* also displayed higher α -glucosidase inhibitory activities than both the *Russula* mushroom species. The methanolic and water extracts of *R. extremiorientalis*

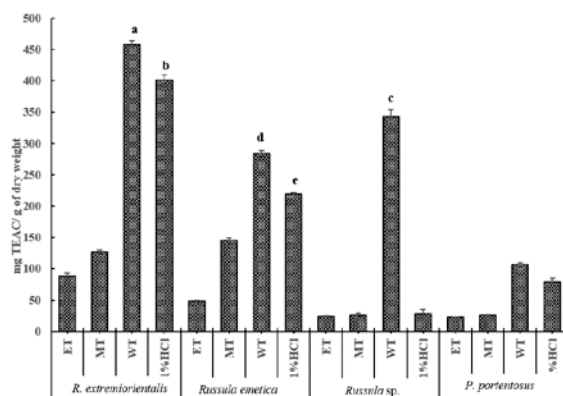


Fig.1 Antioxidant activities of different extracts of the wild edible mushrooms in Thailand measured by DPPH.

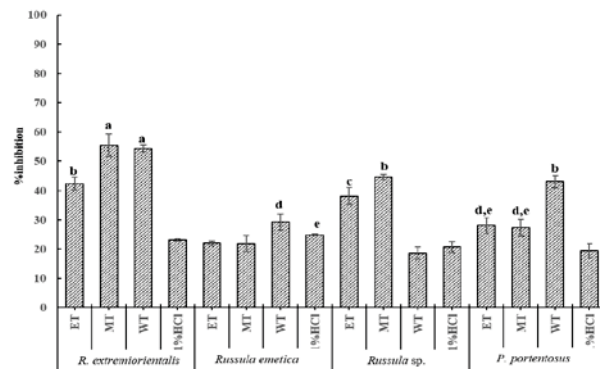


Fig. 2 α -glucosidaseinhibitory activities of different extracts of the wild edible mushrooms in Thailand.

exhibited higher α -glucosidase inhibitory activities (55.5 \pm 3.9 and 54.4 \pm 1.2 % inhibition) than its ethanolic and acidic extract.

This is the first report that has described the phenolic profiles of four wild edible mushroom species that have been collected in Thailand. It is interesting to note that *R. extremiorientalis* mushroom not only exhibited high phenolic content and strong antioxidant properties, but that number of phenolic compounds were also found to be present that were not present in other mushroom species, particularly in its water extract.

ACKNOWLEDGMENT

This work was supported by grant from Chiang Mai University and Thailand Research Fund, Research-Team Association Grant (RTA588006).

REFERENCES

- [1] R. Watling, "Foray in Thailand", *Fungi*, vol. 6, pp. 45-46, 2013.
- [2] R. Sanmee, B. Dell, P. Lumyong, K. Izumori and S. Lumyong, "Nutritive value of popular wild edible mushroom from Northern Thailand," *Food Chem.*, vol. 82, pp. 527-532, 2003.

The effect of temperatures on phase diagram and the low-energy nano-emulsification of the water/ polyoxyethylene (20) sorbitan monostearate (Tween60)/vegetable oil system

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INTRODUCTION

Nano-emulsions are transparent or translucent emulsions with droplet sizes in the range of 50–200 nm, or milky in appearance with droplet sizes up to 500 nm. Despite thermodynamically unstable, nano-emulsions possess a relatively high kinetic stability against aggregation, sedimentation, and/or creaming. In the preparation of nano-emulsion using low-energy method; phase inversion method takes advantage of the chemical energy released by phase transitions taking place during the emulsification process. Proper knowledge of the surfactant phase behavior is important for these emulsification methods, since the phase involved in the emulsification process play a key role in obtaining nano-emulsion with a minimum droplet size and low polydispersity [1]. This work aims to study the effect of temperatures (25, 40, 50, 60, and 70°C) on phase diagram and droplet size of prepared emulsions using low-energy method in water/Tween60/vegetable oil system.

RESULTS AND DISCUSSIONS

The effect of temperature (25–70 °C) on phase behavior and low-energy emulsification courses (A-F course) in water/Tween60/vegetable oil systems is shown as Fig. 1.

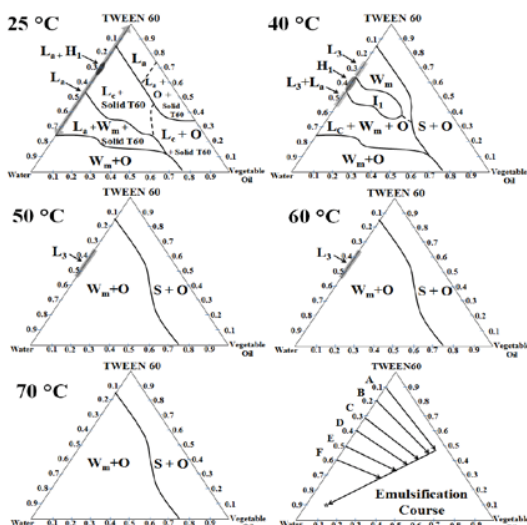


Fig. 1 Phase diagram of water/Tween60/vegetable oil systems at 25, 40, 50, 60, 70°C and emulsification courses which arrange from left to right, top to down, respectively.

At 25 °C, the phase behavior of binary system, sole lamellar (L_a) phase appeared at composition of water:Tween60 between 0.1:0.9 to 0.7:0.3, except the sample at C-point (0.3:0.7) showed coexisting L_a and hexagonal phase (L_a+H_1). In a ternary system, solid Tween60 (SolidT60) was found coexisting with other phases such as liquid crystalline phase (L_c), and micellar phase (W_m). Increasing temperature from 25 °C to 40 °C caused the disappearance of SolidT60 and phase transformation; L_a to H_1 , H_1 to sponge phase (L_3), liquid crystalline phase (L_c) to cubic phase (I_1). Further increasing temperature to 50 °C, a L_a phase and H_1 phase in binary composition transformed to L_3 phase, while an L_3 phase transformed to W_m phase. In ternary compositions, an I_1 phase transformed to W_m+O phase, and an L_c phase disappeared. Therefore at 50 °C W_m+O and $S+O$ phases presented in ternary composition of the diagram. The phases at 60 °C were not different from at 50 °C. Increased temperature to 70 °C, all L_3 phase in binary composition transformed to W_m phase, but did not affect on phases of ternary compositions of the phase diagram.

For preparation of emulsions, the SolidT60 existing at 25 °C caused unsuccessful emulsification. By overlaying the emulsification course onto each phase diagram, the effect of phase behavior along the course on droplet size (Table 1) could be predicted. It is clear that L_3 structure gave an advantage in the formation of small droplet sized emulsions, while H_1 and I_1 structures did not favor the formation of small droplets emulsion.

Table 1 Droplet sizes \pm standard deviations of emulsions prepared by low-energy emulsification methods at different temperature

Preparation Course	Preparation temperature (°C)			
	40	50	60	70
A (0.9:0.1)	551.89 \pm 2.46	240.78 \pm 11.19	251.76 \pm 8.21	323.11 \pm 28.61
B (0.8:0.2)	558.11 \pm 11.97	289.22 \pm 16.03	274.11 \pm 3.42	344.33 \pm 22.17
C (0.7:0.3)	179.56 \pm 19.83	275.11 \pm 15.99	248.00 \pm 18.41	321.78 \pm 12.74
D (0.6:0.4)	1,424.89 \pm 82.79	200.44 \pm 9.99	243.11 \pm 10.34	333.67 \pm 5.36
E (0.5:0.5)	314.00 \pm 7.02	244.78 \pm 38.60	193.44 \pm 11.55	257.39 \pm 23.17
F (0.4:0.6)	1,033.41 \pm 92.23	1,012.22 \pm 6.15	669.97 \pm 11.41	456.78 \pm 53.65

REFERENCES

- [1] M.J. García-Celma, M. Homs, D. Morales, C. Solans, "Nano-emulsions for Pharmaceutical Applications" in *Nanocolloids: A meeting point for scientists and technologists*, 2016, pp. 365 – 388.

Application of Plot Database for Assessment of Soil Nutrient Balance in Farming System of Agricultural Resource System Research Station

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INTRODUCTION

Instead of direct measurements, quantitative assessment for soil fertility provides quick overview and awareness raising [1]. In order to tract soil nutrient balances of nitrogen phosphorus and potassium, key nutrient inputs and outputs were characterized and quantified as regression models in a bounced system [2] [3]. The approach was used to monitor in various scales based on estimation of existed database and soil nutrient-balance modeling [4]. However, the original regression models were developed from the limited data sets and lack of validation [5] but those were lately re-estimated and integrated into land use map, soil map and climate database to evaluate soil nutrient balance spatially [6]. The objective of this study was to use key nutrient inputs and outputs, and the referred soil nutrient models integrated to the tailored farm-plot database in order to evaluate soil nutrient and organic carbon balances of rice-base production system of Agricultural Resource System Research Station, Chiang Mai University, Chiang Mai, Thailand. The explicit results were used to design the management options to maintain soil nutrient balances.

RESULTS AND DSCUSSIONS

Crop nutrient contributions were calculated from dry weight of one square meter of above ground of the crop allotted to residues (straw and stover) and yield (paddy, ear and head) multiplied by percentage of plant nutrients in crop components (TABLE 3). Organic carbon was involved only in the crop residues by incorporating in plot preparation before planting. Those were not included other inputs and outflows. The wide range on organic carbon from rice straw (± 913 kg/ha) was depended on the 37 rice-planted plots which were in the station adopted six cultivars of rice. Plant nutrient depletions were found in cultivation of corn and sunflower, whereas; cultivated rice made the positive balance on all plant nutrient contributions.

Assessment of soil nutrient and soil organic carbon balance through farm-plot database. It reflected an annual consequence of land use in farming system. The rapid findings from the assessment indicated potential problems and led to draw the management options to improve soil nutrient balance in the production system. However the field experiments and direct measurement methods are needed to validate the assessment results and to develop the accuracy of the model in the specific soil condition of the farm system.

TABLE 3 AVERAGE PLAN NUTRIENT CONTRIBUTION BY PLANTED CROPS

Crop	Crop Component	Nutrient contribution (kg/ha)			
		Organic carbon	Nitrogen	Phosphorus	Potassium
Rice	Paddy		71.6 ± 16.2	7.5 ± 1.7	18.7 ± 4.2
	Straw	3523 ± 913	75.2 ± 19.2	7.9 ± 2.0	244.8 ± 63.4
	Balance	3523 ± 913	3.6	0.4	226.1
Corn	Ear		26.5	15.9	38.7
	Stover	3112	25.2	7.6	77.5
	Balance	3112	-1.3	-8.3	38.8
Sun flower	Head		250.6	99.8	92.6
	Stover	2020	52.0	3.6	61.6
	Balance	2020	-198.6	-96.2	-31.0
Sunn hemp	Straw (green manure)	4224 ± 361	171.4 ± 14.7	13.7 ± 1.2	149.0 ± 12.8

ACKNOWLEDGMENT

The authors would like to thank Prof. Dr. Attachai Jintrawet for his advice in writing guideline of this paper. The authors thanks to the Center for Agriculture Resource System Research, Faculty of Agriculture, Chiang Mai University for providing field staffs and facilitation in the assessment.

REFERENCES

- [1] G. R. Conway, "Agricultural Ecology and Farming System Research," in *Agricultural System Research for Deveolopping Countries*, Richnond, N.S.W., Australia, 1985, pp. 43-59.
- [2] G. G. Marten, "Productivity, Stability, sustainability, equitability and autonomy as properties for agroecosystem assessment," *Agricultural System*, pp. 291-316, 1988.
- [3] S. R. Gliessman, "The Agroecosystem Concept," in *Agroecology: Ecological Processes in Sustainable Agriculture*, E. Engles, Ed., Chelsea, Micjigan, Ann Arbor Press, 1988, pp. 17-28.
- [4] S. R. Gliessman, "Agrorcology and Agroecosystems," in *Sustainable Agriculture*, London, Earthscan, 2005, pp. 104-114.
- [5] V. I. Adamchuk, J. W. Hummel, M. T. Morgan and S. K. Upadhyaya, "On-the-go soil sensors for precision agriculture," *Computers and Electronics in Agriculture*, vol. 44, pp. 71-91, 2004.
- [6] D. V. Tran and N. V. Nguyen, "The concept and implementation of precision farming and rice integrated crop management systems for sustainable production in the twenty-first century," in *International Rice Commission Newsletter*, Rome, Food and Agriculture Organization of the United Nation, 2006, pp. 91-102.

Evaluation of liquid-liquid extraction method for Tom Yum flavor

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Tom Yum cuisine has pleasant aroma because of herbal and spicy ingredients such as lemongrass, kaffir limes, and chili pepper. The main aim of this research is to clarify the aroma characteristics of tom yum flavor. To attain the final goal, two kinds of extracts from simultaneous distillation extraction (SDE) and liquid-liquid extraction (LLE) were evaluated and compared the aroma quality by DUO-TRIO sensory test.

INTRODUCTION

Tom Yum is one of Thai cuisine and has been accepted internationally because it has pleasant aroma and taste. Extraction technique has an important role toward the quality of Tom Yum flavor in order to reduce flavor loss during heating and concentrating the extracts. Two kinds of extracts [1] from simultaneous distillation extraction (SDE) and liquid-liquid extraction (LLE) were comparatively evaluated the aroma quality by DUO-TRIO sensory test. LLE was designed for high recovery of original aroma by hexane-methanol extract [2]. DUO-TRIO sensory test was conducted to compare the similarity of the Tom Yum extracts (hexane and methanol extracts from LLE) with the original extract (Tom Yum paste was diluted 6 times of pure water). Oil contents in both phases (LLE) were determined by weighing the residues with comparison to the residues extracted under the vacuum pressure prior to DUO-TRIO sensory test and GC-chromatography analysis.

RESULTS AND DISCUSSION

Hexane and methanol extracts from LLE were recovered by distillation and evaporation of the solvents, individually. The ratio of aroma similarity between methanol and hexane extracts to the reference was 26 : 3 with significant difference of methanol extract against hexane extract ($p < 0.05$) (Figure 1a). Fatty oil contents from 30 mg Tom Yum paste were calculated to be 1329.1mg for hexane extract and 303.1mg for methanol extract. This means that methanol extract from LLE has two advantages in aroma quality and oil residue.

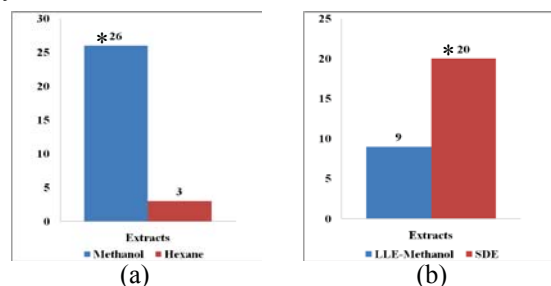


Figure 1. DUO-TRIO sensory test of LLE-Methanol and LLE-hexane extracts (a); LLE-Methanol and SDE extracts (b) (*, $p < 0.05$).

Methanol and SDE extracts were then examined by DUO-TRIO sensory test. SDE extract has significant difference with methanol extract ($p < 0.05$) (Figure 1b). Thus, high aromatic compounds were obtained by SDE when compared with methanol extract from LLE. By SDE, high concentration of citral, lauric acid, capric acid, nerol, and 1,8 cineole were identified by a DB-WAX column equipped with GC-MS (Table 1).

Table 1. Aromatic compounds of Tom Yum by SDE extraction

No.	R. Index	R. Index ref	Compound	Concentration (ppm)
1	1165	1160 ^a	β -myrcene	0.04
2	1219	1212 ^a	1,8-cineole	0.38
3	1453	1452 ^a	2-furancarboxaldehyde	0.15
4	1549	1543 ^a	linalool	0.14
5	1594	1594 ^a	4-terpineol	0.04
6	1610	1602 ^a	citral	2.42
7	1714	1714 ^a	β -bisabolene	0.88
8	1756	1753 ^b	nerol	0.37
9	2084	2083 ^b	caprylic acid	0.67
10	2195	2192 ^a	2-methoxy-4-vinylphenol	0.28
11	2274	2272 ^a	capric acid	0.37
12	2330	2329 ^a	4-allylphenol	0.04
13	2351	2350 ^a	geranic acid	0.08
14	2519	2517 ^b	lauric acid	2.01

^a Retention index reference on VCF online, ^b Retention index reference on "The Pherobase".

Therefore, in the future research work, we will try to characterize the aroma in SDE extract by means of Lod [2] and odor active values.

ACKNOWLEDGMENT

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REFERENCES

- [1] Amanpour, A., Sonmezdag, A. S., Kalebek, H., and Selli, S., GC-MS-Olfactometric characterization of the most aroma-active components in a representative aromatic extract from Iranian saffron (*Crocus sativus* L.)," *Journal of Food Chemistry*, 2015, pp. 251-256.
- [2] Tamura, H., Ueno, S., Naka, A., Zhao, H., Chen, Q.C., Yonekura, L., Yang, R., Isogai, T., Wakui, R., and Shiota, M. The characterization of butter aroma in terms of solvent extraction and Lod method. In *Advances in functional food and flavor chemistry. The 2015 International Chemical Congress of Pacific Basin Societies*. Honolulu (2015).

Effects of Recombinant *Saccharomyces cerevisiae* on Ruminal Degradability of Napier and Ruzi in Thai Native Cattle

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INTRODUCTION

S. cerevisiae (SC) is widely used as a feed additive for ruminants. SC supplements can beneficially modify microbial activity, fermentation and functions in the rumen; it can also decrease lactate-producing bacteria and stabilize ruminal pH. Live yeast cultures have also been shown to stimulate cellulolytic bacteria directly, which may improve ruminal degradability and increase the proportion of propionate, feed intake and average diary gain [1]. Moreover, the beneficial increase in the flow of microbial protein from the rumen is consistent with models that predict stimulation of microbial growth in the rumen and more efficient conversion of ammonia nitrogen into microbial protein [1]. More recent articles have individually covered the use of SC for producing recombinant membrane proteins [2]. Such as studied isolate of *pfaE* genes from *S. putrefaciens* and functionally expressed in SC to produce PUFA [5]. Therefore, the objective of this study was to evaluate the ruminal degradability of roughage supplemented with recombinant *S. cerevisiae*.

RESULTS AND DISCUSSION

Gas production after incubating the roughage at 4 and 8 h of RG were significantly higher than NP1 and PNG ($P < 0.05$) and gas production at 24 and 72 h of RG and NP 1 were significantly highest ($P < 0.05$). While gas production after incubating the roughage supplemented with SC and SCSP for 24 h was significantly higher than C ($P < 0.05$). It can be explained that yeast supplemented in rumen is a higher stability of rumen environment during the day and can increase population cellulolytic bacteria with reduce the growth period in lag phase [3]. For type of roughage found that ME, OMD and SCFA of NP1 and RG were higher PNG. This may be due to the protein of NP1 and RG of this study are higher than PNG (10.20 and 10.49 VS 9.43). In addition, MBY (mg) and % of true digested of RG was higher than NP1 and PNG ($P < 0.05$) because protein of RG in this study is highest (10.49). Therefore, precursor of microbial biomass yield for RG is higher than other roughage. Roughage supplemented with SC and SCSP have the highest ME, OMD and SCFA. This may be because SC and SCSP contributes to an ecological condition that favors the growth and activities of anaerobic microorganisms and fiber-degrading bacteria, and thereby improves the DM and NDF degradation rates, or effective degradability. *S. cerevisiae* are is

known to increase ruminal pH by reducing the lactic acid concentration in rumen fluid and to enhance the utilization of lactate by an increased presence of lactate-utilizing bacteria [5]. The interaction between the type of roughage and yeast supplements was found on the gas production at 4 and 24 h, ME, OMD and SCFA. The RG supplemented with SC responded to gas production at 4 and 24 h, ME, OMD and SCFA then SCSP and C. Demonstrated that yeast had a positive effect on NDF degradation of bulky feeds containing high levels of crude fiber [4].

ACKNOWLEDGMENT

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REFERENCES

- [1] Denev, S. A, Tz. Peeva, P. Radulova, N. Stancheva, G. Staykova, G. Beev, P. Todorova and S. Tchobanova 2007. Yeast Cultures in Ruminant Nutrition. *Journal of Agricultural Science*. 13, 357-374.
- [2] Ferndah, C., B. Nicklas, L. Christel, W. Renaud, G. Lena, L. Christer, H. Kristna, A. J. D. Richard and M. B. Roslyn. 2010. Increasing cell biomass in *Saccharomyces cerevisiae* increases recombinant protein yield: the use of a respiratory strain as a microbial cell factory. *Microbial Cell Factories* 9, 1-11.
- [3] Girard I. D. and Dawson K. A. 1995. Effect of a yeast culture on growth characteristics of representative ruminal bacteria. *Journal of Animal Science* 73, 264.
- [4] Martin, A. S., I. N. Prado, L. M Zeoula, A. F. Brnco and W. G. Nascimento. 2000. Apparent digestibility of diets containing corn or cassava hull as energy source and cottonseed meal or yeast as protein source, in heifers. *Revista Brasileira de Zootecnia* 29, 269-277.
- [6] Chemler, J. A., Y. Yan and M. A. Koffas. 2006. Biosynthesis of isoprenoids, polyunsaturated fatty acids and flavonoids in *Saccharomyces cerevisiae*. *Microbial Cell Factories* 5:20.

Occurrence of Microcystis in ponds of Kagawa (2015)

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Microcystins (MCs) is one of cyanotoxins, which are found in eutrophicated ponds. Kagawa has around 1,400 ponds, in which algae blooms were observed. However the data of contamination with MCs in ponds of Kagawa are very limited. To clarify contamination of MCs in these ponds, we collected waters from three ponds near our campus and 22 typical ponds of East Kagawa (2015) and analyzed MCs by ELISA, and evaluated the risk of MCs.

As results, in almost all waters (97%) from three ponds, near our campus, we detected MCs more than 1 ng/mL (the limit of the drinking water by WHO). In 'Oikma' and 'Hirata' pond, we detected most highly-concentrated MCs in June and October, however in 'Hiragio' pond, highly-concentrated MCs was detected in May and June, the concentration of MCs decreased afterwards until November. In 'Hiragio' pond, there were correlations of MCs and total dissolved nitrogen (TDN) and total dissolved phosphorus (TDP).

In 22 typical ponds of East Kagawa, 39% of waters were more than 1 ng/mL. The highest MCs contaminated sample is from 'Funaoka' pond on September, which was 88,498 ng/mL. If a person intake only 27 μ L of this water every day, some kind of health damage occurs. The means of the MCs concentration in every pond related to means of TDN and TDP. The pond surrounded by farmland or houses were contaminated with high concentration of MCs. We clarified the MCs contamination of these ponds in Kagawa for the first time.

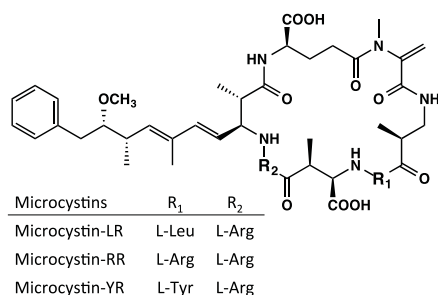


Fig. 1. Structures of Common Microcystins

INTRODUCTION

Microcystins (MCs) are produced by certain freshwater cyanobacteria; primarily *Microcystis aeruginosa*, but also other *Microcystis* sp. and other some cyanobacteria, which form green algae^[1]. MCs are cyclic heptapeptides with seven amino acids. MCs are named for the various amino acids on the peptide structure. MC-LR is named for the leucine (L) and arginine (R) amino acids. MC-LR was the first identified and the most commonly studied. Other common MCs are RR and YR (Fig. 1). MC-LR is specifically accumulated to the liver and inhibits protein phosphatase type 1 and type 2A activities in the cytoplasm of liver cells. LD₅₀ of MC-LR is 5 mg/kg (oral, mouse). MC-LR is one of potent cancer promoters. The International Agency for Research on Cancer committee concluded that MC-LR is group 2B carcinogen (possibly carcinogenic to humans).

Kagawa is rainy few areas in Japan. Furthermore, there is not a big river. Shortage of water is a big problem. Kagawa prefecture has around 1,400 ponds/reservoirs for agriculture use^[2]. Green algae were found in these ponds every year.

However the data of contamination with MCs are very limited. To clarify contamination of MCs in ponds of Kagawa, we collected waters from three ponds near our campus and 22 typical ponds of East Kagawa in 2015 and analyzed MCs by ELISA using novel monoclonal antibody (MC.5-3T)^[3], and evaluated the risk of MCs.

RESULTS AND DISCUSSIONS

We collected waters (total 176) from 'Oima', 'Hirata' and 'Hiragio' ponds from May to November in 2015, analyzed MCs, TDN and TDP. 97% of waters were contaminated with more than 1 ng/mL of MCs (the limit of regulation for drinking set by WHO). 31% of waters were with more than 10 ng/mL of MCs (the limit of regulation for recreational water by Australia). The water from 'Oima' pond was contaminated with 15 times higher MCs than 'Hirata' and 'Hiragio' ponds. However, the reason was not clear.

In these three ponds, MCs and water temperature, rain-fall did not have the correlation. In 'Oima' and 'Hirata' ponds, the high concentration of MCs was detected the samples of June and September. On the other hand, in 'Hiragio' pond, the waters of May and June were contaminated with high concentration of MCs. MCs decreased afterwards. TDN and TDP decreased at the same time, too. In 'Hiragio' pond, after July, lotuses actively grew and consumed nitrogen and phosphorus in water. Therefore, TDN and TDP decreased. Cyanobacteria cannot actively grow and produce MCs.

We collected waters (total 193) from 22 typical ponds in East Kagawa (2015) and analyzed. 39% of waters were contaminated with more than 1 ng/mL of MCs (the limit for drinking), and 19% of waters were more than 10 ng/mL, (the limit for recreation). The highest MCs contaminated sample is from 'Funaoka' pond (September, 2015), which was 88,498 ng/mL. If a person intake only 27 μ L of this water every day, some kind of health damage occurs. The means of MCs concentration in every pond related to the means of TDN and TDP. The ponds surrounded by farmland or houses were contaminated with high concentration of MCs.

We made the MCs contamination of these ponds in Kagawa clear for the first time.

REFERENCES

- [1] S. Merel, D. Walker, R. Chicana, S. Snyder, E. Baurès, O. Thomas, "State of knowledge and concerns on cyanobacterial blooms and cyanotoxins," *Environ. Int.*, vol. 59, pp.303-327, 2013.
- [2] KAGAWater (in Japanese, June 9, 2016) http://www.pref.kagawa.lg.jp/content/etc/subsite/mizu/kagawa_m/index.shtml
- [3] Y. Tabuchi, C. R. Takabayashi-Yamashita, T. A. Miguel, N. K. Ishikawa, L. F. Maciel, K-I. Harada, E.Y. Hirooka, O. Kawamura, "Generation of monoclonal antibodies producing hybridomas for detection of microcystins in environmental water by ic-ELISA," *Proceedings of the International Conference on the Water Crisis in the Asia-Pacific Region*, p59-60, 31 Mar 2015, Kagawa University, Takamatsu, Kagawa Japan.

Economics and Business 1

- Economics and Business for Sustainability -

Sunday 28 August, 2016

15:50-17:50

Room C, North Block

Gandhi's Theory of Trusteeship¹

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Gandhi's theory of trusteeship is an idea that wealthy people should consider their property as something God trusted them to manage as "trustees" for the benefit of the poor. This theory legitimated the positions of capitalists and landlords in society, as long as they behaved as "trustees". Therefore, socialists and communists severely condemned it as supportive for the existing regime, while some scholars reevaluated it as consonant with capitalist or mixed economies during the post-Cold War period. However, the theory is observed to have some aspects concessive to socialists, aspects of which was not really observed in such condemnation or reevaluation.

In this paper, therefore, I would like first introduce evaluations of the theory, both positive and negative, in the past. I would then trace in what way Gandhi presented it from the 1920s to the 1940s. Lastly, I would like to indicate the possibility of understanding the theory as one style of "non-violent" social reform, which was far different from any of existing theories based on capitalism or socialism.

After all, with capitalists and landlords on the one hand and socialists on the other, Gandhi did not take any side. Ultimately, the theory of trusteeship was an attempt to shorten the distance with socialism to avoid class struggle, and to reallocate the wealth of the rich to the poor in non-violent ways. With this theory Gandhi dreamt of establishing – to borrow Ivan Illich's terminology – a "convivial" society by means of mobilizing all the classes into his movement to construct a politically and socio-economically new India.

Gandhi did not regard rich people as his opponents when he advocated this theory. It may be questioned whether the theory was consistent with another position of his, that the minority exploited the masses with the motive force of the former being greed and avarice. Yet only by such means of carrying these philosophical contradictions inside himself, could he tackle the contradictions that existed within Indian society itself at that time.

The theory of trusteeship might have benefited the rich as a result of its attempt to avoid class struggle. That is, though, an inevitable consequence that Gandhi was not particular about his own principles, and that he remained within modernity in order to renovate it from the inside. By doing so, he endeavoured to redress, instead of veiling, the internal contradictions of Indian society in a peaceful manner, which is yet to be highly valued in the 21st century.

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References

- Birla, Ghanshyamdas [1968] *In the Shadow of the Mahatma: A Personal Memoir*, Bombay: Vakils, Feffer and Simons Private Ltd.
- Birla, Ghanshyamdas [1980] *Towards Swadeshi: Wide-ranging Correspondence with Gandhiji*, Bombay: Bharatiya Vidya Bhavan.
- Fischer, Louis [1995] (1951) *The Life of Mahatma Gandhi*, 6th edition, Bombay: Bharatiya Vidya Bhavan.
- Gandhi, Mohandas Karamchand [1945] *Constructive Programme: Its Meaning and Place*, Ahmedabad: Navajivan Publishing House.
- Gandhi, Mohandas Karamchand [1957] *Economic and Industrial Life and Relations*, 3 vols., Ahmedabad: Navajivan Publishing House.
- Gandhi, Mohandas Karamchand [1958-94] *The Collected Works of Mahatma Gandhi (CWMG)*, 100 vols., New Delhi: The Publication Division, Ministry of Information and Broadcasting, The Government of India.
- Gandhi, Mohandas Karamchand [1997] (1927) *An Autobiography or the Story of My Experiments with Truth*, Ahmedabad: Navajivan Publishing House.
- Kulkarni, V. [1951] *A Family of Patriots (The Bajaj Family)*, Bombay: Hind Kitab LTD.
- Namboodiripad, E. M. S. [1981] *The Mahatma and the Ism*, revised edition, Calcutta: National Book Agency (P) Ltd.
- Nanda, Bal Ram [1990] *In Gandhi's Footsteps: The Life and Times of Jammalal Bajaj*, Delhi: Oxford University Press.
- Nehru, Jawaharlal [1996] *An Autobiography*, New Delhi: Jawaharlal Nehru Memorial Fund.
- Nehru, Jawaharlal [1988] *A Bunch of Old Letters*, Delhi: Oxford University Press.
- [Nayar,] Pyarelal [1956-58] *Mahatma Gandhi: The Last Phase*, 2 vols., Ahmadabad: Navajivan Publishing House.

1) This is a revision of Chapter 6 of my book, *Minotake no Keizairon: Gandhi-shiso to sono Keifu (The Human-scale Economy: Gandhism and its Genealogy)*, Hosei University Press, 2016.

6th KU-CMU Joint Symposium 2016

The Contribution of International Organization Policies to the Globalization of Higher Education

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INTRODUCTION

The objectives of this study are to investigate how international organizations create policies for the globalization of higher education and spur educational reforms. It concentrates especially on the policies of the Organization for Economic Cooperation and Development (OECD), the European Union (EU), the United Nations Education, Scientific, and Cultural Organization (UNESCO), and the World Trade Organization (WTO).

The policies of international organizations (OECD, EU, UNESCO, and the WTO) have significantly affected and contributed to the globalization of higher education and national higher educational reform; these policies, which have been influenced by neoliberal thought, have had a major effect on national economies and produced economic benefits.

CONTENTS AND DEVELOPMENT

In the OECD approach to higher education, “the nation” has been forced to innovate by global forces. One principle of this approach at the OECD and national levels is the relationship between national policy decisions and those of autonomous nations. Papadopoulos (1994) has written, “educational policies are to be recognized as the superior national policy, influenced by the specific environment of nation, tradition, and culture.”

I advance the following the hypothesis: The funding of the Erasmus Program is closely correlated with student mobility. In order to prove this hypothesis, I employ the following equations in my analysis:

(1) $f(x) = \sum_{n=1}^n (x_1 - y_1)^2$, where x = Fund for Erasmus Program and y = the student mobility

(2) $S(x,y) = n/(n-1) \text{COVAR}(x_1-x)(y_1-y) + (x_n-x)(y_n-y)$, where

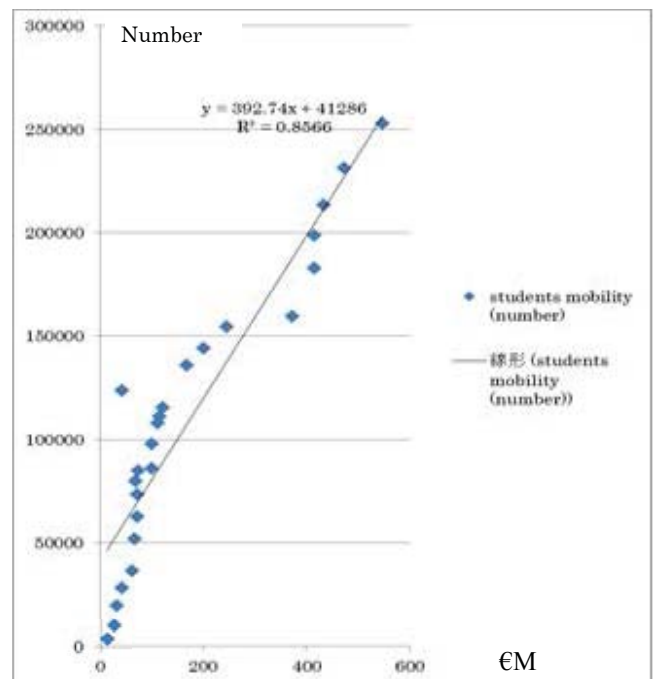
X = Fund for Erasmus Program and y = the student mobility

From this analysis, I conclude that the policies of international organizations have significantly affected the globalization of higher education in the period 1987-2012. The budget of the Erasmus Program has been closely related to the number of international students enrolled in institutions in Europe.

GENERAL CONCLUDING REMARKS

I have explored the policies and roles of international organizations. I have concluded that their contributions to the globalization and internationalization of higher education have been quite effective. The co-variant and correlation analyses demonstrate that in the advanced OECD nations, GDP per capita and the number of international students

The Relationship of the Erasmus Program Budget and the number of students enrolled in institutions through it, 1987-2012



enrolled in higher educational institutions have very strong relationship. Overall, I find that the thesis statement (“The educational policies of international organizations has significantly affected and subsequently contributed to globalization of higher education and national higher educational reforms, respectively. Those policies are having a major impact on national economies and have had economic benefits”) is supported. Moreover, these analyses demonstrate that in EU nations, the budget for Erasmus and the number of Erasmus-program students have a very strong association, a finding that supports my hypothesis.

REFERENCES

- [1] Knight J. (2004), “Internationalization remodeled: Definition, approaches, and rationales,” *Journal of Studies in International Education* 8(1), 5-3.
- [2] OECD /CERI (2002), Background document: current commitment under the GATS in educational services,” paper presented at the OECD /US forum on Trade in Educational Services, Washington DC, Appendix B (3) 1-47.
- [3] Scherrer, C.2005. GATS: long-term strategy for the commodification of education. *Review of International Political Economy* 12, no.3: 484-510

Stakeholders Treatment and Long-run Returns of Initial Public Offering Firms in The Stock Exchange of Thailand

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For the purpose of this study, there are 2 key issues:

1) Testing the theory that explain Long-Run Underperformed IPOs, 2) Testing the theory that describes the relationship between Stakeholders Treatment and Long-Run Performance of IPOs.

The result found that 1) The anomaly of long-run underperformed IPOs can be explained by Divergence of Opinion hypothesis and Impresarios hypothesis 2) The relationship between Stakeholders Treatment and Long-Run Performance of IPO can be explained by the Stakeholders Theory.

INTRODUCTION

From previous related studies, we found that the return of IPOs tended to be underperform in the long run [1]. With this anomaly, it can be demonstrated by 3 hypotheses. 1) Divergence of Opinion hypothesis [2], assuming that all investors perceive the identical IPOs' valuation in the initial phase of trading, resulting in the short-run extraordinary return. However, later on, when the rate of return of those stocks were adjusted to its intrinsic value, the long-run IPOs return will be underperform. This paper use initial return on 25 days as standard deviation of performance (DIVER) to test the hypothesis. 2) Impresarios hypothesis [3], assuming that all business need to ensure that investors will choose to buy their securities, so the securities are priced undervalue, resulting in short-run extraordinary return. While the long-run return of those securities will be adjusted to its reasonable value. This paper uses market value of IPOs that are listed by Underwriter (UNREP) as a proxy to test the hypothesis 3) Window of Opportunity hypothesis [4], assuming that in the blooming market session, investors would willing to trade overvalued securities; however, in the long run, those securities' performance would be normalized. This paper use market to book value of SET index (PBV) as a proxy to test the hypothesis.

As for the theories that explain the relationship between Stakeholders Treatment and Long-Run Performance of IPO are 2 theories, 1) Stakeholder theory [5], assuming that the Stakeholders Treatment can be treated an intangible asset which have positive relationship with the long-run performance. 2) Agency theory [6], assuming that the Stakeholders Treatment enables the CEO to take advantages on companies' economic and social benefits. Which have negative relationship with the long-run performance. The Stakeholders Treatment (STAKE) is proxied by Stakeholders Treatment index [7], using the Organization of Economic Co-operation and Development (OECD) guideline.

RESULTS AND DISCUSSIONS

Using OLS regression, this paper concludes that the anomaly of long-run underperformed IPO "Fig. 1," can be explained by Divergence of Opinion hypothesis and Impresarios hypothesis but not by Window of Opportunity hypothesis. Stakeholders Treatment is not directly related to

long-run performance; nevertheless, is indirectly related by decreasing an effect of divergence according to Divergence of Opinion hypothesis. We conclude that Stakeholders Treatment is positively related to long-run performance of IPOs, according to Stakeholder theory.

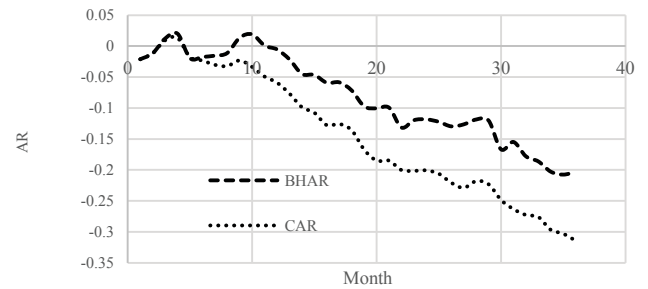


Fig. 1. Long-run performance of 150 Thai IPOs 2001-2013 using CAR and BHAR

TABLE I

RESULTS FROM OLS REGRESSION OF CAR AND BHAR ON VARIOUS VARIABLES INDICATED BELOW

	DEPENDENT VARIABLE			
	CAR		BHAR	
	1	2	3	4
STAKE	0.02	0.08	0.01	-0.09
DIVER	-25.78**	-39.92**	-20.19**	-26.87**
UNREP	5.55**	6.87**	4.00*	8.5*
PBV	-0.18	0.14	-0.09	0.39
STAKE*DIVER		3.33*		1.47*
STAKE*UNREP		-0.41		-1.28
STAKE*PBV		-0.08		-0.13

*And * indicate statistical significance at the 1% and 5%

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REFERENCES

- [1] J.R. Ritter and I. Welch, "A Review of IPO Activity, Pricing, and Allocations," *Journal of Finance*, vol. 57, pp. 1795-1828, 2002.
- [2] E.M. Miller, "Risk, Uncertainty, and Divergence of Opinion," *Journal of Finance*, vol. 32, pp. 1151-1168, 1997.
- [3] R.J. Shiller, "Speculative Prices and Popular Models," *Journal of Economic Perspectives*, vol. 4, pp. 55-65, 1990.
- [4] J.R. Ritter, "The Long-Run Performance of Initial Public Offerings," *Journal of Finance*, vol. 46, pp. 3-27, 1991.
- [5] M.C. Jensen, "Value Maximization, Stakeholder Theory, and Corporate Objective Function," *Journal of Applied Corporate Finance*, vol. 14, pp. 8-21, 2001.
- [6] M.C. Jensen and W.H. Meckling, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics*, vol. 3, pp. 305-360, 1976.
- [7] R. Lonkani, P. Limpaphayom, and J.T. Connelly, "Sustainability Performances of Listed Firms in the Stock Exchange of Thailand," unpublished.

Innovation and Creativity Cultural Capital on Wellness Knowledge in Thailand for Sustainable Tourisms

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Abstract—The aim of this study focuses on an intellectual capital or national capital in Thailand (Thainess Identity). At present the world has changed in almost every aspect, affecting adjustments in society, way of life, culture, and value. People in today's society have to adapt either their daily routine or career to survive. Businesses as well as Thailand as a country have to adjust themselves to the global changes and step into the new world sustainably. Creative economy is a concept that could be developed into a strategy to help progress into the new world sustainably by using the Thai intellectual capital, which is the nation's intellectual property and belongs to all Thais. It is the knowledge and wisdom which transform generation to generation from the ancient society until now. Thus the Thai intellectual capital can develop into creative goods; adding value to products and services. The researcher purpose the concept or model for integrated local intellectual capital and international standard for success Thai service industries in sustainable tourism.

Keywords; Thainess Identity; Creative Economy; Intellectual Capital; Wellness; Tourism

I. INTRODUCTION

World economy is transformed to new way from the old system to become creative economy. The situation of today's global business gets tougher every day, especially when technology has become more advanced. Communication, data transfer and invention are more convenient and fast; making business competition more intense. Various consumer behaviors affect businesses to face more competition. Uniqueness creation or differentiation, therefore, is an important strategy of today's business and entrepreneur. This leads to the application of creative economy concept as an important strategy to generate business development and differentiation. Creative economy is a concept that drives economy on the basis of using knowledge, creativity, and intellectual property that link with cultural foundation, social knowledge accumulation and technology or modern innovation, to produce economic and social value added goods and services that satisfy global consumer's needs. In other words, it is a value generated from ideas. Among all these aspects of global changes, those who can adapt and are aware of them can survive sustainably and live up to the future. Thailand is also affected from these changes just like other countries around the world. In order for Thailand to adapt and handle the fluctuation and step into the new world sustainably, the country must develop into a knowledge & skill-based society under creative economy that emphasizes economy generate from wisdom and cultural capital, which is the nation's heritage, in order to bring the country's economy into the future with a solid base. The differentiation and

usage of cultural identity of each area as a distinctive point makes it stand out and competitive. In other words, turning local item, knowledge, tradition and cultural into creative product is something that entrepreneurs in many businesses pay attention to, especially tourism businesses. Therefore, Thailand tourism development in the creative economy system should emphasize on Thai people, who are the most important resource in developing the country; using Thai intellectual capital to generate value creation and develop the country's creative economy. With the cultural capital accumulated from the primeval age, this asset does not have to be searched for or purchased but it is equipped in all Thais and can be use infinitely. So this intellectual capital or can be use to generate creative goods and services.

II. LITERATURE REVIEW

A. Knowledge Management Theories and Tools

Nonaka and Takeuchi (1995) explain definition that two characteristics of knowledge are tacit and explicit. Explicit knowledge is easy to identify identified, clear, capture and share by writing, pronouncing and expression such as manuals, book, reports. For tacit knowledge is difficult to express by writing and pronounce expression and compose of intuition, perception, feeling, value and beliefs. In addition tacit knowledge is difficult to capture and transfer. Both of knowledge, tacit knowledge sustains the higher value because it is the essence of creativity, wisdom, intellectual capital, mind capital and innovation. Dana et al, p. 11 (2005) demand that in the network era is a multidimensional challenge for successful management in knowledge and intellectual capital. It have to understand and interconnection of domains that that culture, content, process, infrastructure, which also have a tacit as well as explicit dimension.

B. Intellectual capital

Nazari and Herremans (2007) define various of intellectual and measurement capital are difficult to benchmark with competitors and leading organizations. There are schemes classify intellectual capital into the categories of external capital and internal capital. External capital consist relationship between customers and brand, trademark, reputation and suppliers. (Bontis, 1996; Bontis and Fitz-enz, 2002; Edvinsson and Malone, 1997; Roose et al., 1997; Stewart, 1997; Sveiby, 1997).

C. Creative Economy

The creative economy is a concept of economy that utilizes knowledge, skill, and culture to drive change and innovation. The creative economy becomes a mechanism to develop national development of more than 100 countries worldwide. The concept focus on personal creativity and economic development. the creative eco-

onomy marks a shift from previous economic systems that tended to devalue personal involvement in work (Howkins, 2013).

III. RESEARCH METHODOLOGY

This study used methods including data collection by analyzing documents, semi-structured interviews, in-depth interview tourism entrepreneurs, marketing executives, Thainess identity scholars as well as taking pictures as visual evidence. The scope of study and questionnaire design is to retrieve information about usage of Thai knowledge and wisdom, Thai culture, identity, heritage to properly produce creative goods and services by selecting a group of sample who are successful tourism service businesses. The content scope of this study is to collect information about Thai tourism businesses including airline, hotel, tour guide, local transportation, destination, food and entertainment, gift and souvenir, and use this information to analyze the value added to Thai goods and services by using the Thainess Identity that exists in every Thai person.

IV. RESULT / DISCUSSION

From the literature review and data collection by using interview and observation find that presently, Thai identity generally comes from the central region of Thailand. Numbers of identities are listed as follows: Thai food, Thai costumes, Thai architecture, and Thai boxing, additionally, these identities are well-known by foreigner tourists. Moreover, Thai tourist destinations which are notable to foreigner tourists are provinces from the southern of Thailand e.g. Phuket, Krabi, and Phang-nga. In addition, wellness tourism in Thailand is not yet well-known and famous to foreigner tourists when compared to other countries. The study "Perception of international

tourist on Thailand tourism brand under the Amazing Thailand campaign" explain that foreigner tourists clear awareness of nature; a beautiful landscape and nature, Treasures; land of culture, heritage and history, Thai people characteristic; friendly and smile but unclear awareness to theme of health and wellness (Thananya Promboot and Nurumon Kimpakorn. 2558: 31-42). The research by Kasikorn Research Center (2012) explain that the health and wellness tourism in Thailand are rapidly grow forward healthy trend. People today's emphasize on healthy and well-being and care to protect from diseases. Many country in Asia include Thailand have a policy to support wellness tourism. The wellness Tourism become significant factor to bring income or GDP. Nevertheless, there are various concept and characteristic of global wellness trends that is different from each country. Thus, it is essential that Thailand should adapt into the global changes and the global sustainability.

The researcher suggests a new concept of wellness tourism in Chiangmai which is different from other theorists and theories. Chiangmai is one of upper-northern Thai province which is suitable to become wellness centre or wellness market destination. As the research solution refers to the utilizing of brand image and personality concepts to create new model for upper-northern Thai wellness. It also creates and develops the image of Chiangmai to be wellness centre under the designation concept as "Relax City". Considering Chiangmai not only has plenty of natural resources, beautiful landscapes, good climate and kindness people but it also has the traditional knowledge and wisdom in health and wellness that has been transferred from generation to generation right from the ancient time to the present time. In addition Chiangmai tends to become world culture heritage and represents the Lanna (upper-northern Thai regions).

REFERENCE

1. Aaker, David A. 1991. *Managing Brand Equity*. London: The Free press.
2. Aaker, David A. 1996. *Building strong brand*. London. The Free press.
3. Aaker, D. A. (2001). *Developing business strategies*. New York, NY: J. Wiley.
4. Bontis, N. (1996). There's a price on your head: managing intellectual capital strategically. *Ivey Business Journal*, 60(4), 40-46.
5. Bontis, N., & Fitz-enz, J. (2002). Intellectual capital ROI: a causal map of human capital antecedents and consequents. *Journal of Intellectual Capital*, 3(3), 223- 247. doi: 10.1108/14691930210435589
6. *Creative Economy Report 2010*. UNCTED. United Nations, 2010 Howkins, J. (2001). *The Creative Economy: How People Make Money From Ideas*, Penguin, London.
7. Guthrie, J., and R. Petty, 2000, "Intellectual Capital: Australian Annual Reporting Practices", *Journal of Intellectual Capital*, 1, 3: 241-51.
8. Edvinsson, L., & Malone, M. S. (1997). *Intellectual capital: realizing your company's true value by finding its hidden brainpower*. New York, NY: HarperBusiness.
9. "Kasikorn Research Center". (2012). Retrieved Jan 10, 2016 from <https://www.kasikornresearch.com>.
10. Keller, Kevin Lane. (2003). *Strategic Brand Management : Building, measuring and Managing brand equity*. Upper Saddle River N.J. Prentice Hall.
11. Kotler, Philip. (2000). *Marketing Management*. 10th ed. New Jersey : Prentice Hall, Inc.(1997). *Marketing management : analysis, planning, implementation and control*. 9th ed. New Jersey : A Simon and Schuster Company.
12. Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: how Japanese companies create the dynamics of innovation*. New York: Oxford University Press.
13. Tanya Promburom and Narumon Kimpakorn. 2558. "Perception of International Tourists on Thailand Tourism Brand under The "Amazing Thailand" *Journal of Thai hospitality & Tourism*. 10,1 (January-June): 31-42.

Analysis of Spatial Impact of the Setouchi International Art Festivals

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INTRODUCTION

The government is promoting actively MICE (Initial character of Meeting, Incentive, Convention, Exhibition) policy focusing on the economic impact of tourism. So, this paper is focused on the spatial impact of tourism. This study will be verified the spatial impact of the Setouchi International Art Festivals.

Therefore, this study is focusing on the following two points. The first is the tourist's behavior that take pictures at the visited tourist destination. The second is a way to enjoy Social Networking Service. It is to enjoy with friends by uploading pictures on the SNS site after taking the pictures.

Data will be collected a large amount of pictures from "flickr.com" site. It is called big data. And big data will be analyzed with GIS.

DATA COLLECTION AND METHODOLOGY

Data to be used for analysis is a collection of all of the image data that have been uploaded to "flickr.com" after taken by Kagawa prefecture from 2010 to 2015. The collected data are about 35,000, but utilizing data for analysis are 23,759 pictures to be cleaned (Table1).

Year	Data after cleaning
2010*	1,896
2011	2,663
2012	4,877
2013*	5,998
2014	3,953
2015	4,372
Total	23,759

* Setouchi International Art Festival has been held in 2010 and 2013.

GIS is to be used in the analysis, in order to validate the spatial expansion of the tourist's behavior.

CONCLUSIONS AND DISCUSSIONS

Utilizing about 23,759 image data, we revealed two impact of Setouchi International Art Festivals throughout this study.

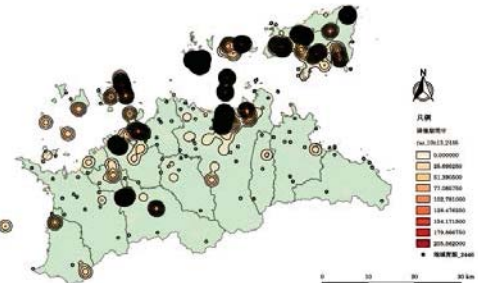
The first is an expansion of the range of tourist's behavior (Fig.1). The second is an extension of the distance to the tourist's residence(Fig.2). In other words, Setouchi International Art Festivals resulted in a spatial impact of guest side and host side.

ACKNOWLEDGMENT

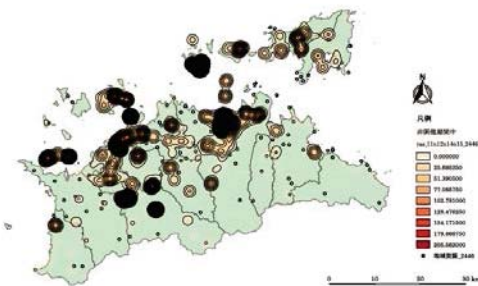
This study is funded by Fukutake Foundation. I would like to express appreciation.

REFERENCES

[1] Deokkyum. Kim, "Locational Analysis of Sanuki Udon Shops in Takamatsu City" *The Tourism Study*, Vol.26, No.2, pp. 39-48, March 2015.

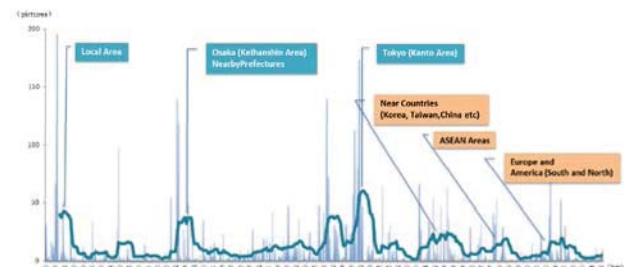


(a) Held Years of Setouchi Art Festivals

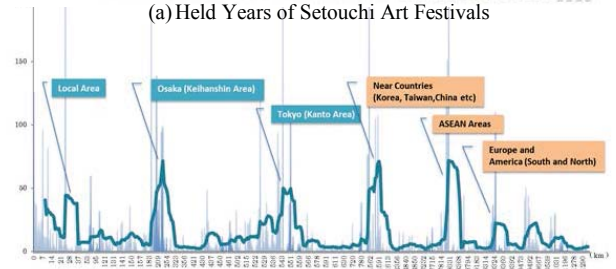


(b) Non-holding Years of Setouchi Art Festivals

Fig 1. Kernel Density Estimator of Image data



(a) Held Years of Setouchi Art Festivals



(b) Non-holding Years of Setouchi Art Festivals

Fig 2. Distance to tourist's residence

[2] Deokkyum. Kim, "Analysis of Tourism Potentiality Using Image Big-data in Kagawa Prefecture" *Kagawa University Economic Review*, Vol.88, No.4, pp. 47-68, March 2016.

[3] Naoto. Yabe, and Yohei. Kurata, "An analysis of the behavior of inbound tourists in the Tokyo Metropolitan Area from the data of IC transit cards" *Theory and Applications of GIS*, Vol.21, No.1, pp.35-46, 2013.

[4] Yukiko. Nomura, and Tatsuya. Kishimoto, "The Analysis for Visitors' Behavior and Activity Using GPS and GIS in Kamakura City" *Architectural Institute of Japan*, Vol.4, No.2, pp.72-77, 2006.

Sustainability in Chiang Mai's Maize Production Management: A Holistic Approach

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Abstract- During the past few decades, corn growing has substantially increased in line with maize contract farming's growth. Over half of northern Thailand's maize cultivation land is in forest area, and improper disposal of agricultural wastes, especially by open burning in the fields, generates enormous amounts of GHGs and Polycyclic Aromatic Hydrocarbons (PAHs). PAHs emissions are highly seasonal in the region. In the dry season, the daily concentration can be up to two times the maximum allowed under the EPA standard. The focus of this study is the sustainability of maize production management in Chiang Mai. Relationships between production, environmental management of operations and GHG emissions are connected through multi-objective optimization to find trade-offs between them. In the case study, 18 entrepreneurs are located at district offices and fields are grouped into 73 sub-districts. The EPA's estimated per-year social cost of carbon is used to convert kgCO₂ into Thai Baht. The lifetimes of atmospheric CO₂ are set to be 5, 25, 50, 100 and 200 years. The results in all cases show that adding proper waste disposals only results in a 1.7-6.9% reduction of total profit.

I. INTRODUCTION

Greenhouse gases (GHGs) contribute appreciably towards climate change. There have been initiatives aimed at limiting corporate greenhouse gas emissions. In Thailand, even though a Nationally Appropriate Mitigation Action (NAMA) plan to reduce greenhouse gases below the business as usual (BaU) level by 2020 was submitted to the UN a year ago, problems related to the pollution have been on the rise. Farmers still prefer to burn agricultural wastes in the fields, which shows that such initiatives have not taken root at the local level [1].

Northern Thailand's maize cultivation area comprises 71.33 percent of the nation's total maize cultivation area. According to 2013 data from the Land Development Department, 54.11 percent of the north's maize cultivation land is located in forest area. With the popularity of contract farming, maize growing has increased to 2, 3 or even 4 crops a year, a practice that generates substantial amounts of biomass which are typically eliminated by burning. The open incineration out in the fields is a major cause of the smoke pollutions that plague Chiang Mai and other northern provinces yearly during February-April. In 2015, recorded amounts of PM10-bound PAHs in Chiang Mai were as high as 299 µg/m³, compared to the EPA's annual mean standard of 50 µg/m³ and daily concentration standard of 150 µg/m³ [2]. Government agencies, including the Energy Technology for Environment Research Center (ETE), have been trying to educate and support local farmers to transform agricultural wastes into refuse-derived fuel (RDF), biochar, fertilizer or even landfill.

Farms in Northern Thailand are typically small in size. For farmers who conduct open burning of biomass because they do not have other disposal alternatives, the solution could lie in small-scale entrepreneurs buying biomass for energy generation or some other useful purpose. Distribution centers

(DCs) are created to represent the hypothetical entrepreneurs. The case study is on the maize production supply chain in Chiang Mai, northern Thailand's economic capital, and the focus of the study is on relationships between production, operations' environmental management and GHG emissions.

II. PROBLEM DEFINITION AND MODELING

The problem is to distribute kernels (product) and residues, in this case, corn stems and leaves (type I), and corncobs and husks (type II), from fields to DCs. Let I and J be the sets of fields and DCs, respectively, K be set of emitted gases which consist of 1) PAHs, 2) CO, 3) CO₂, 4) NO_x and 5) CH₄ and L be set of processes which produce gases, namely 1) production of biomass fuel briquettes at DC, 2) production of organic fertilizer at DC, 3) open burning at field and 4) transportation.

The maize production management can be formulated as a multi-objective linear programming problem. Let x_{ij} be the corn kernels transported from field i to DC j , and $y_{ij}^{(1)}, y_{ij}^{(2)} (z_{ij}^{(1)}, z_{ij}^{(2)})$ be the corn residues type I (II) from field i to DC j for biomass briquettes and fertilizer productions. The corn residues type I (II) eliminated by open burning and turned into fertilizer at field i are $y_i^{(3)}, y_i^{(4)} (z_i^{(3)}, z_i^{(4)})$.

A. Objective Functions

Three different objective functions are used to measure the network's economic and environmental performance. The economic performance indicators used in this work are the total cost and profit. Objective function (1) is the total transportation cost for shipping products and waste from field i to DC j . Objective function (2) is the sum of profits from selling corn kernels, biomass fuel briquettes and organic fertilizers from all DCs.

TABLE I
PARAMETERS IN THE MODEL

	Description	Value	Unit	Source
a_{ij}	Distance between field i and DC j	Euclidean	km	Calculated
b_1	Type I waste production rate	1.1	-	OAE ^a
b_2	Type II waste production rate	0.37	-	
$c_j^{(1)}$	Profit of biomass fuel briquettes	[270-450] ^b	THB/ ton	[3]
$c_j^{(2)}$	Profit of organic fertilizer at DC j	[800-1200] ^b		[4]
f_j	Profit of corn kernels at DC j	[2200-3000] ^b		[5]
S_i	Supply of field i for corn kernels	Actual Data	ton	ETE
d_j	Demand of corn kernels at DC j	$0.8 \times M^c$		**
$P_j^{(1)}, P_j^{(2)}$	Capacity of waste disposal method 1, 2 at DC j	$5 \times M^c$		**
$P_i^{(3)}, P_i^{(4)}$	Capacity of waste disposal method 3, 4 at field i	$3 \times S_i$		**
Q_j	Capacity of holding corn kernels at DC j	$5 \times M^c$	**	**
$e_{kl}^{(1)}, e_{kl}^{(2)}$	Emission factor of gas k by waste disposal method l of corn residues type I, II	TABLE II		-

^aOffice of Agricultural Economics, ^b[a,b] = parameters are randomly generated in interval [a,b], ^cTotal supply in that district, ^{**}These numbers are used to ensure that all demands/requirements will be met at those points.

$$z_1 = \min \sum_i \sum_j a_{ij} (x_{ij} + y_{ij}^{(1)} + y_{ij}^{(2)} + z_{ij}^{(1)} + z_{ij}^{(2)}) \quad (1)$$

$$z_2 = \max \sum_j (f_j \sum_i x_{ij} + c_j^{(1)} \sum_i (y_{ij}^{(1)} + z_{ij}^{(1)}) + c_j^{(2)} \sum_i (y_{ij}^{(2)} + z_{ij}^{(2)})) \quad (2)$$

$$z_3 = \min \sum_k (e_{k1}^{(1)} \sum_{(i,j)} y_{ij}^{(1)} + e_{k1}^{(2)} \sum_{(i,j)} z_{ij}^{(1)} + \sum_k (e_{k2}^{(1)} (\sum_{(i,j)} y_{ij}^{(2)} + \sum_i y_i^{(4)}) + e_{k2}^{(2)} (\sum_{(i,j)} z_{ij}^{(2)} + \sum_i z_i^{(4)}) + \sum_k (e_{k3}^{(1)} \sum_i y_i^{(3)} + e_{k3}^{(2)} \sum_i z_i^{(3)}) + \sum_k e_{k4} (\sum_{(i,j)} a_{ij} (x_{ij} + y_{ij}^{(1)} + y_{ij}^{(2)} + z_{ij}^{(1)} + z_{ij}^{(2)})) \quad (3)$$

Since the objective is to select disposal methods for corn residues by taking into account their effects on the environment, we focus on gas emissions from both the corn residue disposal process and transportation in the whole system. In (3), the total GHG emissions are associated with the production of biomass fuel briquettes, production of organic fertilizer, open burning and transportation.

B. Constraints

$$\sum_i x_{ij} \leq Q_j, \quad \forall j \in J \quad (4)$$

$$\sum_i (y_{ij}^{(1)} + z_{ij}^{(1)}) \leq P_j^{(1)}, \quad \forall j \in J \quad (5)$$

$$\sum_i (y_{ij}^{(2)} + z_{ij}^{(2)}) \leq P_j^{(2)}, \quad \forall j \in J \quad (6)$$

$$\sum_j x_{ij} \leq S_i, \quad \forall i \in I \quad (7)$$

$$y_i^{(3)} + z_i^{(3)} \leq P_i^{(3)}, \quad \forall i \in I \quad (8)$$

$$y_i^{(4)} + z_i^{(4)} \leq P_i^{(4)}, \quad \forall i \in I \quad (9)$$

$$\sum_i x_{ij} \geq d_j, \quad \forall j \in J \quad (10)$$

$$\sum_j (y_{ij}^{(1)} + y_{ij}^{(2)}) + y_i^{(3)} + y_i^{(4)} = b_1 \sum_j x_{ij}, \quad \forall i \in I \quad (11)$$

$$\sum_j (z_{ij}^{(1)} + z_{ij}^{(2)}) + z_i^{(3)} + z_i^{(4)} = b_2 \sum_j x_{ij}, \quad \forall i \in I \quad (12)$$

Constraint (4) is the capacity of holding corn kernels. Constraints (5) and (6) are the capacity of corn residues disposal at each DC from the productions of biomass briquettes and fertilizer, respectively. Constraint (7) is the production capacity in each field. Constraints (8) and (9) are the capacity of corn residue disposal at each field, by open burning and fertilizer production, respectively.

Each DC has a required demand to fulfill while the corn residues in each field need to be eliminated. Constraint (10) ensures that the corn kernels' demand should be satisfied. Constraints (11)-(12) say that the amounts of corn residues correspond to the quantities of the product and that all residues are eliminated.

III. DATA COLLECTION AND SIMULATION RESULTS

Data were collected on actual maize-growing fields in Chiang Mai in 2014 by ETE. Fields are 73 sub-districts in Chiang Mai where maize is grown. A total of 18 DCs are placed at local district offices throughout the province. The values of the parameters appearing in the model are shown in Table I. Data on emission factors of greenhouse gases from the 4 processes in the proposed model are collected from various sources and presented in Table II.

The total transportation cost is calculated based on large 6-wheel trucks with carrying capacity of up to 11 tons. From Royal Irrigation Department, transportation costs for this type of vehicle is 14.5 THB/km for a round trip.

TABLE II
AMOUNTS OF GHG EMISSIONS FROM ALL PROCESSES

Gas emitted	Gas Emissions Factors of each Process				Transportation (kgCO ₂ /tkm)
	Biomass Fuel Briquettes (kgCO ₂ /ton)	Organic Fertilizer (kgCO ₂ /ton)	Open Burning (g/kg)		
			Waste type I	Waste type II	
PAHs	-	-	3.39 ^f	23.38 ^f	-
CO	-	-	63.74 ^f	68.68 ^f	-
CO ₂	107 ^d	43.8 ^e	1,147.43 ^f	1,917.69 ^f	0.0762 ^e
NO _x	26.3 ^d	-	2.31 ^f	3.57 ^f	-
CH ₄	3.89 ^d	68.8 ^e	-	-	-

^{d, e, f} These numbers are obtained from [6], [1], [7], respectively.

TABLE III
SIMULATION RESULTS ON LIFETIMES OF ATMOSPHERIC CO₂

Lifetimes of CO ₂ (year)	Z ₁ (THB)	Z ₂ (THB)	Z ₃ (THB)	F (THB)
1	10,129,471	489,744,648	7,887,147	471,728,029
5			8,214,160	471,401,016
25			15,937,155	463,678,022
50			22,909,452	456,705,724
100			29,314,138	450,301,038
200			33,785,582	445,829,594

Since the weighted sum approach is used to solve the multi-objective optimization problem, the objective function of this model becomes $F = -\hat{a}_1 z_1 + \hat{a}_2 z_2 - \hat{a}_3 z_3$ where $\hat{a}_1 = \hat{a}_2 = \hat{a}_3 = 0.33$. EPA's estimated per-year social cost of carbon is used to convert kgCO₂ of z_3 to THB. Their lowest number, 11 USD/ton of CO₂/yr, is used with the exchange rate quoted by the Bank of Thailand on January 29, 2016, of 35.752 THB/USD. The Intergovernmental panel on climate change states that the lifetime of CO₂ in the atmosphere is between 5 and 200 years, the emitted GHGs are stipulated to be exponentially decayed and completely removed from atmosphere in 5, 25, 50, 100 and 200 years.

The proposed model is formulated on AIMMS and solved using CPLEX. Simulation results with different lifetimes of atmospheric CO₂ are shown in Table III. The first column shows different lifetimes of atmospheric CO₂. The second to fourth columns are the objective functions associated with the total cost, total profit and total gas emissions, respectively. Last column is the weighted sum of three objective functions. The total corn kernel in the network is 117,635 tons in all cases. Both type-I and type-II corn residues are turned into organic fertilizer at DCs with 129,399 and 43,525 tons, respectively.

IV. CONCLUSIONS

Simulation results in Table III show that the product is still produced at maximum capacity to maximize profit since the cost of agricultural waste disposal is relatively low. All agricultural wastes from maize production can be used as ingredients in fertilizer production at DC since there is no capacity cap on each type of production, and this type of agricultural-waste disposal offers maximum profit. It is true that profit will be reduced if the social cost of GHG emission is taken into account. However, the result in every case confirms that the maximum profit reduction from this cause is only 6.9% of the total profit.

REFERENCES

- [1] W. Arjhan. "Supply chain management of agricultural residues for use as fuel and smog reduction," Available: <http://goo.gl/VJhhtB>. [Accessed: Jan. 2016].
- [2] Pollution Control Department, "Haze Report of Northern, Thailand," Available: <http://goo.gl/k0TQnW>. [Accessed: Jan. 2016].
- [3] MGR Online. Available: <http://goo.gl/Q3LqA8>. [Accessed: Jan. 2016] (in Thai).
- [4] Thailand Institute of Scientific and Technological Research (TISTR), Available: <http://goo.gl/kVK3LK>. [Accessed: Jan. 2016] (in Thai).
- [5] P. Khampian, "Study of cost and return for cultivation of animal corn tambon sila, amphoe lom-kao Phetchabun province," Aug. 18, 2014, Available: <http://goo.gl/5xgYs0>. [Accessed: Jan. 2016] (in Thai).
- [6] F. Cherubini and S. Ulgiati, "Crop residues as raw materials for biorefinery systems - A LCA case study," *Applied Energy*, vol. 87, pp. 47-57, Jan. 2010.
- [7] Department of Environmental Quality Promotion (DEQP), Production approach of community businesses with carbon footprint labels, Bangkok: Samart Copy, 2011. (in Thai).

Medicine and Nursing 2

- Aging and Lifestyle Related Diseases -

Monday 29 August, 2016

9:00-10:20

Room A, North Block

Critical role of proteinase-activated receptor 1 in pathogenesis of pulmonary hypertension

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INTRODUCTION

Proteinase activated receptor 1 (PAR₁) is a G protein-coupled receptor that mediates vascular effects of a coagulation factor thrombin, such as vascular contraction and vascular remodeling [1]. Pulmonary artery has unique properties regarding the vascular effects of PAR₁ compared to the systemic artery [2, 3]. PAR₁ has no contractile effects in the normal systemic artery, while it induced smooth muscle contraction in the normal pulmonary artery.

Pulmonary hypertension is one of the refractory vascular diseases with a poor prognosis. It is characterized by a progressive increase in pulmonary vascular resistance, which results in an increase in pulmonary artery pressure. The increase in pulmonary vascular resistance is attributable to vascular contraction, vascular remodeling and thrombus formation. Therefore, it is hypothesized that PAR₁ plays a critical role in the pathogenesis and pathophysiology of pulmonary hypertension. Here I addressed this hypothesis by using animal model of pulmonary hypertension

RESULTS AND DISCUSSIONS

A single injection of 60 mg/kg monocrotaline (MCT) induced a development of pulmonary hypertension in rats in 3 weeks (Fig. 1), i.e., increases in right ventricular systolic pressure (RVSP), pulmonary vascular resistance (RVSP/CI) and development of right ventricular hypertrophy (RVH).

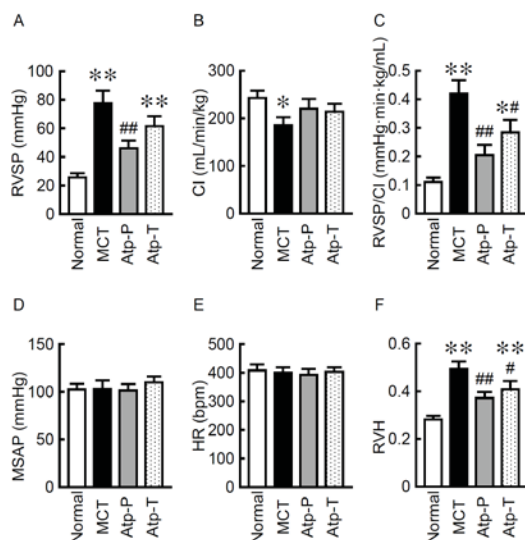


Fig. 1. Summaries of right ventricular systolic pressure (RVSP), cardiac index (CI), pulmonary vascular resistance index (RVSP/CI), mean systemic arterial pressure (MSAP), heart rate (HR) and right ventricular hypertrophy index (RVH) 3 weeks after MCT injection, in normal, MCT-induced pulmonary hypertension rats without (MCT) and with treatment with PAR₁ antagonist atopaxar (Atp-P, Atp-T). The data are the mean \pm SEM (n = 6-12). * P < 0.05, ** P < 0.01 vs. Normal. # P < 0.05, ## P < 0.01 vs. MCT.

Administration of PAR₁ antagonist (atopaxar), starting from the day of MCT injection (Atp-P) or 2 weeks after MCT injection (Atp-T), prevented the development of pathophysiology of pulmonary hypertension (Fig. 1).

The level of expression of PAR₁ mRNA in pulmonary artery was up-regulated in MCT rats, while this upregulation was slightly suppressed by atopaxar treatment (Fig. 2A). The contractile function of PAR₁ is evaluated in the isolated lung preparation perfused at a constant flow rate. A bolus injection of PAR₁-agonist peptide (PAR₁AP) induced a modest pressor response in the normal rats (Fig. 2B). The pressor effect of PAR₁AP was augmented in MCT rats, while this augmentation was suppressed by atopaxar treatment (Fig. 2B). The pressor effect of angiotensin II was also augmented in MCT rats. However, the degree of augmentation seen with 300 nmol PAR₁AP (36 fold) was greater than that seen with 50 nmol angiotensin II (10 fold).

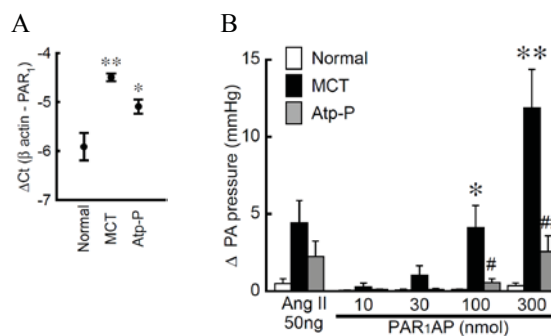


Fig. 2. The summaries for the level of expression of PAR₁ mRNA (A; n = 6-8) and the extent of pressor responses induced by angiotensin II (Ang II) and PAR₁-agonist peptide (PAR₁AP) at the indicated dosage (B; n = 6-9) in Normal and MCT-induced pulmonary hypertension rats without (MCT) and with (Atp-P) treatment with PAR₁ antagonist atopaxar. The data are the mean \pm SEM. * P < 0.05, ** P < 0.01 vs. Normal. # P < 0.05, ## P < 0.01 vs. MCT.

In conclusion, increased expression and contractile function of PAR₁ plays a critical role in pathogenesis of pulmonary hypertension. PAR₁ is a potentially useful novel therapeutic target for the treatment of pulmonary hypertension.

REFERENCES

- [1] K. Hirano, "The roles of proteinase-activated receptors in the vascular physiology and pathophysiology." *Arterioscler. Thromb. Vasc. Biol.* vol. 27, pp. 27-36, 2007
- [2] J. Maki, M. Hirano, S. Hoka, H. Kanaide and K. Hirano, "Thrombin activation of proteinase-activated receptor 1 potentiates the myofilament Ca²⁺ sensitivity and induces vasoconstriction in porcine pulmonary arteries." *Br. J. Pharmacol.* vol. 159, pp. 919-927, 2010
- [3] J. Maki, M. Hirano, S. Hoka, H. Kanaide and K. Hirano, "Involvement of reactive oxygen species in thrombin-induced pulmonary vasoconstriction." *Am J Respir Crit Care Med.* vol. 182, pp. 1435-1444, 2010

Responses of renal hemodynamics and functions to acute administration of a SGLT2 inhibitor in anesthetized rats

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INTRODUCTION

Recent studies have shown that blood pressure reduction with Sodium-Glucose Co-Transporter 2 (SGLT2) inhibitor is associated with natriuresis in hypertensive rats [1,2]. Those background information lead us to hypothesize that SGLT2 inhibitor induces natriuresis by its direct tubular action. Therefore, our specific aim was to examine the acute effect of a SGLT2 inhibitor, luseogliflozin, on renal hemodynamics and functions in anesthetized rats.

RESULTS AND DISCUSSION

Ten-wk-old male Sprague Dawley (SD) rats and 5/6 nephrectomized (Nx) rats were divided into 4 groups and treated with intra-peritoneum injection of either luseogliflozin (.9 mg/Kg) or vehicle (2-hydroxylpropyl-β-cyclodextrin). Group 1- Luseogliflozin, .9 mg/Kg, Group 2- Vehicle, Group 3- Nx Luseogliflozin, .9 mg/Kg, Group 4- Nx Vehicle. Rats were anesthetized with sodium pentobarbital and isoflurane and the left kidney was exposed through retroperitoneal flank incision, renal blood flow (RBF) was continuously measured by placing an ultrasound probe around the renal artery. Urine was collected directly from left ureter in 30 minutes interval. At the beginning and at the end blood was collected.

Acute administration of luseogliflozin did not change mean arterial pressure (Fig 1A), mean RBF (Fig 1B), and creatinine clearance (Fig 2). However, luseogliflozin significantly increased urine flow (Fig 3A), which was associated with significant increase in urinary excretion rate of glucose (Fig 3B) in both groups. In compared with Nx rats, urinary sodium excretion increased only in normal rats treated with luseogliflozin (Fig 4). Moreover, luseogliflozin also resulted in an increase in urinary pH which is associated with decrease in urinary osmolality

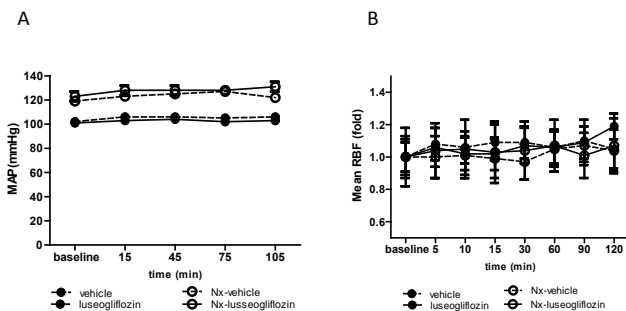


Fig. 1. Mean arterial pressure (A) and mean RBF fold changes (B)

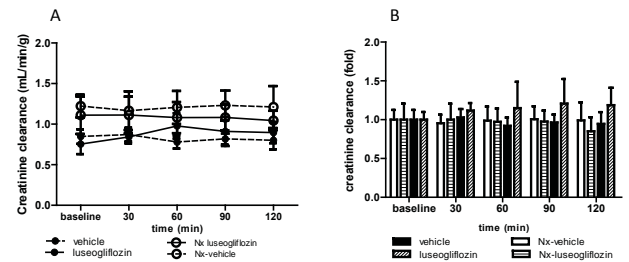


Fig. 2. Creatinine clearance ml/min/g (A) and creatinine clearance fold changes (B)

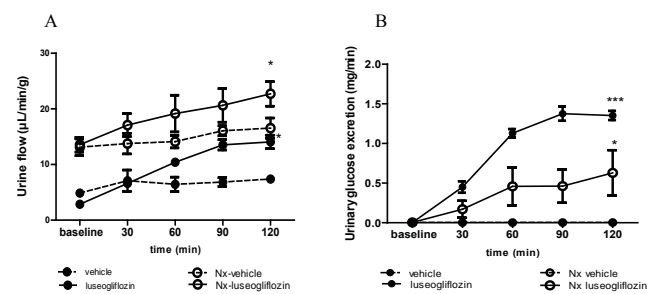


Fig. 3. Urine flow (A) and urinary glucose excretion (B).
 * $P < 0.05$ vs. Nx- luseogliflozin baseline, *** $P < 0.001$ vs. luseogliflozin baseline

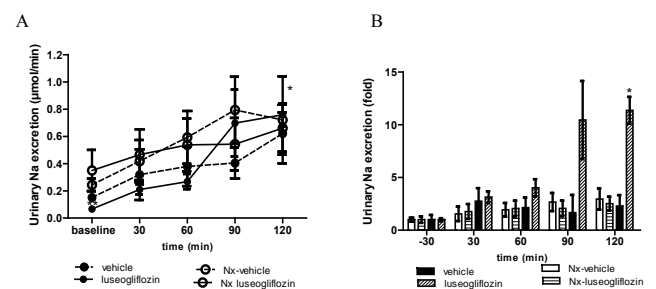
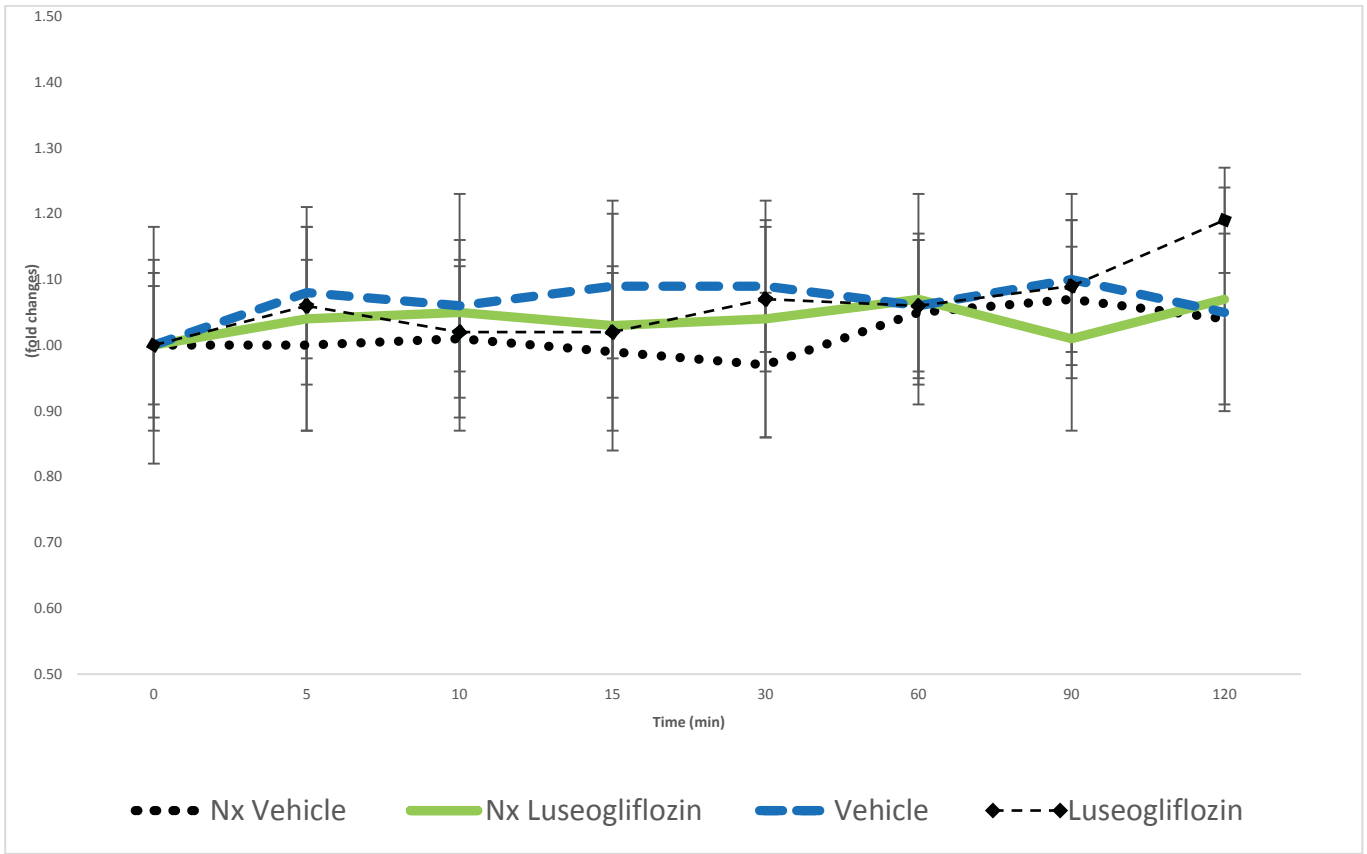


Fig. 4. Urinary Na excretion (μmol/min) (A) and fold changes (B)
 * $P < 0.05$ vs. luseogliflozin baseline

In conclusion, these data suggest that luseogliflozin elicit direct effects on renal tubular functions. Moreover in rats with remnant kidney, luseogliflozin induced urinary changes were markedly attenuated.

REFERENCES

- [1] Rahman A, Kittikulsuth W, Fujisawa Y, Sufiun A, Rafiq K, Hitomi H, Nakano D, Sohara E, Uchida S, Nishiyama A., "Effects of diuretics on sodium-dependent glucose cotransporter 2 inhibitor-induced changes in blood pressure in obese rats suffering from the metabolic syndrome", *J Hypertens.* 34(5):893-906, May 2016.
- [2] Takeshige Y, Fujisawa Y, Rahman A, Kittikulsuth W, Nakano D, Mori H, Masaki T, Ohmori K, Kohno M, Ogata H, Nishiyama A., "A sodium-glucose co-transporter 2 inhibitor empagliflozin prevents abnormality of circadian rhythm of blood pressure in salt-treated obese rats", *Hypertens Res.* 39(6):415-422, June 2016.



Internal Consistency and Inter-rater Reliability of The Functional Test for Hemiplegic Upper Extremity in Persons with Hemiplegia–Thai Version

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This study was to translate The Functional Test for Hemiplegic Upper Extremity – Hong Kong version (FTHUE-HK) into a Thai version and to study the psychometric properties of the instrument including internal consistency and inter-rater reliabilities by 30 hemiplegic patients. The translation process was conducted following standard procedure. Assessment of psychometric properties of The Functional Test for Hemiplegic Upper Extremity – Thai version (FTHUE-Thai version) revealed a very good internal consistency ($r=0.83$, $p<0.01$) and performed excellent in the inter-rater reliability ($r=0.96$, $p<0.01$). The test of FTHUE-Thai version proved to be reliable.

INTRODUCTION

Hemiplegia resulting from stroke is a major health care problem in Thailand. It was the third common cause of death subsequent from heart disease and cancer. In 2009, the total number of stroke patients was 277.67 people per 100,000 and increased to 366.81 people per 100,000 in 2013 [1]. The prevalent age was 60 years or more, the elderly, leading to a greater demand for rehabilitation in communities.

At present, there are a few tests of upper extremity movement designed specifically for hemiplegic patients which have been published. For example, the Fugl Meyer Assessment (FMA) is comprehensive tests of motor recovery from hemiplegia, and the result does not provide a clear picture of actual upper extremity function. Besides, it is a time-consuming test. Others, the Jebsen Hand Function Test is too difficult for partial motor recovery patients, especially at the early stage [2].

FTHUE is a test used to evaluate the total upper extremity impairment of stroke patients [3]. It was developed in Rancho Los Amigos Hospital, USA. The test focus on motor recovery pattern of upper extremity in a sequence based on the Brunnstrom stage of recovery of adults following cerebrovascular disease evaluates the overall functions as well as assesses from no hand movement to full hand function. The test consists of 18 activities arranged in a hierarchy of 7 functional levels and graded by degree of difficulty. Grading is on pass (+) and fail (-). In addition, Winstein, Rose, Tang et al., had used the FTHUE as an outcome measurement on their study comparing two upper extremity rehabilitation strategies in acute stroke patients [4]. The result indicated that patients who practiced task-specific training improved in function capacities measured by FTHUE. However, it takes up to 40 minutes for a single evaluation for most patients.

In 2004, Fong et al. developed a ‘Hong Kong version’ [2]. New items were constructed as well as items which were not commonly found in Hong Kong culture were eliminated.

In Thailand, the lack of standard instrument for measuring arm and hand movement function is due to the difficulty in developing or constructing. Adapting or reconstructing from a standard, well-known instrument is more practical for clinical practice and research study. FTHUE has never been applied to use in Thailand. Since Hong Kong culture is familiar to Thai, the FTHUE-HK could be appropriately used for evaluating arm and hand function progress of hemiplegic patients. It would be a useful standard instrument for therapists and other disciplines to document and guide interventions

MATERIAL AND METHODS

Get permission from the FTHUE-HK’s author to translate the instrument. The translation process was conducted following standard procedure–Cross culture adaptation techniques–as defined by Gjersing [5]. To identify the word understanding and proper uses in clinical practice, the translated FTHUE was tested by 10 samples.

The instrument used in this research is the Functional Test for Hemiplegic Upper Extremity– Thai Version consists of 3 parts: (1) FTHUE-Thai version test, (2) Test equipment (Fig.1) and (3) Test manual



Fig.1. FTHUE-Thai version equipment

Another sample of 30 patients with first stroke, either male or female, aged 20–80 years, able to understand instructions (tested by asking to follow an easy instructions), and no deficits in eyesight or hearing were recruited from 6 rehabilitation centers in Chiang Mai and Lampang provinces for studying internal consistency and inter-rater reliabilities.

RESULTS AND DISCUSSION

Direct and backward translation of FTHUE instrument was made. The content shows consistent results. Although translators used some different words, they corresponded to similar meanings. With suggestions to improve the instrument, item 2C “Arm clearance during shirt tuck” was not clear since the samples were showing mistakes. One sample suggested that this should be added with specific

detail about which arm should do the clearance. Item L1 “using chopsticks” required a plate and foam cubes which were both similar shades of white, making it difficult to recognize objects. Every suggestion was addressed.

Calculation for internal consistency reliability of instrument by using Kuder-Richardson coefficient appeared to be in “very good level” at 0.83 [6]. This indicated that the test items had high correlation between each task item and functional level.

In addition the inter-rater value of the instrument was at 0.96 as measured by using Kuder-Richardson coefficient which indicated that there was excellent reliability among different examiners [7]. (Table5) This occurs as a result of good understanding of the two examiners and scoring are on two options; pass (+) and fail (-). This allows easy determination which is what Zivaina et al. [8] stated in her study that scoring two values–Dichotomous scales–provide higher reliability than the ordinal scales.

CONCLUSION

FTHUE- version Thailand has very good internal consistency reliability at 0.83 and excellent inter-rater reliability at 0.96. Therapists may consider this instrument for measuring the capability of arm and hand function in hemiplegia patients with stroke or patients with traumatic brain injury in Thailand.

ACKNOWLEDGMENT

The authors are grateful to Assoc. Prof. Dr. Kenneth Fong and colleagues, owner of The Functional Test of Hemiplegic Upper Extremity – Hong Kong version, for support and permission.

REFERENCES

- [1] Bureau of Non Communicable Disease. The number and rate per hundred thousand populations of stroke patients (I60-I69) in Bangkok area and all of the country from 2007 to 2014 [internet]. 2014 [cited 2015 Aug 23]. Available from: <http://thaincd.com/information-statistic/non-communicable-disease-data.php>.
- [2] Fong K, Ng B, Chan D, Chan E, Ma D, Au B, et al. Development of the Hong Kong Version of the Functional Test for the Hemiplegic Upper Extremity (FTHUE-HK). *Hong Kong Journal of Occupational Therapy*. 2004;14(1):21-9.
- [3] Wilson DJ, Baker LL, Craddock JA. Functional Test for the Hemiparetic Upper Extremity. *American Journal of Occupational Therapy*. 1984;38(3):159-64.
- [4] Winstein CJ, Rose DK, Tan SM, Lewthwaite R, Chui HC, Azen SP. A randomized controlled comparison of upper-extremity rehabilitation strategies in acute stroke: a pilot study of immediate and long-term outcomes. *Archives of Physical Medicine and Rehabilitation*. 2004;85(4):620-8.
- [5] Gjersing L, Caplehorn JR, Clausen T. Cross-cultural adaptation of research instruments: language, setting, time and statistical considerations. *BMC Medical Research Methodology*. 2010;10(1):1-10.
- [6] Srisatidnarakul B. Development and psychometric testing of a research instrument: psychological measuring features. Bangkok: Chulalongkorn University Printing House; 2012.
- [7] Kitpredaborisut B. Statistical analysis for research: a step by step approach. 6th ed. Bangkok: Faculty of Social Science and Humanities, Mahidol University; 2006.
- [8] Ziviani J, Rodger S, Pacheco P, Rootsey L, Smith A, Katz N. The Dynamic Occupational Therapy Cognitive Assessment for Children (DOTCA-Ch): Pilot study of inter-rater and test retest reliability. *New Zealand Journal of Occupational Therapy*. 2004;51(2):17-24.

Reconstruction of Input Function for Ultra Rapid PET CBF and CMRO₂ Examination

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INTRODUCTION

Parametric CBF, OEF and CMRO₂ images can be measured using ¹⁵O-PET. Recently, we have developed a novel protocol allowing an extremely short PET scan time of <10 min [1]. In that protocol, two tracers of ¹⁵O₂ and H₂¹⁵O are sequentially administrated during a single PET scan. One of issues to be solved, so far, is to remove an invasive procedure for arterial blood withdrawal to obtain an input function. The aim of the present study was to develop a new method for image-derived input function (IDIF).

METHOD

Our technique consisted of formula based on the single tissue compartment model for expressing inputs from a measured tissue curve with parameters of rate constants: K_1^w and K_1^o for water and oxygen, respectively. For multiple tissue curves from brain regions in a PET dynamic image, the rate constants were determined so as to minimize a sum of square differences for expressed inputs for the tissue curves:

$$\arg \min_{K_1^x} \sum_{i,j} \sum_{t=1}^n \|A_i(t) - A_j(t)\|^2$$

where, $A_i(t)$ is an input functions for i -th tissue curve, and N and n indicate the number of tissue curves and frames, respectively. For the estimated rates, IDIFs were reconstructed, and mean of reconstructed inputs was determined as IDIF. To test the validity, 20 subjects with suspected cerebrovascular disorders were studied. The subjects received PET examination with the DBFM protocol. The parametric images were computed using the IDIF and measured input functions. Regions of interests (ROIs) were placed in cortical and white matter regions, and CBF, OEF, and CMRO₂ values were extracted for those ROIs, and extracted values for those were compared.

RESULTS

The estimated IDIFs were well reproduced compare to the measured ones (Fig. 1). The mean of calculated CBF values were 0.46 ± 0.16 and 0.46 ± 0.16 ml/min/g by the measured and IDIF, those for OEF were 0.46 ± 0.08 and 0.44 ± 0.08 , and those for CMRO₂ were 0.037 ± 0.014 and 0.035 ± 0.013 ml/min/g, respectively. Differences were $\pm 7.1\%$, $\pm 6.7\%$ and $\pm 8.3\%$ for those functions, respectively. Regression analysis showed reasonable relationships and tight correlations as: $y = 0.01 + 0.98x$, $r=0.97$, for CBF, $y = 0.05 + 0.81x$, $r=0.93$, for OEF, and $y = 0.001 + 0.90x$, $r=0.97$, for CMRO₂.

CONCLUSION

The presented results demonstrate that IDIF can be estimated directly from tissue curves from dynamic PET image for DBFM, suggesting a possibility of noninvasive CBF, OEF and CMRO₂ assessments.

REFERENCE

- [1] Kudomi, N et al JCBFM 2013;33:440

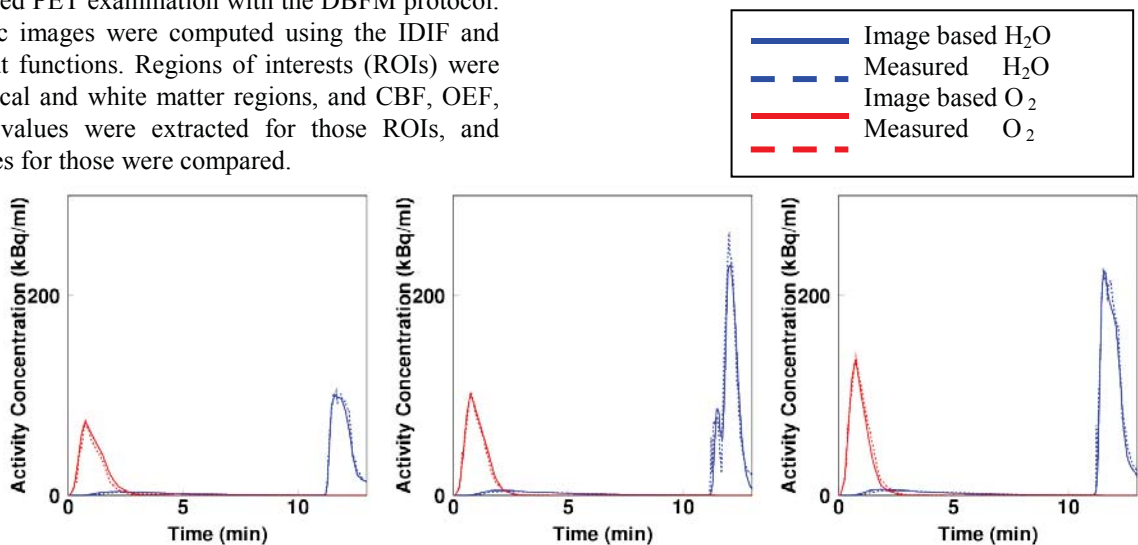


Fig 1: Representative sets of estimated input function (solid lines) for oxygen (red) and water (blue). Measured inputs are depicted with dashed lines. Decay was uncorrected.

Engineering 2

- *Sustainable Technologies* -

Monday 29 August, 2016

9:00-10:20

Room B, North Block

Classification and Dynamic Analysis of Historic Pagodas in Chiangmai

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This paper presents collection of historic pagodas in Chiangmai and numerical investigation on dynamic properties using finite element analysis. First, geometrical survey of pagodas and classification based on structural shape were made. The geometrical survey shown that all pagodas could be classified into three main groups as inverted bell shape, palace (square) shape and other shape (not classified into the first two shapes). Then, three representative pagodas, respectively one from each group, namely Umong pagoda, Lokmori pagoda and That-klang temple pagoda were selected for detail finite element analysis to determine the dynamic properties including natural frequency and mode shapes. The obtained results concluded that the topmost part of the pagodas are very susceptible to earthquake loading. The information can be useful for estimation of seismic performance under future earthquakes leading an appropriate retrofitting method.

INTRODUCTION

Chiang Mai City has been considered as a cultural city founded more or less 700 years ago. Pagoda is one of the historical evident telling the past life regarding the people respects on Buddha and the historical buildings are very important. However, as Chiangmai is a moderate seismic prone area, the buildings have been suffered from earthquake damages. Collection of the pagodas in Chiangmai leads to classification into three main groups as inverted bell shape, palace (square) shape and other shape (not classified into the first two shapes). Umong pagoda having inverted bell shape is 16.48 m. in base diameter and 25.72 m. high. Lokmori pagoda classified as palace shape is 19.85 m. in base width and 39.40 m. high. That-klang temple pagoda is 16.00 m. wide and 18.53 m high.

Finite element models using three-dimensional brick element coded SOLID45 [1] were made for the dynamic analysis, as shown in Fig.1. The models were assumed as solid masonry with no space inside the pagodas [2-4]. The many-tiered umbrella at the topmost part was modeled using three dimensional hollowed pipe element coded PIPE45 representing the vertical steel bar and lumped masses were assumed representing the weight of 35 kg. The analysis was based on linear behavior with isotropic property, as shown in Table1.

TABLE I MECHANICAL PROPERTIES

Properties	Masonry	Steel
Ultimate compressive strength (MPa)	2.0	235
Tensile strength (MPa)	0.2	235
Elastic modulus (MPa)	2,800	200,000
Poisson's ratio	0.15	0.3
Unit weight (kg/cu.m.)	1,800	7,850

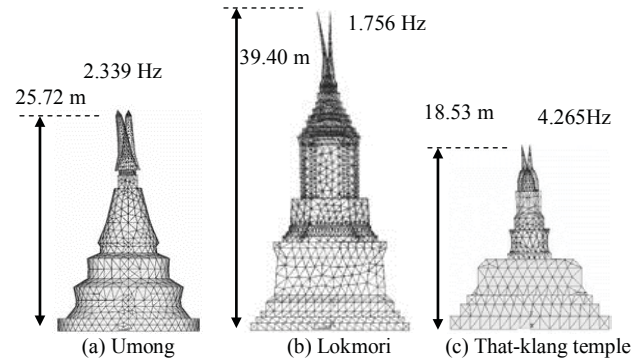


Fig. 1. Finite element model and natural frequency

RESULTS AND DISCUSSIONS

The finite element analyses successfully estimated the free vibration behavior of the three pagodas. From the analytical results, the following conclusions can be made.

- The top part of the pagodas move significantly under vibration. Hence, the area can be predicted as the vulnerable zone. It is agreed well with the past records of pagoda earthquake damages. The AD.1545 earthquake hit Chiangmai city causing failure of top part of Chedi Luang. Recently, the 6.8 Richter earthquake at Shan State, Myanmar around the Thailand-Myanmar border made the top part of Prathat Chedi Luang, in Chiang san with about 100 km from the source, fallen down.

- The natural or fundamental frequencies of the three representative pagodas are 2.339 Hz, 1.756 Hz. and 4.265 Hz. respectively for Umong pagoda, Lokmori pagoda and That-klang temple pagoda. Lokmori pagoda is the less frequency indicating the most slender especially in the top part. The small inverted bell shape pagoda tends to perform rigidly. Hence, the top part of high pagoda should be investigated for earthquake resistant.

- The inverted bell shape pagoda shows a symmetric movement. In addition, the shape is quite stable with large circular base. The frequencies of higher modes of vibration are hence very high compared with the fundamental mode. However, the two other shapes exhibit torsional mode which may create large tension in the masonry resulting to large cracks and severe damage. This behavior is critical as the masonry is very weak under tension.

REFERENCES

- [1] ANSYS User's Manual Vol. I. Swanson Analysis Systems, Inc. 1994.
- [2] Dumrigul, S. Lanna reign. Ancient city. 1996. (in Thai)
- [3] Hansapinyo, C. "Seismic Performances of Brick Masonry Inverted Bell-Shaped Chedi" *The APCBEE Procedia*, Vol.9, pp. 217-221, 2014.
- [4] Hansapinyo, C. and Poovarodom, N. "Ambient Vibration Tests and Finite Element Analysis for Dynamic Properties of Brick Masonry Inverted Bell-Shaped Chedi" *The APCBEE Procedia*, Vol.9, pp.212-216, 2014.

Prediction model of deterioration process of concrete structure subjected to Chloride induced damage

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INTRODUCTION

The method to predict the damage process of deteriorated structure subjected to chloride induced deterioration is proposed in this paper. The deterioration process is modelled as consisting of three phases; The first is the period t_s until depassivation of the reinforcement occurs after completion of the structure, and the second is the period t_{cr} until the corrosion cracking occurs due to pressure of corrosion from corrosion of reinforcement starts. After corrosion cracking, the concrete members will be deteriorated exponentially. The deterioration phenomenon of structures in actual environment is varied widely. Therefore, the stochastic method is carried out in order to consider the actual structure with uncertainty in nature. Two parameters, Equivalent diffusion coefficient, and cover thickness is modelled as stochastic parameters in this paper.

RESULTS AND DISCUSSIONS

The numerical method proposed in this paper is carried out against the target slab of flood gate. Table 1 indicates the values used in computation in order to predict the deterioration of slab. Monte Carlo simulation with 3000 random numbers is used in computation. The main bar and reinforcement bar are used D16. The spacing between reinforcements is obtained 150mm from investigation. Thickness of reinforcement bar is 62mm. Standard deviation of thickness of cover concrete is obtained 10mm by the investigating in situ. The equivalent diffusion coefficient is obtained from results of testing the concrete core sampled at site. The mean value with $1.63 \times 10^{-8} \text{ cm}^2/\text{sec}$ and the standard deviation with $1.50 \times 10^{-8} \text{ cm}^2/\text{sec}$ are obtained from the survey data. The shape of distribution can be approximated as log-normal distribution.

Figure 1 indicates the comparison with the results of computation and survey data of chloride ion density close to reinforcement. Mark \circ in Figure indicates the survey data. The survey data of 85% consists in the mean value \pm standard deviation in computation. Both values are similar with considering the uncertainty of deterioration in nature. Cracking modes are compared with results in computation and in survey data respectively. Figure 2 indicates the relationship between the rate of each cracking mode in computation and elapsed year. Mark \circ indicates measured values from target structure in situ. The red line in Figure indicates cracking along reinforcement, the yellow indicates the floating of surface concrete and the blue indicates the spalling of cover concrete. Green indicates the sound part of slab. Those cracking modes in computation can be obtained

to coincide with survey data considering uncertainty of actual environments.

Table 1 Data used in computation

Items	Mean Value	S.D.	Distribution
Environment	Splash Zone	-	-
Service Period	35years	-	-
Spacing between Reinforcement	150mm	10cm	Normal
Cover Thickness	62mm	10cm	Normal
Compressive Strength of Concrete	39.7N/mm ²	-	-
Mean Temperature in Concrete	18.8°	-	-
Chloride Ion Density at Surface	13.0kg/m ³	-	-
Equivalent Diffusion Coefficient	$1.63 \times 10^{-8} \text{ cm}^2/\text{sec}$	$1.5010^{-8} \text{ cm}^2/\text{sec}$	Log-normal

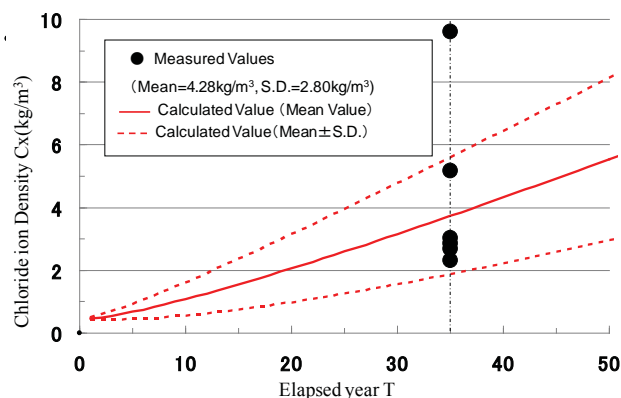


Figure 1 Chloride ion densities and elapsed year

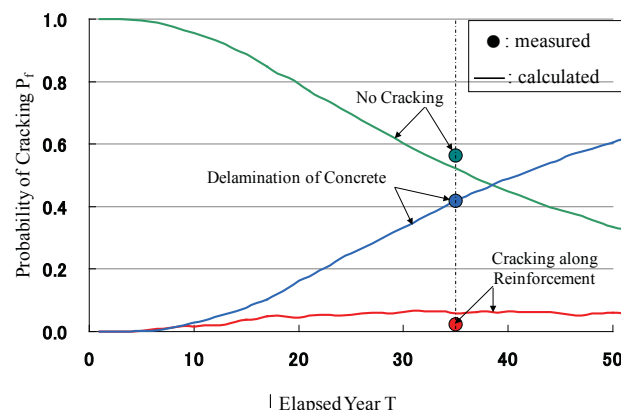


Figure 2 Cracking modes and elapsed year

Study on Regional Characteristics of Wall Clay for Mud Walls

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Mud walls consist of wooden frames, lattice substrata made of bamboo and other materials, and viscous soil mixed with straw. The compressive strength and shear strength of the clay used in mud walls (henceforth, this clay will be referred to as “wall clay”) enable mud walls to resist the lateral forces experienced during earthquakes. Further, the seismic performance of mud walls is decided by the mechanical characteristics of wall clay, which, in turn, are greatly influenced by the location or region in Japan or the amount of straw that is mixed. Viscous soil is mixed with sand and fiber material such as straw for wall clay based on the experience and intuition of craftsmen. In this study, the objective is to clarify the mechanical characteristics of wall clay based on the results of material tests and to evaluate the seismic performance of mud walls considering the regional characteristics of wall clay. It is shown that the mechanical characteristics of wall clay can be changed by the mix proportion of sand or straw to wall clay.

INTRODUCTION

In this study, the objective is to clarify the mechanical characteristics of wall clay, which is used for mud walls, for each region in Japan based on the results of material tests. To clarify the mechanical characteristics of wall clay, such as cohesion and angle of internal friction, 17 samples of Arakabe soil and 8 samples of Nakanuri soil were obtained from all over Japan.

Unconfined compression tests for wall clay were conducted as material tests. A circular specimen was used for the unconfined compression tests [1]. Five specimens were used for each parameter. Soil was obtained from manufacturers from all over Japan. Arakabe soil was mixed in the laboratory. The mixture amounts of straw to 100 L of the Arakabe soil is shown in Table 1. The Nakanuri soil was mixed with sand and straw in the laboratory, and the mixture amounts of sand and straw were decided by one craftsman to be suitable. The ratio of sand to soil and the mixture amount of straw to 100 L of the Nakanuri soil are shown in Table 2. The mixture amounts of sand and straw differed with the region.

RESULTS AND DISCUSSIONS

After the material tests, the average values of cohesion c , angle of internal friction ϕ , and elastic modulus E_{50} were calculated based on the evaluation method [1].

Table 1 shows the results from the material tests for the Arakabe soil, i.e. its material characteristics. The soil from Kumamoto shows the maximum compressive stress σ_u , 1.08 N/mm², and this value is approximately 1.6 times larger than that for the other regions; the average is 0.67 N/mm². The mixing time for the Kumamoto sample is approximately 40 min, whereas it is approximately 10 min for the other regions.

Table 1. Results of material test for Arakabe soil

	m (kg/100L)	σ_u (N/mm ²)	E_{50} (N/mm ²)	μ	ρ (g/cm ³)	c (N/mm ²)	ϕ (°)
Saitama	0.9	0.87	179.9	5.9	1.55	0.30	21
Fukui Sabae	1.9	0.39	110.7	33.7	1.48	0.18	6
Fukui Echizen	2.2	0.26	29.3	13.9	1.25	0.13	0
Gifu	1.8	0.73	121.9	6.6	1.56	0.27	17
Aichi	3.2	0.86	28.5	6.6	1.45	0.43	0
Hyogo	2.0	0.73	107.7	15.2	1.52	0.31	9
Kyoto	1.6	0.75	144.5	13.1	1.54	0.35	4
Kagawa Seisan	1.8	0.58	87.2	6.1	1.48	0.25	9
Kagawa Tosan	3.9	0.63	96.1	18.6	1.32	0.29	5
Tokushima	1.3	0.68	148.4	10.4	1.59	0.29	9
Kochi	0.6	0.41	127.7	3.3	1.70	0.10	33
Yamaguchi Nagato	1.5	0.60	111.3	5.6	1.44	0.22	20
Yamaguchi Hofu	0.5	0.82	243.5	5.5	1.66	0.24	29
Hiroshima	1.0	0.97	185.4	4.8	1.67	0.28	30
Miyazaki	0.6	0.43	104.5	5.2	1.57	0.13	26
Kumamoto	2.5	1.08	96.4	7.1	1.46	0.49	5
Saga	2.4	0.68	39.9	7.9	1.37	0.34	0

Table 2. Results of material test for Nakanuri soil

	m (kg/100L)	clay/sand (%)	σ_u (N/mm ²)	E_{50} (N/mm ²)	μ	ρ (g/cm ³)	c (N/mm ²)	ϕ (°)
Saitama	1.8	-	0.98	193.4	4.6	1.68	0.32	24
Fukui Echizen	1.2	38	0.52	214.7	7.0	1.65	0.14	34
Aichi	1.4	39	0.60	185.2	7.6	1.64	0.17	30
Hyogo	1.0	43	0.74	280.7	6.3	1.67	0.22	29
Kyoto	1.2	117	0.87	222.7	3.9	1.64	0.23	35
Kagawa Seisan	2.1	-	0.94	205.4	3.5	1.46	0.35	17
Yamaguchi Hofu	1.3	59	0.71	171.1	4.6	1.55	0.29	13
Kumamoto	1.4	38	0.72	200.2	7.4	1.51	0.23	25

These results suggest that the volume of straw decreases, and the volume of soil particles increases for Kumamoto. According to the Japanese standard, the maximum compressive stress of wall clay used for mud walls is required to be greater than or equal to 0.30 N/mm². Except for Fukui Echizen, the maximum compressive stress of wall clay obtained from all over Japan is sufficient.

Table 2 shows the results from the material tests for the Nakanuri soil, i.e. the material characteristics. The volume of straw used for the Nakanuri soil is small compared with the Arakabe soil, and therefore, the volume of soil particles, density, and compressive strength increases. Sand is mixed into the Nakanuri soil, thereby making it easy to plaster, and the cracks produced by drying shrinkage are restrained. In case of Kumamoto, the maximum compressive stress σ_u of the Nakanuri soil is small compared with the Arakabe soil, owing to the mixture of sand.

The results of the material tests show that the mechanical characteristics of the Arakabe and Nakanuri soils vary widely with the extraction area, type of soil and fiber material, and mixture amount of sand.

REFERENCES

- [1] Utsunomiya N., Yamanaka M. and Matsushima M., “A proposal of new compressive test form of wall clay blended with fibers for plastering,” *AIJ Journal of Structural and Construction Engineering*, Vol. 76, No. 664, 2011, 1119-1124.

Forest burning prevention for Asia sustainability

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INTRODUCTION

Chiang Mai haze problem is mainly caused by the farmers' forest burning for the additional income increase from mushroom cultivation. Basically the burning is forbidden legally, however it is actually difficult to control it. Even if the smoke was found it will be too late in most of the cases, because it takes time to find and identify who put the fire on it. One of the most important things is to strictly control farmers not to burn definitely before they do. The condition is getting worse not only in Chiang Mai, but also in Chiang Rai and Khon Kaen, in Thailand. Sugarcane burning is also making similar problem, In this paper the author's idea is introduced again and the current situation is overviewed how it was getting changed worse, then rethink and propose how it should be done.

PROGRAM SCHEME TO CONTROL



Fig. 1 Schematic view for "Stop burning" concept

The haze problem caused by farmers' forest burning is now creating another serious problem of interfering the tourist bus traffic in Chiang Mai very often. Fig. 1 shows the schematic diagram how to control the farmers not to burn and use the bio-resources remain unburned. Here shows how to control burning and the monetary flow by the new products development. strict control by continuous monitoring by use of frequent flight of drone which is cheaper than the real helicopter application for

total operation fee in addition to the safety security. Basic concept of the idea proposed here is to pay a certain amount of money to the farmer for giving up and stop burning, however the unburned bio-resources are carried away by the municipality to some research organization to develop new products with value added for getting pay back the paid amount of money. New products means here bio-fuel energy pellet, animal feed, fertilizer, cellulose nano fiber, bio-plastics, etc. This is the basic concept of idea how to stop burning and use bio-resources for value added products development, In case of successful program operation, the burning can be controlled completely and new business may be created instead. Some of the feasibility study are now under operation using this model concept in Chiang Rai. Additional new idea for further improvement here is the application of drone for frequent flights and detailed data acquisition for monitoring and analysis of real problem involved in addition to data & information sharing commonly.

CONCLUSION

Previously proposed idea how to control the forest burning was introduced and overviewed the current situation of haze problem. Application of drone was newly proposed for precise information gathering, monitoring and analysis of the real cause of the problem involved. Feasibility study is undergoing by use of this concept, however it looks a little bit earlier to see the significant effective result yet.

ACKNOWLEDGMENT

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Economics and Business 2

- Economics and Business for Sustainability -

Monday 29 August, 2016

9:00-9:40

Room C, North Block

The relationship between auditor communication style, psychological comfort and trust of Thai listed company

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ABSTRACT

This study examines the extent to which clients' perceptions of a financial auditor's communication style affect their psychological comfort and trust when hiring a professional accounting firm to conduct annual financial audits. A study of 190 firms listed on the Stock Exchange of Thailand and Market Alternative Investment reveals that, consistent with social interaction theory, affiliation communication influence the client's psychological comfort in the auditor. From a managerial perspective, an affiliation communication style is fundamental for building client comfort and trust, especially for professional service firms in Eastern, collectivist cultures that are relationship rich, seek to avoid conflict, and prefer indirect communication styles over more direct styles.

INTRODUCTION

Professional services (e.g., healthcare, management consulting, financial advising, legal, auditing) by their very nature are complex, customized, involve information asymmetry and are high in credence properties meaning clients have difficulty evaluating the technical quality of the core service before, during or often even after the service has been 'produced' for a client. However clients can, and do evaluate the personal interactions with a professional service provider which then act as a proxy for technical quality in evaluations of trust and relationship quality (Bitner, et.al., 2000; Sarapaivanich & Patterson, 2015). There is evidence that communication is instrumental in contributing to the creation of strong bonds between client and provider and so have a positive impact on key elements of relationship quality such as satisfaction, trust and commitment (Booms & Nyquist, 1981; Mohr & Nevin, 1990). It is surprising then that scant attention has been paid to the role of interpersonal communication in shaping clients evaluations of professional service providers. A key element of communication is *communication style* because of its pivotal role in providing recipients (clients) feelings of *psychological comfort* - i.e., confidence, reduced anxiety, a sense of control and connectedness (Albrecht & Adelman, 1987; Ring & Van De Ven, 1994). From a managerial perspective it would seem important to understand how different communication styles enacted by professional employees might reduce client psychological discomfort, build trust and contribute to establishing bonds. It would assist professional managers in identifying an appropriate communication style for a given situation.

Based on the social interaction model (Ben-Sira, 1980) and social capital theory (Putnam, 1995) this study examines the extent to which a financial auditor's communication style impacts on organizational client's

psychological comfort and trust when engaging a professional accounting firm to conduct their annual financial audit. The study is undertaken in an emerging economy, Thailand, which has a strong collectivist cultural orientation where interpersonal communication is a key element in relationship development.

CONCEPTUAL MODEL AND HYPOTHESES

Fig. 1 portrays the conceptual model to be empirically tested

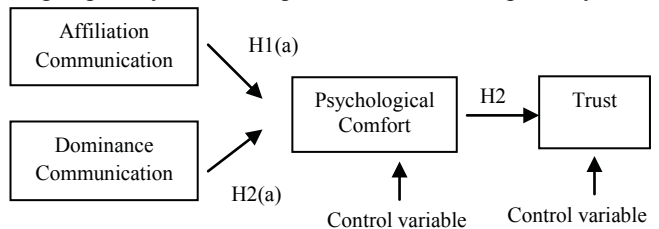


Fig. 1 Conceptual model

Communication style and psychological comfort

In accord with Ben-Sira's (1980) social interaction model, when clients are involved in a service encounter in which there is high information and knowledge asymmetry, and an inability to evaluate important technical outcomes (in the current study, the outcome of a financial audit required by law), clients will rely on the affective component of a professional's communication to reduce anxiety and uncertainty. The affective component corresponds to affiliation style of communication (Weiss & Mohr, 1991; Wong & Tjosvold, 1995). Service encounters are first and foremost social exchanges. In the context of the current study a financial audit process (which weeks or even months) there are multiple service encounters between client and the audit team manager. These interaction (communication) between service professional and client therefore have special salience, and as Czepiel noted "The social content of service encounters often overshadows the economic". The cultural context is also important here. Collectivist economies (e.g., Japan, Indonesia, China, Thailand) are typically "relationship rich" value harmony and conflict avoidance at all costs. An affiliation style of communications style seems more consistent with these values than a dominance style.

This also go to great pains to maintain relationships by making sure they do not offend others by their deeds or words. From a very early age they are instilled with norms of conflict avoidance and desire for harmony in personal and business relations. The maintenance of 'face' is also a powerful cultural norm in Thailand and other South East Asian nations, meaning people go to considerable to avoid themselves or others losing face. Brown and Levinson (1987) defined face as a form of a person's self-image, which requires emotional investment. They present the politeness theory, where the concept of 'face' is exemplified by a broad view of politeness. Given a more dominance communications style (talking over the top of a client, displays of arrogance, etc.) runs the risk of damaging a client's face (given a client may be highly professionally qualified, and a successful business person in their own right), we expect this communications style will be

counterproductive and so be negatively associated with invoking psychological comfort.

Based on this discussion we predict that:

H1(a): An affiliation communication style will be positively associated with client psychological comfort;

H1(b): A dominance style of communication will be negatively associated with client psychological comfort.

Psychological comfort and trust

Psychological comfort and trust are similar but distinct constructs. Comfort is defined as an affective psychological state wherein the customer's anxiety concerning a service has been eased, and he/she enjoys peace of mind and is calm and worry free concerning dealings with a provider (Spake et al., 2003) and similarly described as an emotion characterized by feeling at ease due to lack of anxiety and reduced mental stress in a service interaction (Lloyd & Luck, 2011). Trust is on the other hand is beyond a 'feel good' factor (Penglase, 2014). It is a cognition, a belief that the service provider can be relied upon to behave in objectively, be technically competent and not behave opportunistically if an occasion presents itself (Morgan & Hunt, 1994; Sharma & Patterson, 1999). It implies reliance on, or confidence in the process or person (auditor) and implies a vulnerability dimension. Trust plays a central role in financial auditing services owing to the inherent credence properties and complex nature of the service which make sit inherently difficult for the client to confidently predict the audit outcome.

Logic then would seem to dictate that the affective state (psychological comfort) would be an important antecedent of trust. Hence our third prediction is:

H2: Psychological comfort will be positively associated with trust.

RESEARCH METHOD

A multiphase approach was undertaken for this research. The first phase was exploratory and qualitative in nature and comprised five in-depth interviews with CFOs. The second phase comprised a cross-sectional survey. Our cross sectional survey yielded valid responses from 190 incorporated listed firms in SET and mai. The data was collected using a questionnaire and the response rate was 33.2 percent. The key informant (respondent) in each case was the person in the client firm who was directly involved in the audit and selection processes. To check for non-response bias, we compared the answers from late respondents (comprising approximately 18 percent of the final sample) to the balance of respondents on key constructs. No differences were detected on key constructs (psychological comfort, trust) and demographic variables at the $p < 0.05$ level. This, together with the respectable overall response rate indicates that the danger of non-response bias is quite low (Armstrong & Overton, 1977).

Measures

All measures were developed from the literature and considered to have content and face validity. All were captured on a 7-point Likert scale. Face validity was established by showing all scales to three marketing and accounting academics, and five CFOs, who all agreed that the items captured the essence of the constructs.

Validity and reliability

The composite reliabilities for all measures are greater than 0.7 (Table 1 refers). Next, the average variance extracted (AVE), which measures the amount of variance that a latent construct captures from its indicators, relative to measurement error, ranged from a modest, but acceptable 0.52 (dominance communication) to 0.72 (trust). To further assess whether the communication style constructs are distinct from each other, the procedure described by Fornell and Larcker (1981) was employed. As an indication of convergent and discriminant validity, the square root of the AVE for each construct should be higher than the correlation between that construct and any other construct. This proved to be the case. Thus it may be concluded that the constructs are discriminant. A correlation matrix is shown in Table 1.

TABLE 1 CORRELATION MATRIX

Construct	Affiliation Communicati on	Dominance Communicati on	Psychologic al Comfort	Trust
Commu_AF	(0.82)			
Commu_DM	-0.49**	(0.72)		
Psycho_Comf ort	0.59**	-0.47**	(0.85)	(0.85)
Trust	0.71**	-0.34**	0.56**	(0.85)

The diagonals in parentheses (boldfaced) indicate square root of AVE.

** $p < 0.01$; * $p < 0.05$.

Control variables

Years of using current audit firm is fundamental to establishing psychological comfort and trust. This is especially so in higher-context, relationship Asia cultures where tenure helps engender psychological comfort and trust. To provide a more robust test of our hypotheses we included tenure (number of years the client had been using the incumbent audit firm, and client general experience in being involved with annual financial audits) as control variables to both psychological comfort and trust.

RESULTS

We conducted an exploratory factor analysis entering all items for affiliation and dominance communication styles. The results confirmed a two factor solution explaining 71.8 percent of the total variance, with the first factor (dominance communication style – 4 items) explain 55.5 percent of the cumulative variance; and affiliation communication style (7

items) 16.3 percent. Cronbach's Alpha for the two constructs was a respectable 0.88 and 0.93, respectively. Next, all multi-item constructs were subjected to scale purification using confirmatory factor analysis (CFA). There were no standardized residuals covariances greater than ± 2.58 . Each scale was considered simultaneously in the model to provide for the test of convergent and discriminant validity.

The hypothesised models were tested using AMOS software. The fit statistics indicated that the model represented the data well, with $\chi^2 = 459$, $df = 244$, $CFI = 0.94$, $TLI = 0.93$ and $RMSEA = 0.068$. All statistics provide sound support for the measurement model. Table 2 shows the completely standardized parameter estimates, average variance extracted for each construct and their reliabilities.

TABLE 2 COMPOSITE RELIABILITY AND AVE OF LATENT VARIABLES

Variable		Factor loading	Composite reliability	AVE
Commu_AF			0.93	0.67
Commu_AF1	Listened carefully to our concerns	0.83		
Commu_AF2	Spoke clearly and effectively	0.83		
Commu_AF3	Were always calm and cool-headed	0.80		
Commu_AF4	Communicated in a friendly, but professional manner	0.87		
Commu_AF5	Generally expressed concern and empathy during our conversations	0.73		
Commu_AF6	Were open and honest in conversations	0.79		
Commu_AF7	They were extremely attentive to our point of view in meetings	0.88		
Commu_DM			0.76	0.52
Commu_DM1	In some discussions and arguments, the auditor was arrogant	0.86		
Commu_DM2	Spoke to us like they were always right and we were wrong	0.93		
Commu_DM3	They came on too strong in expressing their opinion	0.74		
Psychological comfort			0.94	0.71
Psycho_Comfort 1	The auditor who you mainly dealt with made you feel psychological comfort	0.80		
Psycho_Comfort2	The auditor who you mainly dealt with made you feel very much at ease	0.86		
Psycho_Comfort 3	The auditor who you mainly dealt with made you feel very relaxed	0.80		
Psycho_Comfort 4	The auditor who you mainly dealt with made you feel secure	0.80		
Psycho_Comfort 5	The auditor who you mainly dealt with made you feel worry free	0.88		
Psycho_Comfort 6	The auditor who you mainly dealt with made you feel calm	0.89		
Trust			0.91	0.72
Trust1	The auditor can be relied upon to keep their promises	0.88		
Trust2	The auditor was always honest with us	0.96		
Trust3	The auditor was trustworthy	0.73		
Trust4	We have confidence in the auditor's suggestions	0.73		

Commu_AF: Affiliation Communication; Commu_DM: Dominance Communication

All relationships were as predicted. Consistent with social interaction theory, the link between affiliation communication and psychological comfort was positive (0.53; $p < 0.00$) while the link between dominance communication and psychological comfort was negative (-0.23; $p < 0.00$). This supports the view that affiliation communication style has vital role in establishing customer psychological comfort. As predicted the link between psychological comfort and trust was positive (0.63; $p < 0.00$).

DISCUSSION AND MANAGERIAL IMPLICATIONS

The results highlight the critical role that affiliation communication plays in influencing psychological comfort. From a managerial perspective, it is especially so for professional services in collective culture, in which people are always takes another person's feelings into account and likely to prefer indirect and covert communication style (Beaulne, 2003; Komin, 1990). This serves to illustrate the point that auditor's affiliation communication style is a key factor in connecting auditor to customer and building customer comfort. Consisting with the slogan says the way you present your message is more important than the message itself. Therefore, the audit firm should place affiliation communication skills as one of the main criterion when recruiting new employees.

The path from dominance communication to psychological comfort was negatively significant. As predicted, in collective culture, dominance style represents communicating in a negative combative fashion. Clients do not favor communicating in a way that auditors tend to dominate conversations, come too strong in expressing their opinion or speak to clients like clients are always wrong.

There are a number of benefits in building customer comfort during service encounters. Comfort reduces the client's anxiety and makes client feel that he/she is highly respected and so enhancing their self-esteem (Schneider & Bowen, 1999). Enhancing comfort increases confidence and trust (Spake et al., 2003). Comfort in social interaction determines one's ability to interact with people of different cultures. As a result, the auditor should build the environment between auditor and client to be relaxed (but professional) and secure. This will make client will be more willing to provide information pertaining their firm's needs which is decisive for an auditor to deliver the service according with statutory requirements.

REFERENCES

- [1] Albrecht, T. L., & Adelman, M. B. (1987). *Communicating social support*. Thousand Oaks, CA: Sage Publications.
- [2] Beaulne, P. (2003). Communication style and culture. *Language Institute Journal*, 1(1), 18-26.
- [3] Ben-Sira, Z. (1980). Affective and instrumental components in the physician-patient relationship: an additional dimension of interaction theory. *Journal of Health and Social Behavior*, 21(2), 170-180.
- [4] Bitner, M. J., Brown, S. W., & Meuter, M. L. (2000). Technology infusion in service encounters. *Journal of the Academy of Marketing Science*, 28(1), 138-149.
- [5] Booms, B. H., & Nyquist, J. (1981). Analyzing the customer/firm communication component of the services marketing mix. In J.

- Donnelly & W. George (Eds.), *Marketing of Services* (pp. 172-177). Chicago, IL: American Marketing Association.
- [6] Brown, P., & Levinson, S. C. (1987). *Politeness: Some universals in language usage* (Vol. 4). Cambridge: Cambridge University Press.
- [7] Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.
- [8] Komin, S. (1990). Culture and work-related values in Thai organizations. *International Journal of Psychology*, 25(3-6), 681-704.
- [9] Lloyd, A. E., & Luk, S. T. (2011). Interaction behaviors leading to comfort in the service encounter. *Journal of Services Marketing*, 25(3), 176-189.
- [10] Mohr, J., & Nevin, J. R. (1990). Communication strategies in marketing channels: A theoretical perspective. *Journal of Marketing*, 54(4), 36-51.
- [11] Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(3), 20-38.
- [12] Penglase, D. (2014). The power of intentional trust in professional services. Retrieved from <http://www.charteredaccountants.com.au/News-Media/Charter/Charter-articles/Business-management/2014-04-Intentionomics.aspx>Putnam, 1995
- [13] Ring, P. S., & Van de Ven, A. H. (1994). Developmental processes of cooperative interorganizational relationships. *Academy of Management Review*, 19(1), 90-118.
- [14] Sarapaivanich, N., & Patterson, P. G. (2015). The role of interpersonal communication in developing small-medium size enterprise (SME) client loyalty toward an audit firm. *International Small Business Journal*, 33(8), 799-990.
- [15] Schneider, B., & Bowen, D. E. (1999). Understanding customer delight and outrage. *Sloan Management Review*, 41(1), 35-45.
- [16] Sharma, N., & Patterson, P. G. (1999). The impact of communication effectiveness and service quality on relationship commitment in consumer, professional services. *Journal of Services Marketing*, 13(2), 151-170.
- [17] Spake, D. F., Beatty, S. E., Brockman, B. K., & Crutchfield, T. N. (2003). Consumer comfort in service relationships: Measurement and importance. *Journal of Service Research*, 5(4), 316-332.
- [18] Weiss, J. E., & Mohr, J. (1991). Communication style: Looking beyond content in designing influence strategies. Paper presented at the AMA Educator's Conference Proceedings. Chicago: American Marketing Association.
- [19] Wong, C. L., & Tjosvold, D. (1995). Goal interdependence and quality in services marketing. *Psychology & Marketing*, 12(3), 189-205.

New Business Development Processes of Market Oriented Companies in the Japanese Apparel Industry

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INTRODUCTION

One of the study groups investigating market orientation, which is a focal construct in marketing literature, focuses on the implementation process of market orientation. Many studies pointed out that market orientation was understood as a culture or a set of behaviors. (e.g., Narver and Slater, 1990). Previous studies mainly discussed the implementation process of market orientation based on a cultural perspective (Gebhardt et al., 2006; Beverland and Lindgreen, 2007).

On the other hand, there is very little research existing from a behavioral perspective. Kohli and Jaworski (1990) defined market orientation “as the organization wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments and the organization-wide responsiveness to it.” (p.6). However, there is insufficient discussion pertaining to how firms behave in the actual business processes of market orientation. The purpose of this study is to explore the implementation process of market orientation in a new business development context from the behavioral perspective.

This study sets three conditions that enable us to analyze the processes of market orientation; 1) we focus on market oriented “small-to-medium sized enterprises (SMEs)”, 2) we analyze the process of developing a new business, 3) we focus on industrial businesses, which provide products for business organizations, but not for general consumers..

RESEARCH APPROACH AND DISCUSSIONS

We use the Activity-Resource-Actor (ARA) model (Håkansson et al, 2010) as research framework and adopt a multiple-case study design; three market oriented SMEs in the Japanese apparel industry are selected and their implementation processes of new business developments are analyzed (TABLE 1).

Case data shows that there are some differences among market oriented processes of new business developments and

TABLE 1: COMPANY PROFILES

Company	Business Description	Employees
A	Manufacturing/wholesale of textile (Obi/Kijaku) utilized for traditional Japanese kimono	49
B	Manufacturing high-density textile for marine sports and fashion	53
C	Manufacturing narrow-weaving textile for apparel and industrial products	145

		Knowledge on who potential customers are	
		Have	Doesn't have
New business idea	Have	Company B - The new business idea is ascertained with customer needs - Acquiring customer needs steadily	- The new business idea is ascertained with customer needs - Acquiring customer needs by chance
	Doesn't have	Company C - The new business idea emerges with customer needs - Acquiring customer needs steadily	Company A - The new business idea emerges with customer needs - Acquiring customer by chance

Fig 1: Relationship between the difference of knowledge and process of new business development

two aspects of knowledge the company possessed before gathering market intelligence (customer needs) are relevant to the differences. One is the knowledge on whether the company has a new business idea before generating market intelligence or not. If the company already has a new business idea, customer needs' knowledge is supplementary in order to ascertain its idea. However, if the company doesn't have the idea, a new business idea is emerged with customer needs and market intelligence performs a critical part of deciding a direction of a new business.

Other knowledge of existing resource is whether a company realized who a potential customer for new business is. If the company has some awareness of who provides a new business as a customer, it acquires customer needs steadily. On the other hand, if the company has no image of a new customer, its process of acquiring customer needs is affected by a chance.

Fig 1 presents the relationship between the difference of knowledge and process of new business development. This Fig suggests that it is more important to realize who a potential customer of a new business is than what is a new business because the company with knowledge of a potential customer goes through a process of a new business development steadily.

REFERENCES

- [1] Beverland, M.B and Lindgreen, A., “Implementing Market Orientation in Industrial Firms: A Multiple Case Study”, *Industrial Marketing Management*, 36(4), pp.430-442, 2007.
- [2] Gebhardt, G.F., Carpenter, G.S., and Sherry Jr., J.F., “Creating a Market Orientation: A Longitudinal, Multifirm, Grounded Analysis of Cultural Transformation” *Journal of Marketing*, 70(4), pp.37-55, 2006.
- [3] Håkansson, H., Ford, D. I., Gadde, L., Snehota, I. and Waluszewski, A., *Business in Networks*, Wiley, 2010.
- [4] Kohli, K. A. and Jaworski, J. B., “Market Orientation: The Construct, Research propositions, and Managerial Implications”, *Journal of Marketing*, 54, pp.1-18, 1990.
- [5] Narver, J. C. and Slater, S. F. “The Effect of a Market Orientation on Business Profitability” *Journal of Marketing*, 54(4), pp.20-35, 1990.

Medicine and Nursing 3

- Aging and Lifestyle Related Diseases -

Monday 29 August, 2016

10:40-12:00

Room A, North Block

Changes of memory function and resting electroencephalography by various aromatic stimulation

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INTRODUCTION

Previous studies showed some aromatic stimulation increased cognitive or memory function [1] [2], and induced mental relaxation in normal humans [3]. In nursing care, aromatic therapy is a common technique to induce mental and physical relaxation or relieve pain in palliative care units [4]. However, the efficacy or mechanism of this procedure is not clearly proven.

In the present study, we intended to detect effects of various aromatic stimulation on memory function and resting electroencephalography (EEG).

Considering previous studies, the suppressed θ wave activity and facilitated α wave activity appear to correspond to raised arousal level and stabilization of brain function [5]. Therefore, the present results in PSA suggest that aromatic stimulation raises arousal level and stabilizes brain activity resulting in increasing memory function.

However, we need further studies to confirm the effects of aromatic stimulation on cognitive function and elucidate its mechanism.

SUBJECTS AND METHODS

Eight normal females with ages of 21-23 years old, who gave us informed consent, participated in this study. This study was performed under the permission from the local ethical committee in our institution.

Subjects sit down on a relaxing chair in a dark booth, and cotton soaked by a fragrance oil of jasmine, lavender or chocolate or water as a control were set in front of subjects' nose. In this condition, memory tests on visual, semantic and digits memory of the revised version of Wechsler's Adult Intelligent Scale (WAIS-R) were performed by the subjects. In different days, EEG was recorded for 3 minutes during exposure of a kind of aroma fragrances or water. Smell stimulation was repeated in order of jasmine, lavender, chocolate and water inserting a break for 5 minutes. Using raw EEG for 3 minutes excluding artifacts, power spectrum analysis (PSA) was undertaken. Peak amplitudes and frequencies of theta, slow alpha or fast alpha waves were measured and were statistically compared among the conditions.

RESULTS AND DISCUSSIONS

All aromatic stimulation increased in visual memory performance ($P < 0.05$). Figure or digits memory function was not significantly affected by aromatic stimulation. This result suggests that aromatic stimulation affects memory function, especially visual memory function.

Power spectrum analysis (PSA) on resting EEG showed that aromatic stimulation decreased peak values of theta wave ($P < 0.05$), and jasmine stimulation increased peak values of slow alpha wave ($P < 0.05$).

REFERENCES

- [1] K. Sakurai, H. Tanaka, Y. Watanabe, Y. Hoshino, R. Takashima, M. Saito and K. Hirata, "Efficacy of tea tree oil for behavioral and psychological symptoms of dementia (BPSD) of Alzheimer's disease patients," *Japanese J. Aromatherapy*, vol. 11, pp. 12-16, January 2011.
- [2] X. Duan, M. Tashiro, D. Wu, T. Yambe, S. Nitta and M. Itoh, "Heart rate variability in autonomic function and localization of cerebral activity during inhalation of perfumed fragrances." *J. Int. Soc. Life Information Sci.*, vol. 24, pp. 383-389, September 2006.
- [3] M. Nagai, M. Wada, N. Usui, A. Tanaka and Y. Hasebe, "Pleasant odors attenuate the blood pressure increase during rhythmic handgrip in humans." *Neurosci. Lett.*, vol. 289, pp. 227-229, August 2000.
- [4] S. Wilkinson, J. Aldridge, I. Salmon, E. Cain and B. Wilson, "An evaluation of aromatherapy massage in palliative care." *Palliative Med.*, vol. 13, pp. 409-417, September 1999.
- [5] G. M. Martin, "Human electroencephalographic (EEG) response to olfactory stimulation: two experiments using the aroma of food." *Int. J. Psychophysiol.*, vol. 30, pp. 287-302, November 1998.

Association between daily life activities and blood pressure increase : Three-year longitudinal study in Japanese male employees living in suburban cities

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INTRODUCTION

In recent years, it has been reported that individuals with high-normal blood pressure levels have a higher incidence of cardiovascular diseases compared to those with normal or optimal blood pressure. Therefore, we elucidate the association between activities in daily life and blood pressure by conducting a longitudinal study on male employees living in suburban cities.

METHODS

Participants were recruited among employees (age 20–60 years) working in offices located in suburban cities. Physical activity and dietary assessment, medical interviews, anthropometric measurements, and blood tests were taken from the employees who gave consent to participate in the study (baseline study in FY2010 and follow-up study in FY2013). The physical activity assessment consisted of the Japanese version of the International Physical Activity Questionnaire (Long Version) with additional questions. Individuals with exceeded normotension (hereinafter, hyper-normotensive individuals) were defined as those with systolic pressure ≥ 130 mmHg or diastolic pressure ≥ 85 mmHg, as per the blood pressure classifications of the Japanese Society of Hypertension. For analysis, each daily life activity was categorized into 2 or 4 groups according to the quartile of activity time (in time/week). A logistic regression analysis was conducted with the presence of hyper-normotensive individuals (FY2013) as the dependent variable and each physical activity category (FY2010) as the independent variable to seek the odds ratios and 95% confidence intervals. This research was approved by the Clinical Research Ethics Committee of the Tokushima University Hospital.

RESULTS

Hyper-normotensive individuals were excluded from the 2010 data. Data was available for 2013 in 455 individuals. Of these subjects, there were 160 individuals who have become hyper-normotensive by FY2013. The activity parameters for which an association was observed with a development of hyper-normotensive individuals were sitting time during work (time/week) and bicycle use for transportation (yes/no). The odds ratio (95% confidence interval) for developing hyper-normotension in Group 1 with the shortest sitting time during work (≤ 480 min/week) was significantly high at 2.2 (1.256–3.935) compared to Group 4 with the longest sitting

time among the groups (≥ 2100 min/week) (p for trend = 0.003) (Table1). The odds ratio (95% confidence interval) for developing hyper-normotension in the group that uses a bicycle for transportation was significantly low at 0.497 (0.271–0.912) compared to the group that does not use a bicycle (p for trend = 0.024) (Table2).

TABLE 1 OR for developing Hyper-normotension according to level of sitting time at work in men

Sitting time at work (minutes/week)	Sampl	Hyper-normotension, %	OR	95%CI	
1 <480	117	47.0%	2.223	1.256	3.935
2 480–1439	109	39.4%	1.684	0.943	3.007
3 1440–2099	105	28.6%	1.116	0.612	2.034
4 ≥ 2100	122	25.4%	1.000		
			p for trend=0.003		
※Adjusted for age, family history, smoking, alcohol, intake of energy and Na					

TABLE 2 OR for developing Hyper-normotension according to bicycle use in men

Bicycle use	Sampl	Hyper-normotension, %	OR	95%CI	
No	377	37.9%	1.000		
Yes	78	21.8%	0.497	0.271	0.912
			p for trend=0.024		
※Adjusted for age, family history, smoking, alcohol, intake of energy and Na					

Conclusion

In Japanese male employees living in suburban cities, the results suggested shorter sitting time during work was associated with blood pressure increase. Results also suggested the potential of riding bicycle for transportation to suppress increased blood pressure.

REFERENCES

- [1] PT.Katzmarzyk, TS.Chourch, and CL.Craig, et al, "Sitting Time and Mortality from All Causes, Cardiovascular Disease, and Cancer," *Med.Sci.Sports.Exerc*, vol.41, pp.998-1005, 2009.
- [2] N.Owen, GN.Healy, and CE.Matthews, et al, "Too Much Sitting: The Population-Health Science of Sedentary Behavior," *Exerc.Sports. Sci. Rev*, vol.38, pp.105-113, 2011.
- [3] K. Oka, T Sugiyama, and S.Inoue, et al, "Science of sedentary behavior: application of the behavioral epidemiology framework," *J.J.H.E.P.*, vol.21, pp.142-153, 2013.
- [4] T.Ichihara, A.Tamura, and Makoto Funaki, et al, "The Effects of physical Activity on Metabolic Syndrome-From the 2009 Cross-Sectional Study on Working Men in Tokushima-," *9th International Diabetes Federation Western Pacific Region Congress*, p.269, 2012.

Prevalence and Risk of Poor Outcomes in Elderly Patients with Hemorrhagic Stroke in Maharaj Nakorn Chiang Mai Hospital, Chiang Mai, Thailand

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INTRODUCTION

Stroke is one of the leading cause of morbidity and mortality, especially among older people [1]. In Thailand, stroke is the third leading cause of morbidity and mortality. However, the outcome of hemorrhagic stroke (HS) and its associating factors among elders under specific circumstance like Thailand are not fully understood. Thus, this secondary data analysis study was conducted aimed to describe the prevalence of poor outcome along with its associating factors in elderly patients with HS who admitted in Maharaj Nakorn Chiang Mai Hospital between 2009 and 2013.

RESULTS AND DISCUSSIONS

Data from 231 elderly patients with HS were included in this analysis. Subjects were ranging in age from 61 to 101 years (mean = 71.3 ± 7.8 years). Fifty-one percent was male. All subjects had risk factors and/or co-morbidity beside HS; the top three were hypertension, dyslipidemia, and smoking, respectively. Intracerebral hemorrhage (ICH) was found in 64.5 percent of subjects. The Glasgow Coma Scale (GCS) during admission were between 3 and 15 (mean = 9.9 ± 3.7). 66.2 percent underwent surgery and the major type of operation was craniotomy. 43.7 percent had infection such as respiratory tract infection and urinary tract infection. At discharge, the GCS were between 3 and 15 (mean = 10.0 ± 3.8). (The characteristics of the patients with HS are presented in table 1.)

TABLE 1 CHARACTERISTICS OF ELDERLY PATIENTS WITH HEMORRHAGIC STROKE (N = 231)

Characteristics	Value
Age (year), mean ± standard deviation	71.3 ± 7.8
Gender	
Male, N (%)	117 (50.6%)
Female, N (%)	114 (49.4%)
Risk factors/ co-morbidity	
Hypertension, N (%)	209 (90.5%)
Dyslipidemia, N (%)	76 (32.9%)
Smoking, N (%)	37 (16.0%)
Binge drinking, N (%)	30 (13.0%)
Diabetes, N (%)	28 (12.1%)
Prior stroke, N (%)	19 (8.2%)
Kidney problem, N (%)	14 (6.1%)
Anticoagulant, N (%)	8 (3.5%)
Glasgow Coma Scale, mean ± standard deviation	
Admission	9.9 ± 3.7
Discharge	10.0 ± 3.8

Characteristics	Value
Subtypes of hemorrhagic stroke	
Subarachnoid hemorrhage, N (%)	82 (35.5%)
Intracerebral hemorrhage, N (%)	149 (64.5%)
Operation	
No, N (%)	78 (33.8%)
Yes, N (%)	153 (66.2%)
Craniotomy, N (%)	108 (46.7%)
EVD, N (%)	59 (25.5%)
Craniectomy, N (%)	8 (3.5%)
V-P shunt, N (%)	8 (3.5%)
Coiling, N (%)	1 (0.4%)
Others, N (%)	4 (1.7%)
Infection	
No, N (%)	130 (56.3%)
Yes, N (%)	101 (43.7%)
Pre-hospitalized, N (%)	3 (1.3%)
Other hospital, N (%)	3 (1.3%)
At this hospital, N (%)	95 (41.1%)
Respiratory tract infection, N (%)	67 (29.0%)
Urinary tract infection, N (%)	39 (16.9%)
Ventriculitis related infection, N (%)	9 (3.9%)
Blood stream infection, N (%)	6 (2.6%)
Phlebitis, N (%)	2 (0.9%)
Surgical wound infection, N (%)	1 (0.4%)
Fever of unknown origin, N (%)	4 (1.7%)
Modified Ranking Scale (mRS)	
Good outcome, N (%)	48 (20.8%)
Poor outcome, N (%)	183 (79.2%)

Of the 231 elderly patients with HS, 183 (79.2%) had poor outcome. The association between poor outcome and its associating factors, including demographic data, risk factors and comorbidities (i.e. hypertension, dyslipidemia, smoking, binge drinking, diabetes and prior stroke), type of HS, and infection were tested by using multiple logistic regression analyses. Male gender (adjusted OR 3.53, $p < .01$), GCS at admission (adjusted OR 0.66, $p < .0001$), and infection during hospitalization (adjusted OR 2.49, $p < .001$) were significantly predicted poor outcome in elderly patients with HS. (The details are presented in table 2.)

TABLE 2 POOR OUTCOME ASSOCIATING FACTORS TO DEMOGRAPHIC DATA, RISK FACTORS, COMORBIDITIES, TYPE OF HEMORRHAGIC STROKE AND INFECTION

Variable	Odds ratio (95% CI)	P-value
Gender		
Male	3.53 (1.55 – 8.05)	< .01
GCS at admission	0.66 (0.57 – 0.76)	< .0001
Infection	2.49 (1.54 – 4.02)	< .001

The prevalence of HS in male elderly patients is slightly higher than those in female (50.6% vs. 49.4%) which is similar to a systematic review in 2009 [2]. In this study, the prevalence of poor outcome among elderly patients with HS is quite high. It might be due to the reason that Maharaj Nakorn Chiang Mai hospital is the largest tertiary hospital in the Northern part of Thailand; all HS patients with severe and/or complicated condition are referred from other hospitals if they are required modern medical technology and interventions. The gender difference influence risk of hemorrhagic stroke has been identified in several studies. All type of stroke is more common among male than female about 33 percent [2]. Several reasons have been explained including genetic factors, higher prevalence of hypertension in male, more common seeking health promotion among female and higher smoking incidence in male [3]. GCS at admission is also statistically significant associated to poor outcome in elderly patients with HS. Since GCS is always deployed to assess level of consciousness, the low score GCS the patient has, the worse severity of illness that patient may become. The most concern associating factors with poor outcome is infection. Since elderly patients with infection have 2.5 times higher that they may have poor outcome comparing with those who have not had infection. Since infection can be control and manage, we suggest that early precaution might be needed among elderly patients with HS. If infection is controllable, the prevalence of poor outcome among elderly patients with HS might decline.

ACKNOWLEDGMENT

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REFERENCE

- [1] World heart federation: Stroke: The global burden of stroke; 2015 [accessed 2015 Sep 4]. <http://www.world-heart-federation.org/cardiovascular-health/stroke>.
- [2] P. Appelros, B. Stegmayr and A. Terént, "Sex differences in stroke epidemiology: A systematic review," *Stroke*, vol. 40, pp. 1082-1090, 2009. DOI: 10.1161/STROKEAHA.108.540781
- [3] S. Barker-Collo, D.A. Bennett, R.V. Krishnamurthi, P. Parmar, V.L. Feigin, M. Naghavi, et al., "Sex differences in stroke incidence, prevalence, mortality and disability-adjusted life years: Results from the Global burden of disease study 2013," *Neuroepidemiology*, vol. 45, pp. 203-214, 2015. DOI: 10.1159/000441103

Non-cognitive skills and health problems for junior high school students in Japan

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INTRODUCTION

Non-cognitive as well as cognitive abilities are very important to achieve fruitful and healthy life. Children with low NCS are more likely to financially, socially and physically disadvantaged, negatively affecting academic achievement, income and job when they grow up [1,2]. Adolescents with mental and physical health problems tend to suffer from school absenteeism and poor academic performance [3]. We assume that children who failed to develop non -cognitive skills (NCS) sufficiently at home as well as at school may tend to have these health problems. In this research, we examined how NCS and health problems were associated.

METHODS

We accessed 1,566 mothers who had 14 year-old children and distributed self-administered questionnaires through the internet in Japan. The questionnaire includes questions on children (sex, present BMI, siblings, school achievement, life style, presence of psychosomatic diseases, school absenteeism), NCS (perseverance and brief self-control scale Japanese version) [4,5], depression scale (DSRS-C) and parents (age, marital status, working hours, education, income, relationship with children). Primary outcome is depression and psychosomatic diseases. We set the lowest 25% of perseverance and self-control scale as low NCS. Logistic regression analysis was applied to explore associations between outcomes and other related variables.

RESULTS AND DISCUSSIONS

We had 1,566 samples (783 boys: 50%). Demographic characteristics were as follows; 249 (15.9%) families with only one child, 257 (16%) children having depression, 405 (26%) having psychosomatic disorders, 53 (3%) of school absenteeism, 61 (4%) having developmental disabilities, 1486 (95%) having good friends and 184 (12%) single mothers. Depression was significantly associated with low NCS and poor relationships with friends and parents, whereas psychosomatic disorders were not associated with NCS (TABLE 1). High NCS were strongly associated with good academic performance and playing games under restrictions (TABLE 2).

To the best of my knowledge, this is the first research to explore the association between NCS and health problems in adolescents in Japan. Strong association between NCS and good academic performance and addiction-free from games reflected previous studies. The research added the new implication that adolescents with low NCS are at risk for ill mental health, which is associated with school absenteeism.

TABLE 1 Association with depression and psychosomatic disorders: Logistic regression analysis

	Depression	Psychosomatic disorders
	OR (95%CI)	
School absenteeism	3.3 (1.4-8.0)**	5.4 (2.4-13.3)**
BR with mother ¹	2.7 (1.6-5.6)**	0.7 (0.4-1.1)
BR with father ¹	2.6 (1.6-4.2)**	1.5 (1.1-2.2)*
No good friends	2.4 (1.0-5.7)*	1.2 (0.5-2.7)
Low self-control	1.6 (1.1-2.4)*	1.0 (0.7-1.4)
Low perseverance	1.3 (0.87-2.0)	0.9 (0.6-1.3)
Poor academic acvmt ²	1.2 (0.7-1.9)	1.0 (0.7-1.6)

¹BR=bad relationship, ²acvmt=achievement, *p<0.05, **p<0.01

TABLE 2 Association with non-cognitive skills: Logistic regression analysis

	Self-control	Perseverance
	OR (95%CI)	
Good academic achvmt ¹	3.6 (2.1-6.0)*	5.9 (3.5-9.9)*
Play games under rstret ²	2.7 (1.7-4.2)*	2.7 (1.7-4.1)*

¹achvmt=achievement, ²restct=restrictions, *p<0.01

REFERENCES

- [1] Moffitt et. al. A gradient of childhood self-control predicts health, wealth, and public safety. PNAS. 2011, 108(7)2693-98
- [2] Gutman, L. M., Schoon, I. The impact of non-cognitive skills on outcomes for young people. Education Endowment Foundation. 2013.
- [3] Japanese Society of Psychosomatic Pediatrics. Japanese Society of Psychosomatic Pediatrics Guideline. 2015.
- [4] Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. Grit: perseverance and passion for long-term goals. Journal of Personality and Social Psychology, 2007, 92(6), 1087.
- [5] Tangney, J.P., Baumeister, R.F., Boone, A.L. High Self-Control Predicts Good Adjustment, Less Pathology, Better Grades, and Interpersonal Success. Journal of Personality, 2004, 72, 271-324.

Agriculture 2

*- Agriculture, Bioscience, Food Science and
Environmental Science for a Healthy and
Sustainable Society -*

Monday 29 August, 2016

10:40-12:00

Room B, North Block

Rare Sugar: A New “Signal” in Plant Signal Transductions

Akimitsu, K., Mochizuki, S. Ohtani, K., Matsudaira, K., Shimagami, T., Aki, A., Igarashi, C., Kummanid, J., Tsuji, N., Matsuoka, S., Tanaka, S., Ishihara, A., Ohtani, N., Toya, S., Yoshida, H., Kamitori, S., Yoshihara, A., and Izumori, K.

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Rare sugars are defined as monosaccharides with a low abundance in nature. There are 34 hexoses (8 ketohexoses, 16 aldohexoses, and 10 hexitols) including D-glucose, D-galactose, D-mannose, D-fructose, D-xylose, L-arabinose, and D-ribose, which exist a large amount in nature, and all of the rest among 34 hexoses are defined as rare sugars. Prof. Ken Izumori innovated a strategical concept for bioproduction of rare sugars, named Izumoring. Izumoring indicates that all 34 hexoses are able to be interconverted by series of enzymatic reactions, and Kagawa University became only one institution to synthesize all these hexoses based on the strategy. A major source for biosynthesis of monosaccharides in nature is plants. Plants can fix the carbon from CO₂ by photosynthesis to provide carbohydrates including major monosaccharides such as D-glucose and D-fructose. Since plants can produce monosaccharides but also use the molecule as an energy source for ATP production, reactions to monosaccharides are different from other livings. In this study, role of rare sugar as a signal molecule in plant signal transductions will be discussed using D-allulose (=D-psicose) and D-allose as examples. .

INTRODUCTION

Mono-saccharides and their derivatives that are rarely present in nature are defined as a rare sugar by International Society of Rare Sugar. Studies of the function or role of rare sugars for livings had been limited by the difficulty of production of rare sugars. Recently, the new strategy for a mass production of hexose, called “Hexose Izumoring”, has established by Prof. Ken Izumori and co-workers, and the physiological studies of rare sugars to various livings including plants were opened. We found that D-allulose (=D-psicose) and D-allose has a function as an effective inhibitor of plant growth. Various results [1-5] revealed that rare sugars, not like natural sugars such as D-glucose or D-fructose which are cellular carbon sources for energy metabolism, have different functions as a signaling molecule for plant hormone regulation with a low concentration in plants.

RESULTS AND DISCUSSIONS

Effect of D-allose on hexokinase. Arabidopsis hexokinase 1 (AtHKK1), is involved in hormonal response in early seedling development. In order to study the overall mechanism of the plant growth inhibition caused by D-allose (D-glucose epimer), we focused on involvement of HXK and regulation of plant hormone signaling. The growth inhibition caused by D-allose was prevented by treatment with HXK

inhibitors, D-mannoheptulose and N-acetyl-D-glucosamine. Furthermore, the Arabidopsis glucose-insensitive2 (*gin2*) mutant, which is a loss-of-function mutant of the glucose sensor AtHKK1, showed a D-allose-insensitive phenotype. D-Allose effects were recovered in transgenic *gin2* over-expressing wild-type AtHKK1 but not in *gin2* over-expressing the catalytic mutant AtHKK1S177A, indicating that the D-allose phosphorylation by HXK to D-allose 6-phosphate (A6P) is the first step for D-allose-induced growth inhibition

D-Allose-6-phosphate (A6P) production is essential for D-allose function in plants.

D-Allose strongly inhibited the GA-dependent responses such as elongation of the second leaf sheath and induction of α -amylase in embryo-less half rice seeds. The growth of the slender rice1 (*slr1*) mutant, which exhibits a constitutive GA-responsive phenotype, was inhibited by D-allose, and the growth inhibition of the *slr1* mutant by D-allose was also prevented by HXK inhibitor treatment. The findings also indicated that HXK is important for the plant growth inhibition by D-allose treatment. 6-Deoxy-D-allose, a structural derivative of D-allose unable to be phosphorylated at C6 position, did not confer growth inhibition. Transgenic rice plants expressing *Escherichia coli AlsK* encoding D-allose kinase to increase A6P synthesis were more sensitive to D-allose, but *E. coli AlsI* encoding A6P isomerase expression to decrease A6P reduced sensitivity. These results clearly indicated that A6P production by HXK is essential for D-allose functions including growth inhibition in plants/

ACKNOWLEDGMENT

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REFERENCES

- [1] Kano A, Gomi K, Yamasaki-Kokudo, *et al.*. 2010. A rare sugar, D-allose, confers resistance to rice bacterial blight with upregulation of defense-related genes in *Oryza sativa*. *Phytopathology* 100, 85–90.
- [2] Kano A, Hosotani K, Gomi K, *et al.* 2011. D-Psicose induces upregulation of defense-related genes and resistance in rice against bacterial blight. *Journal of Plant Physiology* 168, 1852–1857.
- [3] Fukumoto T, Kano A, Ohtani K, *et al.* 2011. Rare sugar D-allose suppresses gibberellin signaling through hexokinase-dependent pathway in *Oryza sativa* L. *Planta* 234, 1083–1095.
- [4] Fukumoto T, Kano A, Ohtani K, *et al.* 2013. Phosphorylation of D-allose by hexokinase involved in regulation of OsABF1 expression for growth inhibition in *Oryza sativa* L. *Planta* 237, 1379–1391.
- [5] Kano A, Fukumoto T, Ohtani K, *et al.* 2013. The rare sugar D-allose acts as a triggering molecule of rice defence via ROS generation. *Journal of Experimental Botany* 64(16):4939-4951

Plant growth promoting actinomycetes from mycorrhiza spores

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INTRODUCTION

Actinomycetes are Gram-positive bacteria with high %G+C content and known prolific producers of bioactive compounds. Our research effort has been directed at assessing the diversity of actinomycetes in various environments. Recently, microorganisms associated with AM fungal spores have been reported including several Gram positive bacterial species such as *Streptomyces* [1,2] These mycorrhizal associated bacteria showed interesting properties on biocontrol and plant growth promoting activities. Currently, we are interested in these mycorrhizal associated bacteria which may be a good source for novel taxa for bioprospecting. In this study, we report on the isolation of actinomycetes from spores of *Funneliformis mosseae* and provide preliminary evidence of their potential in agriculture as plant growth promoter.

RESULTS AND DISCUSSIONS

Five actinomycete strains were isolated from spores of *F. mosseae* using media selective for actinomycetes. Phylogenetic analyses based on a 16S rRNA gene sequences showed that the isolates belonged to the genera *Pseudonocardia* and *Streptomyces*. These isolates were able to produce siderophores, indole-3-acetic acid (IAA) and solubilized phosphate *in vitro* at varying level. *S. thermocarboxyus* S3 produced 11.23±0.02 mg/ml IAA and high activity of phosphate solubilization and siderophore production. The results provide evidence that actinomycetes were associated with arbuscular mycorrhizal spores of *F. mosseae*. The ability of these organisms to produce plant growth promoting agents support the possibility of using these actinomycetes for agricultural purposes.

TABLE I IAA PRODUCTION AND MOLECULAR IDENTIFICATION OF ISOLATED ACTINOMYCETES

Isolates	Closest match	IAA ($\mu\text{g ml}^{-1}$)
48	<i>Streptomyces themocarboxyus</i>	4.44 ± 0.04
S3	<i>Streptomyces themocarboxyus</i>	11.12 ± 0.02
S4	<i>Streptomyces pilosus</i>	0.74 ± 0.00
S4-1	<i>Streptomyces pilosus</i>	6.04 ± 0.05
SP	<i>Pseudonocardia nantongensis</i>	0.00 ± 0.00

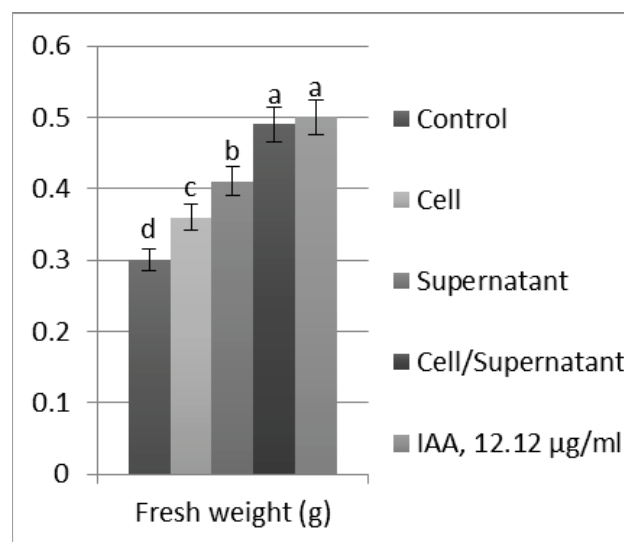


Fig. 1. Growth promotion activity in *V. radiata* by *S. thermocarboxyus* S3.



Fig. 2. Phosphate solubilization and siderophore production by *S. thermocarboxyus* S3.

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REFERENCES

- [1] S. Poovarasan, M. Sukhada, P. Paneerselvam, B. Saritha and K.M. Ajay, "Mycorrhizae colonizing actinomycetes promote plant growth and control bacterial blight disease of pomegranate (*Punica granatum* L. cv Bhagwa)," *Crop Prot.*, vol. 53, pp. 175-181, 2013.
- [2] M. Sukhada, S. Poovarasan, P. Paneerselvam, K.K. Upreti, K. Ranveer and T. Sita, "Guava (*Psidium guajava* L.) rhizosphere *Glomus mosseae* spores harbor actinomycetes with growth promoting and antifungal attributes," *Sci. Hort.*, vol. 150, pp. 371-376, 2013.
- [3] A. Gordon and P. Weber, "Colorimetric estimation of indole acetic acid," *Plant Physiol.*, vol. 26, pp. 192-195, 1951.
- [4] C.S. Nautiyal, "An efficient microbiological growth medium for screening phosphate-solubilizing microorganism," *FEMS Microbiol. Lett.*, vol. 170, pp. 165-170, 1999.

Retarding activity of 6-*O*-decanoyl-2-deoxy-D-allose on plant growth

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INTRODUCTION

Plant growth retardants are a diverse group of chemicals which inhibits the growth of plants. To date, so many synthetic growth retardants are commercially available such as chlormequat-Cl, mepiquat-Cl, uniconazole, ancymidol, flurprimidol, daminozide etc. They act as an antagonist of plant hormones especially on gibberellin (GA) biosynthesis [1]. But most of them are not biodegradable and creating hazardous problem to flora and fauna [2]. To minimize the environmental risks, rare sugar fatty acid esters are approaching one of feasible options as a growth inhibitor [2,3]. Recently, we reported the synthesis of 6-*O*-decanoyl-2-deoxy-D-allose (2-DOAll-C10) from D-allose and its retardants activity on plant growth [4]. In this study, we examined the mode of action of 2-DOAll-C10 in a GA biosynthesis using known growth retardants.

MATERIALS AND METHODS

2-DOAll-C10 was synthesized from rare sugar, D-allose [4]. Known plant growth retardants (daminozide and uniconazole) and gibberellin (GA₃) were purchased from Nippon Soda Co. and Wako Chemical Co. Bioassay using lettuce (*Lactuca sativa*), cress (*Lepidium sativum*), Italian ryegrass (*Lolium multiflorum*) and rice (*Oryza sativa* L. cv. Nihonbare) seedlings were performed with GA₃, daminozide and uniconazole [4,5].

RESULTS AND DISCUSSION

Of the plant species tested, we found that rice seedlings were most susceptible to 2-DOAll-C10 and the growth of rice seedlings were decreased in a concentration dependent manner similar to All-C10 [4]. Therefore, we investigated the effect of co-addition of GA₃ on growth inhibition by the deoxy allose ester and daminozide which is reported to block 3 β hydroxylation of GA₂₀. We found the recovery of rice growth (165 and 166 %) when GA₃ (1 μ M) and daminozide (1.5 mM) was co-added with a solution of 2-DOAll-C10 (0.20 mM) (Fig. 1A). These results implied that deoxy-D-allose esters might mainly inhibit gibberellin biosynthesis due to the similar behavior to daminozide. To confirm this possibility, we did another experiment using uniconazole. We observed similar recovery of growth when exogenous GA₃ and 2-DOAll-C10 were added on rice seedlings pre-treated with uniconazole (Fig. 1B).

In summary, growth inhibitory activity of 2-DOAll-C10 on rice seedlings was abolished by co-treatment with exogenous GA₃, which was similar to that of daminozide. These results suggest that 2-DOAll-C10 might be inhibiting the biosynthesis of GA as a plant growth retardant.

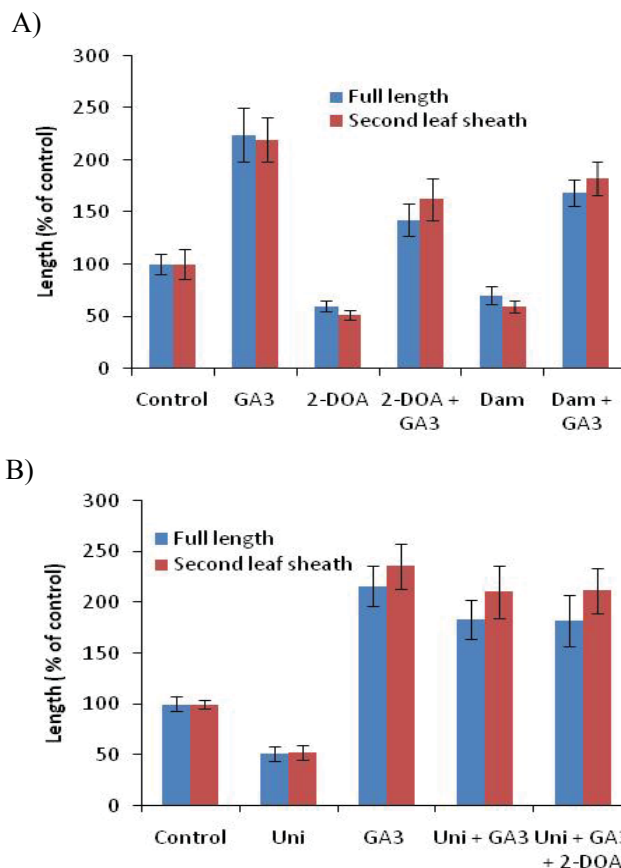


Fig. 1. Effect of daminozide (A), uniconazole (B), GA₃ and 2-DOAll-C10 on the full length and secondary leaf sheath of rice seedlings (Dam, daminozide; Uni, uniconazole; 2-DOA, 2-DOAll-C10).

REFERENCES

- [1] W. Rademacher, "Growth retardants effects on gibberellins biosynthesis and other metabolic pathways", *Annu. Rev. Plant Physiol. Plant Mol. Biol.*, vol. 51, pp. 501–531, 2000.
- [2] M. Kobayashi, M Ueda, T. Furumoto, Y. Kawanami, "Retarding activity of 6-*O*-acyl-D-allose against plant growth", *Biosci. Biotechnol. Biochem.*, vol. 74, pp. 216–217, 2010.
- [3] M.T.I. Chowdhury, M. Naito, R.C. Yanagita, Y. Kawanami, "Synthesis of 6-*O*-decanoyl-D-gulose and 6-*O*-decanoyl-D-altrose and evaluation of their biological activity on plant growth", *Plant Growth Regul.*, vol. 75, pp. 707–713, 2015.
- [4] M.T.I. Chowdhury, H. Ando, R.C. Yanagita, Y. Kawanami, "Syntheses and biological activities of deoxy-D-allose fatty acid ester analogs", *Biosci. Biotechnol. Biochem.*, vol. 80(4), pp. 676–681, 2016.
- [5] K. Furukawa, Y.Y. Yang, I. Honda, T. Yanagisawa, A. Sakurai, N. Takahashi, Y. Kamiya, "Effects of ethylene and gibberellins on the elongation of rice seedlings", *Biosci. Biotechnol. Biochem.* Vol.61(5), pp. 864–869, 1997.

Selection of *Cordyceps militaris* Isolates for Rice-based Medium Cultivation

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Abstract

Cordycepin is a nucleoside adenosine derivative which has pharmacological activity to inhibit cancer, inflammatory and acts as an antioxidant. Naturally, cordycepin is found in *Cordyceps* sp., however the amount is of high variation depending on environment leading to the difficulty of industrial cordycepin production. Although cordycepin can be chemically synthesized, biological synthesis of cordycepin is safer but the productivity is insufficient. Therefore, improvements of cordycepin producing microorganisms are attempted by a number of researchers. However, the induced mutagenesis using proton beam for improvement strains of *Cordyceps militaris* resulted in high cordycepin producing mutant strains. The aim of this research is to improve a strain of *C. militaris* by induced mutagenesis using x-ray. Preliminarily, five strains of cordycepin producing *C. militaris* have been screened including *C. militaris* BCC 18247, *C. militaris* BCC 17893, *C. militaris* BCC 17944, *C. militaris* VPP-1 and *C. militaris* VPP-2, by evaluation of the inhibition zone formation against *Bacillus subtilis* TISTR 1460. It was found that *C. militaris* VPP-2 obtained from a cordyceps farming in Chiang Rai province was selected. The x-ray induced mutagenesis of *C. militaris* VPP-2 was performed and the selection of strains capable of growing on Vogel's agar supplemented with 200 ppm 8-azaguanine or 8-azaadenine is now in progress.

INTRODUCTION

Most of people in Asia exactly known *Cordyceps* from its property, which content many bioactive for healthcare such as polysaccharides, nucleosides, sterols and peptide (Shashidhar et al., 2013). This reason affected the price of Cordyceps demanding is higher and also rise up of researchers and farmer to cultivate Cordyceps for markets. However, some bioactive had reported that possible to use in pharmaceutically active as cordycepin and its derivatives, ergosterol, polysaccharide, glycoprotein and peptides (Russell and Paterson, 2008; Shashidhar et al., 2013).

Cordycepin is a nucleoside adenosine derivative which has pharmacological activity to inhibit cancer, inflammatory and acts as an antioxidant. Naturally, cordycepin is found in *Cordyceps* sp. however the amount is of high variation depending on environment leading to the difficulty of industrial cordycepin production. Although cordycepin can be chemically synthesized (Rottman et al., 1963), biological synthesis of cordycepin is safer but the productivity is insufficient. The alternative cultivation base on biological synthesis has reported to produce the high yield of cordycepin from *C. militaris* by surface liquid culture (Shih et al., 2007; Masuda et al., 2007; Das et al., 2009). However, the amount of cordycepin which are produced from Cordyceps nature represent in low level (Mao and Zong, 2006; Musuda et al., 2006; Musuda et al., 2007). Therefore, improvements of cordycepin producing microorganisms are attempted by a number of researchers. Similarly cordycepin's procedure cultivation of Das et al. (2007) is shown the very high yield of cordycepin by *C. militaris* mutant induced with ion beam irradiation. From this study, the successful production of cordycepin can be improved with mutagenesis by irradiation to achieve the high amount of cordycepin.

This experiment aims to select the strain of *C. militaris* for cordycepin production. An improvement of cordycepin

producing capability of the selected *C. militaris* using x-ray mutagenesis will be also described. The aim of this research is to improve a strain of *C. militaris* by induced mutagenesis using x-ray.

MATERIALS AND METHODS

Fungal strain

Three of *C. militaris* isolates were purchased from National Center for Genetic Engineering and Biotechnology (BIOTEC), Bangkok including *C. militaris* BCC18247, *C. militaris* BCC17893 and *C. militaris* BCC17944). The other two isolates, *C. militaris* VPP-1 and *C. militaris* VPP-2 were obtained from Cordyceps cultivated farming of Wiang Papao, Chiang Rai. All isolates were grown on Yeast Malt Agar (YMA) at 20°C for using as stock culture.

Screening and selection of cordycepin producing strain

The five isolates of *C. militaris* were screened for cordycepin producing capability using bioassay as described by Das et al. (2009). *Bacillus subtilis* TISTR was used to detect the inhibition zone caused by cordycepin produced during the growth of *C. militaris*. Cell suspension of *B. subtilis* 0.1 mL was spread on modified PDA, three disks of fungal mycelium was placed, then incubated at 20°C for 5 days. The capability of cordycepin production was observed from inhibition zone and the fungal isolate exhibited the widest clear zone was selected to use for x-ray mutagenesis experiment.

Induce mutation by x-ray approach

The fungal isolates were cultured on Czapek dox agar for 10 days and the fungal colony obtained was used to expose through the x-ray irradiation with exposure dose of 50 kV, 100 mA, 0.2 sec and 50 cm distance. The mycelium treated by from x-ray irradiation was suspended in 5 mL of sterilized distilled water with 0.1% (w/v) tween80 and then filtrated

through Whatman No.1. The filtrated solution was spread on a Vogel's medium agar plate supplemented with 200 ppm of 8-azaadenine or 8-azaguanine analogue (Das et al., 2009) and incubated at 20°C for 2-3 weeks. The fungal colonies capable of growth on agar plate were assumed to be the target mutant isolate and was confirmed for the anti-microbial activity comparing to the parental *C. militaris* isolate.

Selection of expected mutants

The expected mutants were measured the amount of cordycepin by HPLC analysis with a UV detector. Separation was performed by gradient elution which was the mobile phase consisted of ammonium acetate (40 mM, pH 5.2) and methanol. The flow rate was 0.2 ml/min and the column temperature was 40°C (Xie et al., 2010).

RESULTS AND DISCUSSIONS

Screening for cordycepin production strain

The two strains of BCC18347 and VPP-2 obtained from the positive result, which can inhibit *B. subtilis* as a clear zone around the colony (Fig 1). Appeared clear zone would correspond to the amount of abundant cordycepin, therefore, the size and clarity of clear zone were referred to be cordycepin.

Proper x-ray irradiation dose

After selected strains were BCC18247 and VPP-2 by anti-

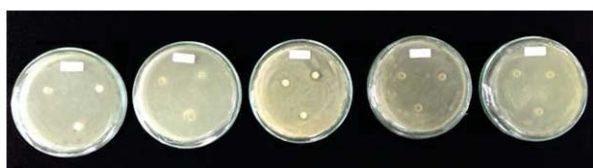


Fig. 1. Preliminary measurement of cordycepin amount by anti-microbial test.

microbial test. All of strains were approached on x-ray, which can be alive in rate of 1.39% and 8.66% respectively (Fig 2). Regarding survival rate, the suitable x-ray irradiation dose was selected the survival rate that showed the lowest of VPP-2 strain due to this condition will give more chances to get the expected mutant.

X-ray induced mutation of *C. militaris*

Twelve colonies were obtained from x-ray approach. To confirm that the ability of growing on analogue selective media showed six colonies can grow well on analogue medium plus 8-azaadenine (Table 1).

Table 1. The number of *C. militaris* resistance after confirmation on analogue selective media

Strain	Expected mutant				Total
	8-azaguanine		8-azaadenine		
VPP-2 (obtained)	CDX-G9, CDX-G11 and G12	CDX-G10, CDX-G12	CDX-A1, CDX-A3, CDX-A5, CDX-A7 and CDX-A8	CDX-A2, CDX-A4, CDX-A6, CDX-A8	12
VPP-2 (confirm)	-	-	CDX-A1, CDX-A5, CDX-A7 and CDX-A8	CDX-A3, CDX-A6, CDX-A8	6

From this result, only six colonies from twelve of expected mutant can resist to 8-azaadenine analogue which unknown of mechanism.

Growth of expected mutants

The two strains of BCC18347 and VPP-2 obtained from

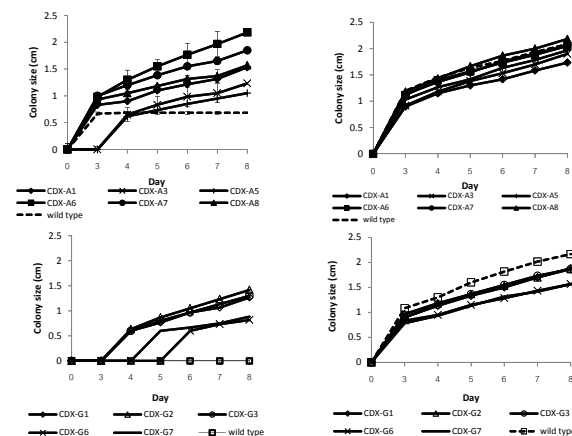


Fig. 1. Growth of expected mutants on analogue media compared to control

Conclusion

Screening of the suitable strain of *C. militaris* for using in x-ray mutagenesis revealed that *C. militaris* VPP-2 was selected among five tested strains based on the capability of clear zone formation against *B. subtilis* TISTR 1460. The x-ray induced mutation approach was applied to get the cordycepin overproducing strain and one expected strain was obtained.

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REFERENCES

- [1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," *Phil. Trans. Roy. Soc. London*, vol. A247, pp. 529-551, April 1955.
- [2] J. Clerk Maxwell, *A Treatise on Electricity and Magnetism*, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.
- [3] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in *Magnetism*, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.
- [4] K. Elissa, "Title of paper if known," unpublished.
- [5] R. Nicole, "Title of paper with only first word capitalized," *J. Name Stand. Abbrev.*, in press.
- [6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," *IEEE Transl. J. Magn. Japan*, vol. 2, pp. 740-741, August 1987 [*Digests 9th Annual Conf. Magnetism Japan*, p. 301, 1982].
- [7] M. Young, *The Technical Writer's Handbook*. Mill Valley, CA: University Science, 1989.

Economics and Business 3

- Economics and Business for Sustainability -

Monday 29 August, 2016

10:40-11:40

Room C, North Block

The Optimum Portfolio of ASEAN Stock Markets using GARCH-EVT Copula Model

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Abstract-The economy of the developing countries in ASEAN (Developing ASEAN) was an international group that had been classified as interesting market for many investors especially when the Western countries experienced economic problems. The objective of this paper is to construct the optimum portfolio of ASEAN Stock Markets by using GARCH with t distribution model, extreme value theory and multivariate t copula model. The stock price index returns was obtained from the stock price index of 8 major countries in ASEAN+3 namely, Bursa Malaysia KLCL (Malaysia), SET (Thailand), Ho Chi Minh (Vietnam), Straits Times (Singapore), Jakarta composite (Indonesia), KOSPI (South Korea), NIKKEI 225 (Japan), and Shanghai SE Composite (China). The data period was from Jan 1, 2007 – Dec 31, 2015. Firstly, the ARMA-GARCH with t -distribution was applied to estimate the residuals. Secondly, in order to combine both the fat tail return distribution and time varying volatility the GARCH-EVT was applied. Thirdly, the multivariate t copula was used to get dependent copula parameters. The simulated data was obtained from the Monte Carlo simulation in order to calculate the Value at Risk (VaR) and expected shortfall (ES) based on equally weights. The optimal portfolio was estimated and suggested the optimum shares for each stock market. The Efficient frontier from each portfolio was drawn.

After Asian financial crisis in 1997, the five stock markets in the original Association of Southeast Asian Nations countries (ASEAN-5), namely Indonesia, Malaysia, the Philippines, Singapore, and Thailand, have more corroboration in order to mitigate that crisis. Consequently, Click and Plummer (2005) found that ASEAN-5 stock markets have long run relationship with common trend or cointegration. In the other word, the ASEAN-5 stock markets were integrated in the economic sense, but that integration was far from complete [1]. Later, Karim and Karim (2012) found that the stock markets in the ASEAN region were integrated during the pre-, post-1997 and post U.S. subprime financial crisis by using Autoregressive Distributed Lag (ARDL). They also confirmed that the benefits from international portfolio diversification tend to diminish in the long-run term.

The economy of the developing countries in ASEAN (Developing ASEAN) was an international group that had been classified as interesting market for many investors especially when the Western countries experienced economic problems. In 2014 the market capitalization of ASEAN stock markets (Thailand, Malaysia, Indonesia, Philippines, Vietnam, and Singapore) was 2.3 trillion US\$ and accounted for 3.74 of world market capitalization. The ASEAN market capitalization expanded 2.28% comparing to 2013. Moreover, in case of ASEAN +3, which is the cooperation between member Association of Southeast Asian Nations (ASEAN) and other 3 countries outside ASEAN namely, Japan, South Korea, and Japan, the market capitalization was jump to 13.97 trillion US\$ and accounted for 22.07 of world market capitalization in 2014 with the growth rate 11.21% comparing to previous year.

INTRODUCTION

The overall stock markets in the ASEAN region have formed a relatively long average of over 50 years, with some of the stock exchange, such as the Philippines. Indonesia and has been established since 1912 and 1977 respectively, prior to the development of a trading system that continues to the present. While some markets such as Malaysia, Singapore and Thailand have formed later in the same year in 1930, 1962 and 1999, respectively, prior to the establishment of a stock exchange in Ho Chi Minh of Vietnam in 2000, after Vietnam started policy to push the country into an international trade and investment countries.

TABLE I ESTIMATE ARMA-GARCH(1,1) WITH t DISTRIBUTION

	SET	KLCI	HOCHI	JAKCOM	STRAIT	KOSPI	NIKKEI	CHCOMP
μ	0.001***	0.000***	0.000	0.001***	0.000**	0.001**	0.001***	0.001**
AR(1)	0.873***	-0.881***	-0.620***	2.137***	-1.831***	1.850***	0.366***	0.742***
AR(2)	0.455**	0.115***	0.152***	-1.802***	-0.832	-1.613***	0.138**	-0.952***
AR(3)	-0.671***	-	-	0.570***	-	0.465**	0.453***	0.449*
MA(1)	-0.856***	0.993***	0.827***	-2.081	1.844***	-1.866***	-0.398***	-0.733**
MA(2)	-0.473**	-	-	1.656***	0.845***	1.640***	-0.115**	0.961***
MA(3)	0.655***	-	-	-0.467***	-	-0.487**	-0.447***	-0.424*
ω	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000**
α	0.109***	0.127***	0.185***	0.136***	0.084***	0.062***	0.092***	0.051***
β	0.882***	0.863***	0.786***	0.832***	0.913***	0.934***	0.882***	0.949***
K (t -coefficient)	5.464***	4.954***	11.662***	14.172***	8.510***	5.874***	8.275***	4.019***
AIC	-6.259	-7.311	-5.845	-6.064	-6.563	-6.166	-5.789	-5.586
BIC	-6.232	7.291	-5.825	-6.037	-6.541	-6.139	-5.762	-5.559

Note: ***, **, * denote significant at the 1%, 5% and 10%, respectively.

TABLE II TAIL PARAMETERS ESTIMATION FOR EACH STOCK INDEX RETURN'S RESIDUAL

	SET	KLCI	HOCHI	JAKCOM	STRAIT	KOSPI	NIKKEI	CHCOMP
u_L	-1.594	-1.561	-1.622	-1.495	-1.593	-1.571	-1.594	-1.487
β_L	0.065	0.038	-0.010	0.100	-0.322	-0.132	0.013	-0.041
ξ_L	0.402	0.493	0.405	0.483	0.589	0.504	0.378	0.517
u_R	1.712	1.651	1.616	1.803	1.764	1.776	1.784	1.634
β_R	0.057	0.134	0.164	0.139	-0.044	-0.112	0.045	-0.111
ξ_R	0.605	0.622	0.487	0.665	0.583	0.623	0.599	0.844

Source: Calculation

The objective of this paper is to construct the optimum portfolio of ASEAN+3 Stock Markets by using GARCH with t distribution model, extreme value theory (EVT) and multivariate t copula model. In the literature, there are few paper about portfolio optimization by using GARCH-EVT Copula Model (see for example, Wang, Chen, Jin, and Zhou (2010) [4], Deng, Ma and Yang (2011) [5], Huang, Chien, and Wang (2011) [6] Dharmawan (2014) [7] and Tang, Zhou, Yuan, and Sriboonchitta (2015) [8]).

The stock price index returns was obtained from the stock price index of 5 major countries in ASEAN namely, Bursa Malaysia KLCI (Malaysia), SET (Thailand), Ho Chi Minh (Vietnam), Straits Times (Singapore), and Jakarta composite (Indonesia) including KOSPI (South Korea), NIKKEI 225 (Japan), and Shanghai SE Composite (China). The data period was from Jan 1, 2007 – Dec 31 2015.

RESULTS AND DISCUSSIONS

First of all, all stock price index were transformed to stock price index return by using compound interest rate formula. Second, the ARMA-GARCH with t distribution model was used to model the autocorrelation and to capture the conditional heteroskedasticity. Table I present the estimated ARMA-GARCH with t distribution model. The Ljung-Box and ARCH LM test were applied for serial correlation and conditional heteroskedasticity testing, and most of them are not a statistical significance.

Third, in order to better estimate the tails of the distribution, EVT is applied to the standardized residuals (z_t) that obtained from the ARMA-GARCH model. EVT is then applied to those residuals which Generalized Pareto Distribution (GPD) especially is for tail estimation. We choose the exceedances to be the 10th percentile of the sample for the upper and lower tail of the residual

distribution because of the appropriateness to choose 10th percentile in the generalize Pareto model and the same biases occurred as in the stable law analysis. We assume that excess residuals over threshold follow the GPD and use the Gaussian kernel estimate is for the remaining part. The estimated parameters from EVT were displayed in Table II.

Fourth, after obtaining the GPD parameter and residuals $z_{it}, i=1,2,3,4, t=1,2,\dots,T$, were transformed to the marginal distribution $u_i = F(z_{it})$, then the standardized residuals were transformed to uniform variable by the semi-parametric empirical CDF of each margin, and calibrating of t copula by maximum log-likelihood method. Table III shows the correlation matrix that obtained from fitting the t copula with the degrees of freedom are 20.7633.

Fifth, the empirical GARCH EVT t copulas parameters obtained from previous step are applied to simulate the returns at time $t+1$ based on the correlation structure of t copula or copulas parameters in table III. Under the equally weighted assumption, Table IV shows the estimated VaR and CVaR or expected shortfall at level of 1%, 5% and 10%, respectively.

TABLE IV VALUE AT RISK EQUALLY WEIGHTED PORTFOLIOS

Portfolio	Expected Value		
	1%	5%	10%
VaR	-4.422%	-2.550%	-1.729%
CVaR	-5.803%	-3.739%	-2.918%

Source: Calculation

In period $t+1$, the estimated CVaR are higher than VaR and converges to -2.918, -3.739 and 5.803 at 10%, 5% and 1% level, respectively. The Monte Carlo simulation is applied in order to simulate a set of 10,000 samples and to estimate the expected shortfall of an optimal weighted

TABLE III EMPIRICAL T COPULAS PARAMETERS ($\hat{\rho}$)

$\hat{\nu} = 20.7633$	SET	KLCI	HOCHI	JAKCOM	STRAIT	KOSPI	NIKKEI	CHCOMP
SET	1.0000	0.3957	0.0890	0.4577	0.5000	0.3803	0.3303	0.2177
KLCI	0.3957	1.0000	0.1212	0.4914	0.5167	0.4509	0.4134	0.2344
HOCHI	0.0890	0.1212	1.0000	0.1123	0.1183	0.1244	0.1780	0.0677
JAKCOM	0.4577	0.4914	0.1123	1.0000	0.5656	0.4562	0.4112	0.2599
STRAIT	0.5000	0.5167	0.1183	0.5656	1.0000	0.5439	0.5047	0.3073
KOSPI	0.3803	0.4509	0.1244	0.4562	0.5439	1.0000	0.5784	0.3175
NIKKEI	0.3303	0.4134	0.1780	0.4112	0.5047	0.5784	1.0000	0.2732
CHCOMP	0.2177	0.2344	0.0677	0.2599	0.3073	0.3175	0.2732	1.0000

Source: Calculation

TABLE V OPTIMAL WEIGHTED PORTFOLIOS FOR ES5%

Portfolios	SET	KLCI	HOCHI	JAKCOM	STRAIT	KOSPI	NIKKEI	CHCOMP	Returns
1	0.039	0.253	0.203	0.188	0.000	0.000	0.316	0.000	0.695%
2	0.028	0.199	0.192	0.233	0.000	0.000	0.347	0.000	0.792%
3	0.011	0.173	0.160	0.274	0.000	0.000	0.382	0.000	0.889%
4	0.000	0.127	0.147	0.300	0.000	0.000	0.426	0.000	0.987%
5	0.000	0.086	0.117	0.332	0.000	0.000	0.465	0.000	1.084%
6	0.000	0.051	0.085	0.355	0.000	0.000	0.509	0.000	1.181%
7	0.000	0.000	0.067	0.379	0.000	0.000	0.554	0.000	1.278%
8	0.000	0.000	0.000	0.400	0.000	0.000	0.599	0.000	1.375%
9	0.000	0.000	0.000	0.201	0.000	0.000	0.799	0.000	1.473%
10	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	1.570%

Source: Calculation

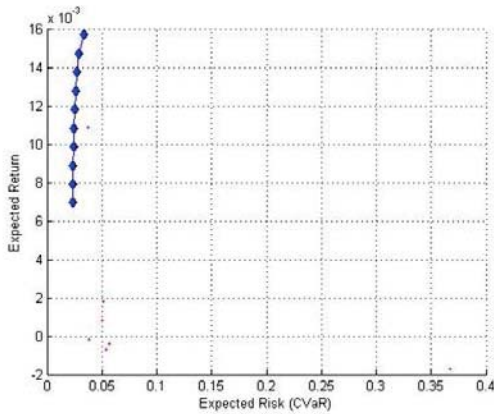


Fig. 1. The efficient frontiers of CVaR under mean

portfolio. At given significant level of 5%, the optimized portfolio based on mean-CVaR model provides the efficient frontier of the portfolio under different expected return as shown in Figure 1.

Finally, under minimize expected shortfall with respect to maximize returns we obtained the optimal weight of the portfolios. Table V showed the results of optimal weight with the expected returns in the frontier. Surprisingly, the optimal portfolio weight was focused only on SET, KLCI, Ho Chi Minh, Jakarta composite, and NIKKEI 225. In addition, the optimal portfolio weight suggests to invest in the largest proportion in Nikkei stock market (Japan) followed by Jakarta composite index (Indonesia), Ho Chi Minh stock index (Vietnam), Bursa Malaysia KLCL index (Malaysia), and SET index (Thailand), respectively.

CONCLUSION

In this paper, we investigate the optimum portfolio of ASEAN+3 index return consisting of Bursa Malaysia KLCI (Malaysia), SET (Thailand), Ho Chi Minh (Vietnam), Straits Times (Singapore), Jakarta composite (Indonesia), KOSPI (South Korea), NIKKEI 225 (Japan), and Shanghai SE Composite (China). In this study was applied GARCH with *t* distribution model, extreme value theory and multivariate *t* copula model and component VaR (CVaR) model. The first, empirical results showed that the ARMA-GARCH with student's *t* distribution is appropriate to estimate parameter and conditional volatility because the AIC and BIC statistics are adopted to select the most suitable models. Second, the

filtered residuals were extracted from such estimations and then applied the extreme value theory with GPD for fitting the residual tails in order to model marginal residual distributions. Third, multivariate *t*-copula was used to construct the ASEAN index dependence structures. Finally, 10,000 samples were simulated and estimate value at risk and Expected shortfall. In the risk management results displayed the VaR and ES values for an equally weighted portfolio of ASEAN index in time *t*+1. Moreover, the optimal investment was found, focused on SET, KLCI, Ho Chi Minh, Jakarta composite, and NIKKEI 225. This result could be the guideline in making decisions of investors that interest in ASEAN+3 stock markets.

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REFERENCES

- [1] R. Click and M.G. Plummer, "Stock market integration in ASEAN after the financial crisis," *Journal of Asian Economics*, 16(1), pp. 5-28, February 2005.
- [2] B.A. Karim and Z.A. Karim, "Integration of ASEAN-5 stock markets: a revisit," *Asian Academy of Management Journal of Accounting and Finance*, 8(2), pp. 21-41, 2012.
- [3] The World Bank, "Market capitalization of listed domestic companies (current US\$)." <http://data.worldbank.org/indicator/CM.MKT.LCAP>. CD, 2016.
- [4] Z. Wang, X. Chen, Y. Jin, and Y. Zhou. "Estimating Portfolio Risk Using GARCH-EVT-Copula Model: An Empirical Study on Exchange Rate Market," in *Lecture Notes in Electrical Engineering*, 1, Volume 67, *Advances in Neural Network Research and Applications*, Part 1, pp. 65-7, 2010.
- [5] L. Deng, C. Ma and W. Yang. "Portfolio optimization via pair copula-GARCH-EVT-CVaR model." *Systems Engineering Procedia*, 2, pp. 171-181, 2011.
- [6] S. Huang, Y. Chien, and R. Wang. "Applying GARCH-EVT-Copula Models for Portfolio Value-at-Risk on G7 Currency Markets." *International Research Journal of Finance and Economics*. pp. 136-151, 2011.
- [7] K. Dharmawan. "The Application of EVT-GARCH-COPULA Model for the Estimation of VaR of a Portfolio." *IndoMS Journal on Statistics*. pp. 1-17, 2014.
- [8] J. Tang, C. Zhou, X. Yuan, and S. Sriboonchitta. "Estimating Risk of Natural Gas Portfolios by Using GARCH-EVT-Copula Model." *The Scientific World Journal*. 2015.

Theory and Application of the Wald Test of One-way Effect Causal Measure

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INTRODUCTION

The discussions of 'what caused what' in economics such as sudden oil price rises or changes in productivity are 'central and classical' questions in economics. To solve the problems of determining the direction of causality between a pair of time series and also of statistically testing the absence of feedback, Granger (1969) introduced a celebrated definition of causality. Sims (1972, 1980), in view of the zero restriction of some coefficient in moving-average processes, introduced the test of absence of feedback relationships. For the purpose of quantitative characterization of the feedback relationship between two multivariate time series, Geweke (1982, 1984) introduced the measure of causality from one time series to another in the time domain as well as in the frequency domain. Developing Geweke's approach, Hosoya (1991, 1997) effectively depicted the mutual relationships among the variation of time series, established the theoretical foundation for one-way effect causal analysis.

THE WALD TEST OF ONE-WAY EFFECT

Based on the overall as well as frequency-wise causal measures for cointegrated no-stationary multiple time series (Johansen 1996), Yao and Hosoya (2000) proposed the Wald statistic of one-way effect causal measure. In contrast to the conventional tests of Granger's non-causality, the new approach enables us to examine a variety of causal characteristics between multiple time-series; it can test not only Granger's non-causality by means of testing the nullity of the overall measure of one-way effect, but also the strength of the one-way effect. Hosoya et al (2005) provided an approach to testing the measures of the one-way effect in the presence of trend breaks. In that paper we also showed causal characterization of money supply and income as well as interest rates for the last 44 years of the Japanese economy. Yao (2007), by means of the integral of the frequency-wise measure of one-way effect on the specific frequency bands, showed the approach for testing the long- and short-run causal relationships. For other topics, see Kinoshita and Oya (2014). Some of the successful applications of the Wald test of one-way effect causal measure can be found in Yao (1996, 2005, 2007), Yao and Shi (2003), Yao et al (2010, 2012).

CAUSAL RELATION OF GDP AND INTERNATIONAL TRADE

In view of the Wald test of one-way effect causal measure, we investigate the causal relationships of Japanese economic growth and international trade between Japan and China as

well as Thailand. The indices we discussed in ECM are quarterly observations of Japanese GDP, Exports, Imports, Exports and Imports between Japan and China, Exports and Imports between Japan and Thailand. In view of the empirical causal measures in time domain and frequency domain, we show the long-run and short-run causal relationships of Japanese economic development and international trade between Japan, China and also Thailand.

REFERENCES

- [1] C.W.J. Granger, "Investigating causal relations by cross-spectrum methods," *Econometrica*, vol.39, pp.424-438, 1969.
- [2] J. Geweke, "Measurement of linear dependence and feedback between multiple time series," *Journal of the American Statistical Association*, vol.77, pp.304-313, 1982.
- [3] J. Geweke, "Measures of conditional linear dependence and feedback between time series," *Journal of the American Statistical Association*, vol.79, pp.907-915, 1984.
- [4] R. Kinoshita, K. Oya, "Measurement of causality change between multiple time series," *Journal of the Japan Statistical Society*, vol.44, Series J, pp.19-40, 2014.
- [5] Y. Hosoya, "The decomposition and measurement of the inter-dependency between second-order stationary processes," *Probability Theory and Related Fields*, vol.88, pp.429-444, 1991.
- [6] Y. Hosoya, "Causal analysis and statistical inference on possibly non-stationary time series," *Advances in Economics and Econometrics: Theory and Application*, Seventh World Congress vol. III, eds D.M. Kreps and K.F. Wallis, Cambridge University Press, pp.1-33, 1997.
- [7] Y. Hosoya, F. Yao, T. Takimoto, "Testing the One-way Effect in the Presence of Trend Breaks," *The Japanese Economic Review*, vol.56, pp.107-126, 2005.
- [8] S. Johansen, *Likelihood-based inference in cointegrated autoregressive models*, Oxford University Press, 1996.
- [9] F. Yao, "Causal Relationships between Japanese Money and International Trade," *Statistical Analysis of Time Series*, ISM, no.90, pp.119-130, 1996.
- [10] C.A. Sims, "Money, income and causality," *American Economic Review*, vol.62, pp.540-552, 1972.
- [11] C.A. Sims, "Macroeconomics and reality," *Econometrica*, vol.48, pp.1-48, 1980.
- [12] F. Yao, "The long-run and short-run causal relationships between Japanese money and income," *Annual Report of the Economic Society*, Tohoku University, vol. 68, no.3, pp.1-14, 2007.
- [13] F. Yao, Y. Hosoya, "Inference on one-way effect and evidence in Japanese macroeconomic data," *Journal of Econometrics*, vol.98, pp.225-255, 2000.
- [14] F. Yao, N. Shi, "Long-run and causal relations between Japan-China economic time series," *Journal of Chinese Management Science*, vol.6, no.4, pp.55-62, 2003.
- [15] F. Yao, Y. Ying, L. Zhang, "Analysis of Stock Market Information: A New Financial Engineering Approach," *Proceedings of Information and Automation International Conference 2010*, pp.430-435, Harbin, 2010.
- [16] F. Yao, Y. Ying, S. Dai, "Asymmetric Causal Relationships between the Stock Markets of European and East Asian Countries," *Proceedings of Computational and Financial Econometrics*, Oviedo, 2012.

Unimodal Income Distribution, Marginal Utility of Money Income And Indices of Happiness

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INTRODUCTION

Income Distribution has been a recurring theme in the literature on Economics. Gini (1912), Lorenz (1905) and much later Welfare Economists – notably Sen (1973) provided insights on the subject. Throughout the literature, it seems that the underlying assumption about the Income Distribution in most societies is of the Log-Normal type. The elegance of the Log-Normal curve is beyond dispute but it is not very amenable to analytical manipulation. Also the assumption of zero and infinity as the extreme income levels seems unreasonable. This paper looks at societies with a Triangular Income Distribution which is skewed to the left. This allows us to concentrate on the positive extreme income levels and the mode. Next, it is reasonable to assume that the utility of income is a monotonically increasing function. As a solution to the famous St. Petersburg Paradox. The utility is supposed to increase at a decreasing rate. We attempt to evaluate the total happiness in the society by using this function and then aggregating. The maximum and minimum level of the resulting indices would depend on if the modal income is equal to the midpoint or the minimum income. The indices are then standardized to lie between 0 and 1 in order to allow comparisons of different societies – rich or poor.

THE INDICES OF HAPPINESS

We assume a triangular continuous income distribution with positive a and b as minimum and maximum levels respectively with modal income as d . The distribution is skewed to the left. The density function, then, is given by

$$\text{For } a \leq x \leq d \quad f(x) = \frac{2(x-a)}{(b-a)(d-a)}$$

$$\text{For } d \leq x \leq b \quad f(x) = \frac{2(b-x)}{(b-a)(b-d)}$$

The mean and variance of this distribution are well known. It tends to be most unequal when d nears a , and most equal when d nears the mid-point of a and b .

Now, it is possible to do calculations easily as everything can be explained by the 3 parameters a , b and d . Simple indices like Coefficient of variation are easily usable. We have used this in the past to come up with an index of Envy, based on taking the income difference with the richer as a proxy for bitterness or envy in Ranade and Shimono (2016).

Here we will look at the problem with a more positive angle. It is reasonable to assume that a rise in income will give more happiness, although it is beyond dispute that this is not the only source of happiness. For example in a classic study of comparison of happiness over age in the USA vs

Japan, it is claimed that over years an average American gets happier and happier after the hard teenage years, as time goes by since the financial situation improves, whereas in Japan, the freedom of teenage student years gets sadder and sadder over the years despite a systematic increase in incomes.

Despite this caveat, we look at happiness functions $h(y)$ with properties that it is a strictly increasing function but at a decreasing rate over higher levels of income. At lower levels we have two options: either a positive increasing rate or a negative one, we ignore the straight line. Both are interesting in their own right. We do find that people are great risk lovers when given an option of certainty vs a fair bet at a lower level, when their income is high. This also explains why the rich pay the beggars good earned money. The feel good factor outweighs the money loss. On the other hand, in risk averse societies, it is not possible to give incentive enough for people to take even a grossly favorable gamble. The two options give rise to two different families of indices.

TECHNICALITIES AND CONCLUSION

The first family of indices can use $h(y)$ as a constant multiplied by the income to a power less than the unity. And the second can use an increasingly increasing function till a certain level of income and then a decreasingly increasing function. Here we will present two typical examples from the two families of indices and discuss the pluses and minuses of the two assumptions. It is worth noting that the normalization of indices with zero and unity as the bounds allows us to compare the indices with each other, as well as allowing comparisons between two extreme examples like Bhutan vs USA or, UK vs EU – which is in the news now.

It seems only fair to state that our use of mathematics assumes a complete interpersonal comparison because we integrate over levels of income. And, since this is a work in progress, the conclusions will be presented at the symposium for an active criticism. The main point is sustainability of societies with an unequal distribution of income. If the indices throw up societies that are not sustainable, the polity requires the problem to be addressed – in the short run as in Thailand or in the long term as in Japan.

REFERENCES

- Gini C. (1912), *Variabilita e Mutabilita*, Bologna
Lorenz, M.O. (1905), "Methods of measuring the concentration of wealth", *Publications of the American Statistical Association*, Vol. 9, No. 70, pp 209–219.
Ranade, Ravindra and Yuki Shimono (2016), in *Themes in Economic Analysis (Ed)*, Routledge, Oxon.
Sen, A.K (1973), *On Economic Inequality*, Oxford: Clarendon Press.

Medicine and Nursing 4

- Aging and Lifestyle Related Diseases -

Monday 29 August, 2016

13:00-14:40

Room A, North Block

Introduction of the preventive measures against Lifestyle-related diseases with Specific Health checkups and Specific counseling guidance in Brunei Darussalam

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INTRODUCTION

In Kagawa Prefecture, the prevalence of patients treated for diabetes mellitus (DM) is especially high as compared to the other prefectures in Japan[1], and efforts to prevent DM are emphasized across the Kagawa prefecture. Meanwhile, in Brunei Darussalam, which has a population comparable to that of Takamatsu City, obesity and DM are also serious national health challenges, and there is an urgent, nationwide need to develop measures against these diseases[2]. Kagawa University and University of Brunei Darussalam have previously conducted projects focused on basic studies of DM and obesity. Although clinical studies of nutraceuticals and basic epidemiological studies focused on obesity and DM have been conducted, these research efforts have not as yet resulted in specific interventions.

Therefore we introduced specific medical checkups and health guidance, which attract attention worldwide as efforts unique to Japan, provides effective training that facilitates acquisition of the ability to stratify patients in need of support by simple indicators and to implement an appropriate high-risk approach through on-site training for the specific medical checkups and health guidance. This training program aims to provide a basis for transferring the findings obtained in Japan, especially Kagawa Prefecture, to Brunei Darussalam.

METHODS

The project was implemented by 2 times; firstly from 23 to 30 September, 2015 and secondly from 11 to 15 November, 2015. First program had been held at Kagawa Prefecture, which aimed to understand the specific health checkups and specific counseling guidance system. After the first program finished, participants were introducing these preventive systems in Brunei Darussalam. After introducing, Japanese specialists visited Brunei Darussalam to check how the system was going well.

RESULTS AND DISCUSSIONS

This training program is anticipated to provide proposals on effective methods of preventing and controlling DM and obesity, which are also extremely serious health problems in

Brunei Darussalam. Although efforts to combat DM and obesity have been made at the RIPAS Hospital and core hospitals in 7 regions in Brunei Darussalam, none of these efforts has as yet proven to be effective. In this training program, the Bruneian staff learned specific items of the specific medical check-ups, strategies for applying the results of these check-ups, actual and detailed contents of the specific counselling guidance, and so forth. We can reasonably expect that implementation of these practices and the skills acquired in Brunei Darussalam enabled the Bruneian staff to more effectively prevent and control DM and obesity.

Moreover, this project not only contributes to health promotion for Bruneian citizens, but can also be expected to have a spillover effect on neighboring Muslim countries with similar problems (e.g., Malaysia and Indonesia). If the specific medical check-ups and counselling guidance, which are programs unique to Japan, can be implemented in Brunei Darussalam, which is a politically and economically stable country strictly following Islamic law, as the first step to internationally spreading the Japanese-style healthcare system, it will be relatively easy to introduce these techniques and methods to other Muslim countries.

The prevalence of obesity and DM is increasing globally in both developed and developing countries, and preventive measures are urgently needed worldwide[3]. It seems that recognition and introduction of the efforts made in Japan are extremely meaningful and important for solving international issues.

ACKNOWLEDGMENT

This project was supported by the National Center for Global Health and Medicine, Japan.

REFERENCES

- [1] Kagawa Prefecture, "Kagawa Tounyoubyou Yobou Nabi (DM prevention navigation system of Kagawa)," in Kagawa Prefecture Web site (in Japanese), *available at* <http://www.pref.kagawa.lg.jp/kenkosomu/tounyounavi/state/>
- [2] Universiti Brunei Darussalam, "Looking into the cultural causes of diabetes," in Universiti Brunei Darussalam Web site, *available at* <http://www.ubd.edu.bn/discoverubd/issue-16/research/looking-into-the-cultural-causes-of-diabetes/>
- [3] International Diabetes Federation (IDF), "A huge and glowing problem," *IDF Annual Report 2014*, pp 6, 2014.

Migraine, metabolic syndrome and obesity: A cross-sectional study

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Abstract

Background

Migraine headache is a common cause of disability worldwide. Although some studies identified obesity and metabolic syndrome as a risk factor for migraine transformation, but more clinical study is needed to clarify the clinical correlation.

Objection

To study an association between migraine , metabolic syndrome, obesity among Thai migraineurs.

Methods

A cross-sectional study was conducted in CMU headache clinic during January 1st 2015 to December 31st,2015. All migraineurs were recorded for demographic data, headache character, headache frequency, drugs, severity, and headache impact. The metabolic syndrome, blood test for triglyceride ,HDL and sugar, and psychiatric co-morbidity were tested.

Result

162 patients were included in our study, 21 were male (12.8 %) and 141 were female (87.2%). The migraine subtypes comprised of migraine without aura (64.6%) and migraine with aura (35.4%). Mean frequency of migraine attacks per month was 7.13 ± 6.8 (range 1-14 days). Most common severity was mild (41.5%) following by very severe (26.2%), moderate (19.5%), and severe (12.8%) consequently. Our result showed that metabolic syndrome was presented in 18.5% patients and 4.3% were obese. Male and high score of migraine headache severity had significant association with metabolic syndrome ($P = 0.014$ and 0.012 respectively). Headache frequency, type of medication used, psychiatric co-morbidities (depression and anxiety) were not associated with metabolic syndrome and obesity in migraineurs.

Conclusion : Our results demonstrate that male and very severe headache in migraineurs had significant association to metabolic syndrome.

Key words : Metabolic syndrome, migraine ,obesity

1. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition (beta version). *Cephalalgia*. 2013 Jul 1;33(9):629–808.
2. Likitmaskul S, Kiattisathavee P, Chaichanwatanakul K, Punnakanta L, Angsusingha K, Tuchinda C. Increasing prevalence of type 2 diabetes mellitus in Thai children and adolescents associated with increasing prevalence of obesity. *J Pediatr Endocrinol Metab JPEM*. 2003 Jan;16(1):71–7.
3. Horev A, Wirguin I, Lantsberg L, Ifergane G. A high incidence of migraine with aura among morbidly obese women. *Headache*. 2005 Aug;45(7):936–8.
4. Bigal ME, Lipton RB, Holland PR, Goadsby PJ. Obesity, migraine, and chronic migraine: possible mechanisms of interaction. *Neurology*. 2007 May 22;68(21):1851–61.

Stage of Readiness to Perform Health Behaviors among Older Adults with Diabetes Mellitus

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INTRODUCTION

Controlling blood sugar levels is the most important health behavior among persons with diabetes, especially in older adults [1]. Successful health behavior changes to control blood glucose often depend on a person's stage of readiness to change [2]. The purpose of this descriptive study was to explore the stage of readiness to perform health behaviors among Thai older adults with type 2 diabetes mellitus (T2DM). The transtheoretical model of behavior change (TTM) of Prochaska and Velicer was used as the theoretical framework of this study [3]. Purposive selected sample comprised 62 older adults with DM type 2 receiving treatment at health promotion hospitals under the jurisdiction of Nakornping Hospital and Hang Dong Hospital, Chiang Mai province, Thailand. Participants completed a demographic questionnaire and the Readiness to Adopt Health Behaviors Questionnaire developed by Jarustanaput [4]. Data were analyzed by using descriptive statistics.

RESULTS AND DISCUSSIONS

Among the sample of 62 older adults with uncontrolled DM type 2, 59.68% (n = 37) were female and 40.32% (n = 25) were male, with an age range of 60 – 79 years old (mean age 65.70; SD. 5.36). For marital status, 70.97% were married. The majority of the samples finished primary school, and 95.16% of them revealed a mean blood sugar value of 130 mg%.

For the readiness to perform health behaviors, it was found that the samples consistently performed health behaviors in the dimension of medication use and stress management more than 6 months at 95.16% and 75.81%, respectively (see Table I). These behaviors were in the phase of maintenance. A possible explanation is that they were married and received care from family members. Participants with family member support and closed care had proper medication consumption [5]. The dimension of stress management could be explained by their age. Thus, they could appropriately cope with stressful situations in their lives.

In the dimension of diet control and exercise, it was found that the samples irregularly performed certain health behaviors

at 37.1% and 41.9%, respectively (see Table 1). These behaviors were in the preparation phase. These results could be explained by the advanced age of the participants, which led to a decrease in the ability of self-care. It was also found that the majority of the samples finished primary school. Their educations may have affected their knowledge and understanding of performing health behaviors on diet control.

Nearly half of the sample had the readiness to perform exercise in the phase of preparation. The age of the sample could also explain because they had jobs as wage workers with low income. They worked hard and were often tired, so perhaps they needed rest more than exercise [6]. Concurrently, the older adults had health problems of musculoskeletal system such as gout and osteoarthritis, which are barriers to exercise [7].

The findings serve as preliminary data for health professionals to consider the readiness to perform health behaviors among older adults with DM. Nurses may use the information to plan to further promote performance of health behaviors appropriate to the phase. Further research may be on the prediction of the readiness to perform health behaviors and find appropriate strategies to promote health behaviors, particularly in the dimension of diet control and exercise.

ACKNOWLEDGMENT

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REFERENCES

- [1] American Diabetes Association. "Diagnosis and classification of diabetes mellitus," *Diabetes Care*, vol 37, suppl. 1, pp. S81-S90, January 2014.
- [2] R. Mayberry, R.J. Willock, L. Boone, P. Lopez, H. Qin, and D. Nicewander, "A high level of patient activation is observed but unrelated to glycemic control among adults with type 2 diabetes," *Diabetes Spectr*, vol. 23, pp. 171-176, July 2010.
- [3] J.O. Prochaska, and W.F. Velicer, "The Transtheoretical Model of health behavior change," *Am J Health Promo*, vol. 12, pp. 38-48, September/October 1997.
- [4] P. Jarustanaput, P. Soivong, and M. Somrarnyart, "Readiness to adopt health behaviors among persons with uncontrolled type 2 diabetes mellitus," *Nursing Journal*, in press.
- [5] W. Srichana, "Affecting factors on the control of fasting blood sugar level of type 2 diabetic patients attending diabetes mellitus clinic at Fang Hospital, Chiang Mai province," unpublished master's thesis, Chiang Mai University, Thailand, 2005.
- [6] S. Kajornboon, "Physical activity in persons with uncontrolled type 2 diabetes mellitus," unpublished master's thesis, Mahidol University, Thailand, 2011.
- [7] A. Pirochom, and A. Hansakul, "Factors influenced with self-care behaviors in type II diabetes mellitus patients in Nongbuarawae district, Chaiyaphum province," *Journal of The Office of DPC 6 Khno Kaen*, vol. 19, pp. 1-10, October 2011-March 2012.

TABLE I NUMBER AND PERCENTAGE OF THE READINESS TO PERFORM HEALTH BEHAVIORS

Stage of readiness	Diet control		Exercise		Medication use		Stress management	
	n	%	n	%	n	%	n	%
Precontemplation	2	3.23	3	4.84	0	0.00	3	4.84
Contemplation	0	0.00	1	1.61	1	1.61	0	0.00
Preparation	21	33.87	22	35.48	1	1.61	11	17.74
Action	4	6.45	5	8.06	1	1.61	1	1.61
Maintenance	35	56.45	31	50.00	59	95.16	47	75.81

Effect of rare sugar D-allulose (D-psicose) on established diabetes in OLETF rats

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INTRODUCTION: Rare sugar D-allulose (previous name is D-psicose) has been evaluated having anti-obese, anti-diabetic and anti-inflammatory effects in various experimental rat models [1,2,3] as well as in clinical short studies [4]. In the present study we have investigated the anti-obese and anti-diabetic effects of D-allulose in type 2 diabetic model Otsuka Long-Evans Tokushima Fatty (OLETF) rats to study mainly two things; whether D-allulose was able to reduce blood sugar levels in hyperglycemic rats and whether withdrawal of D-allulose further increase blood sugar levels.

MATERIALS AND METHODS: Twenty control OLETF rats were fed drinking water from early age and feeding 5% D-allulose was started in 10 rats after developing hyperglycemia and obesity. Similarly, 20 D-allulose-treated OLETF rats were started feeding D-allulose from early age and withdrew in 10 rats at the same time when D-allulose was started in control rats. Body weight and blood sugar levels were measured weekly until the age of 100 weeks. Periodical OGTT (Oral glucose tolerance test) was performed with other measurements related to obesity, diabetes and pancreas inflammation.

RESULTS AND CONCLUSION: D-allulose was shown to reduce body weight (Fig. 1) significantly even when started feeding after the commencement of obesity in control rats (Fig. 1). On the other hand, withdrawal of D-allulose in the feeding group significantly increased body weight (Fig. 2). In case of blood sugar levels there were no remarkable changes neither starting D-allulose feeding after the commencement of hyperglycemia in the control rats nor withdrawal of D-allulose feeding in the feeding rats. These findings support the clinical use of D-allulose any time for the people with increased body weight to reduce and for the people who are obese tendency from the early life. For hyperglycemic people it is advised to use D-allulose before the commencement of hyperglycemia and diabetes. However, in the diabetic stage D-allulose could be used mainly to prevent the inflammatory complications of diabetes, particularly pancreatic b-cell inflammation. Previous studies had evaluated the strong anti-inflammatory effect of D-allulose [2,3].

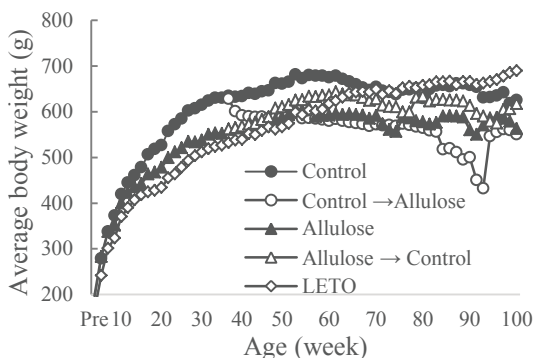


Figure-1: Effect of D-allulose on body weight changes. D-allulose decreased the body weight after the commencement of diabetes and obesity in OLETF control rats at age from 40 weeks (control; solid circle, control-allulose; open circle). On the other hand body weight in the D-allulose group started to increase when D-allulose was withdrawn at the same time at 40 weeks in D-allulose group (D-allulose; solid triangle, D-allulose- Control; open triangle).

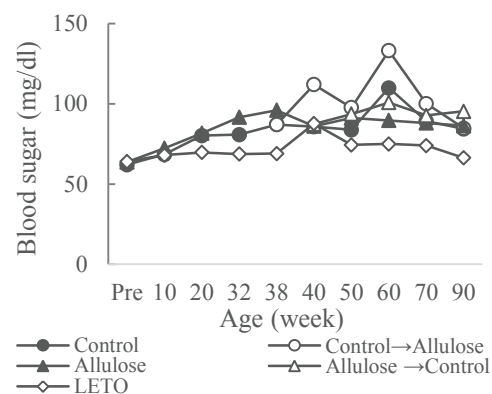


Figure-2: Effect of D-allulose on blood sugar levels. Blood sugar levels were not significantly changed when D-allulose feeding was started after the commencement of obesity and diabetes in the control group (solid circle) and also not changed even after withdrawal of D-allulose (solid triangle).

REFERENCES

- Hossain MA, Tokuda M *et al.* Rare sugar D-psicose improves insulin sensitivity and glucose tolerance in type 2 diabetes otsuka long-evans tokushima fatty (OLETF) rats, *Biochem. Biophys. Res. Commun.* 405 (2011) 7-12.
- Hossain A, Tokuda M *et al.* Rare sugar D-psicose protects pancreas b-islets and thus improves insulin resistance in OLETF rats. *Biochem Biophys Res Commun* 425 (2012) 717-723.
- Hossain, A., Yamaguchi, F., Hirose, K., Matsunaga, T., Sui, L., Hirata, Y., *et al.* (2015). Rare sugar D-psicose prevents progression and development of diabetes in T2DM model Otsuka Long-Evans Tokushima Fatty rats. *Drug Des Devel Ther* 9, 525-535.
- Iida, T., Yamada, T., Hayashi, N., Okuma, K., Izumori, K., Ishii, R., *et al.* (2013). Reduction of abdominal fat accumulation in rats by 8-week ingestion of a newly developed sweetener made from high fructose corn syrup. *Food Chem* 138, 781-785.

Telemedicine and Healthcare System Integration Projects in Kagawa

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INTRODUCTION

Kagawa University Hospital has been developing system for telemedicine since 1998. In the early stages, we made the system based not only on regional demands but also policy of standardization. The main system in Kagawa; Kagawa Medical Internet eXchange (K-MIX) implemented international standard protocol, "Digital Imaging and COmmunication in Medicine (DICOM)" for digital images transmission and "Health Level Seven (HL7)" for electronic health information handling. The policy of Kagawa for the standardization involved feedbacks to the Standards Developing Organizations (SDOs). The staffs of Kagawa University have contributed SDOs. They implemented standards in their system and made feedback to the SDOs such as DICOM, ISO etc. With the activities, Kagawa has been establishing policy based on standards and reasonable value judgment. We continue Tele-healthcare support for Japanese residents living in Chiang-Mai using Skype; we acquired some know-hows of tele-consultation.

RESULTS AND DISCUSSIONS

1. The Tele-healthcare Support from Kagawa for Japanese Residents in Chiang Mai

Kagawa University (KU) has been opening the consultation office 2 days in a month at the free of expense because it has been at a stage of trial. The motivation of the action was based on some successful reports^{[2]-[4]} of telemedicine. Three physicians make a rotation of consultation. They check the interview sheet before meeting the consulter (Fig.1). If there is a difficult item to answer, they take advice from domain experts in KU hospital. KU performed 62 consultations since 2010 to 2015. Several times (less frequently), the teleconference was completely disconnected, never recovered and the consultation must be cancelled.

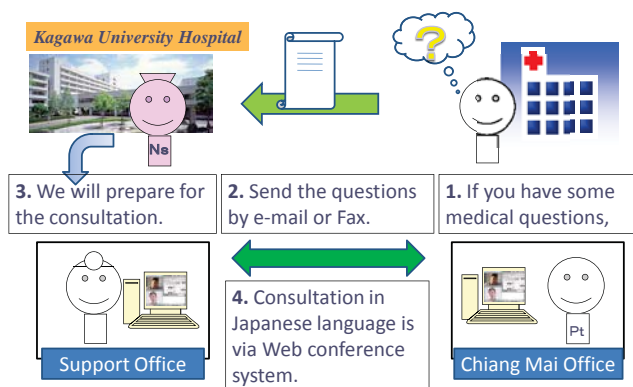


Fig. 1. The workflow of Japanese resident support in Chiang Mai

Many consultations have been performed via internet with the system "Skype". We chose "Skype" because of the low speed network communication. The result was led by low speed infrastructure of Chiang Mai civilian internet in 2010.

We experienced that the consultations with Japanese language were very welcomed by Japanese residents. Although many of them are good at speaking English and also Thai language, they felt certain stress for their medical communications with Thai doctors because of the specialization.

2. K-MIX and International Standardization

K-MIX is a cloud system which makes medical institutions share patients' information. We have developed K-MIX with using standard protocol for medical information (e.g. DICOM, HL7 etc.). The standards should contribute to improve interoperability between several systems. We might have also contributed to the development of standardizations themselves. The staffs in KU have joined some SDOs (Table I) and have made suggestions from clinical point of view and boost their international profiles.

TABLE I STANDARD PROTOCOL THAT KAGAWA UNIV. CONTRIBUTES

International Standard Protocol		
Standard Development Organization	Group Name	Target
International Standard Organization (ISO)	TC215/WG3	Semantic content
Digital Imaging and COmmunication in Medicine (DICOM)	Working Group 13	Visible light
Integrate the Healthcare Enterprises (IHE)	IHE Endoscopy	Endoscopic Domain
Clinical Data Interchange Standards Consortium (CDISC)	Japan CDISC Coordination Committees	Clinical Research in Japan

REFERENCES

- [1] Wang F., "Economic evaluations of the effects of longevity on telemedicine and conventional healthcare provision." *Telemed J E Health.*, 17(6):431-4., Jun. 2011.
- [2] Hopper B, Buckman M, Edwards M., "Evaluation of satisfaction of parents with the use of videoconferencing for a pediatric genetic consultation" *Twin Res Hum Genet.*, 14(4):343-6. Aug. 2011.
- [3] Oliver DP, Demiris G., "Comparing face-to-face and telehealth-mediated delivery of a psychoeducational intervention: a case comparison study in hospice." *Telemed J E Health.*, 16(6):751-3. 2010.
- [4] Kagawa Medical Internet eXchange (K-MIX). Available: <http://www.m-ix.jp/>

Engineering 3

- *Sustainable Technologies* -

Monday 29 August, 2016

13:00-15:05

Room B, North Block

Steel Corrosion Monitoring for RC Deck of Open Type Wharf by embedded sensor

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INTRODUCTION

Port facilities are generally located in severe environments. Therefore, their structural performance is often easily degraded owing to material deterioration and corrosion. To keep their performance above the required level, effective and efficient maintenance should be carried out. In this study, focusing on upgrading and optimizing maintenance of port concrete facilities, we tried developing the deterioration judgment method used by electrochemical properties of reinforced concrete (RC) members. The RC specimens, in which corrosion sensors were installed, were exposed to sea water splashing environment. The corrosion sensor can detect the initiation of corrosion and corrosion rate by monitoring half-cell potential and polarization resistance.

Analyzing the 2-year monitoring data, the following concluding remarks can be obtained; the lowest value of Half-cell potential during a measurement term with judgment criteria of ASTM standard can detect the corrosion initiation. Mean value of half-cell potential population can be estimated by the measured half-cell potential values.

TARGET MEMBER AND MONITORING ITEM

Corrosion of steel bar in concrete is often inspected by measuring electrochemical parameters such as half-cell potential and polarization resistance. Here, sensors capable of measuring these parameters continuously shown were installed on the steel bar in concrete, and the corrosion deterioration of the member was investigated by using the local information obtained by the sensors.

Water to cement ratio of concrete specimen was 0.55, which corresponds to the upper limit value of concrete in port facilities in Japan. The cover depth of the small specimen was 2cm.

The sensor shown in Photo 1 for measuring the half-cell potential and polarization resistance of steel bar were installed on each steel bar, and a lead cable was connected to the steel bar. 24 sensors were set on each steel bar in specimen as shown in Fig.1 and lead cables were connected to the steel bars. Specimens were prepared 2 types: one contained 5 kg/m³ of chloride inside the concrete initially, while the other had no chloride. These specimens were exposed at severe condition, which consisted in seawater splash environment for 3 h twice every day.

DISCUSSION AND RESULTS

Measured value of Half-cell potential of 24 sensor were normally distributed. Distribution model of half-cell potential was determined, therefore mean value of half-cell potential of whole member was predicted as shown in Fig.2. Furthermore, effect of the number of sensors on the width of

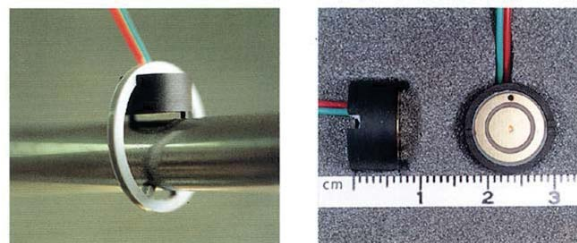


Photo 1. Sensor embedded in specimen

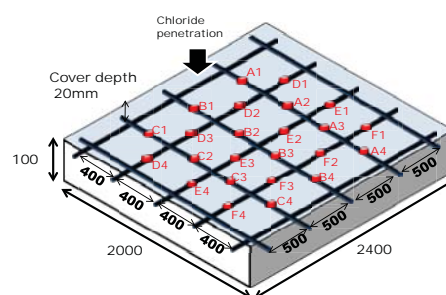


Fig. 1. Size of specimen and position of embedded sensor

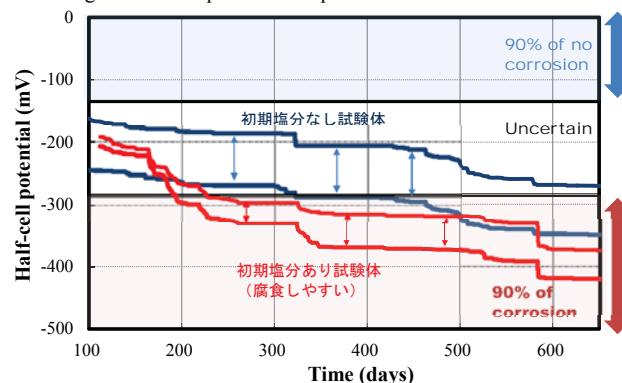


Fig. 2. Predicted mean value of half-cell potential of whole member

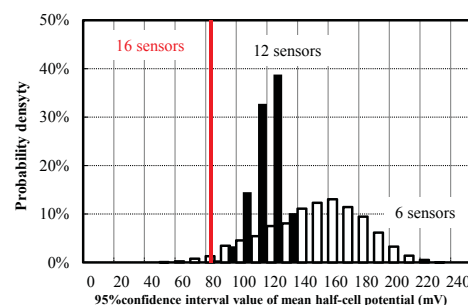


Fig. 3. Relation between number of sensor and confidence interval

confidence interval was shown in Fig.3. According to the result, more than 1 sensor per 1 meter is needed for precise prediction of rebar corrosion.

REFERENCES

ASTM C876-91(1999).Standard Test Method for Half-Cell Potential of Uncoated Reinforcing Steel in Concrete , Annual Book of ASTM Standards, Vol.03.02, pp.457-462

The optimal time to sterilize on Scalpel Handle by Dielectric Barrier Discharge Plasma Technique

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INTRODUCTION

The purpose of research is to study the optimal time for sterilization on scalpel handle by Dielectric Barrier Discharge (DBD) Plasma Technique. This research was tested on the scalpel handle No. 3 with two species of bacteria, *Staphylococcus aureus*, a representative of gram-positive bacteria and *Escherichia coli*, a representative of gram-negative bacteria. The plasma generates from Argon gas which is inert gas, so it does not react with the surface of the scalpel handle with flow rate 22 L/min at 180 Watt RF power supplies.

Keywords: Dielectric Barrier Discharge Plasma / *Escherichia coli* / *Staphylococcus Aureus*

RESULTS AND DISCUSSIONS

The method in this experiment was factorial design. The growth rate of two types of bacteria was analyzed on nutrient agar (NA) compared with the standard method at 37 ° C for 24 hours [1-3]. The results were as follows.

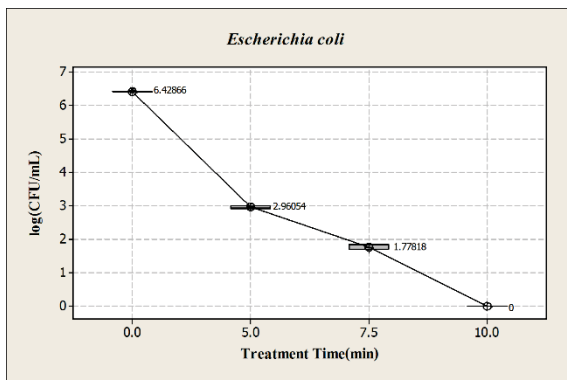


Fig1. Box-plot of *Escherichia coli* survivor

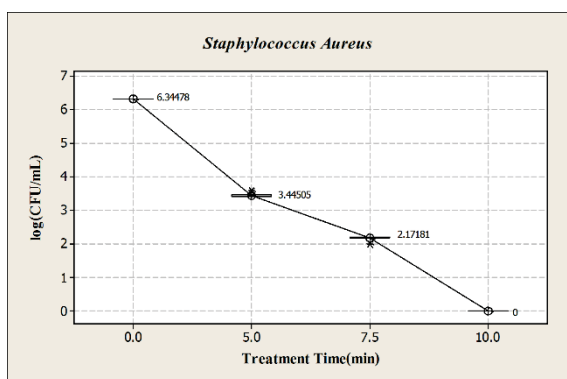


Fig 2. Box-plot of *Staphylococcus aureus* survivor

As can be seen from the results, the number of *Escherichia coli* and *Staphylococcus aureus* bacteria on scalpel handle after plasma treatment for 5 and 7.5 minutes decreased, and sterilized for 10 minutes. Therefore, the optimal duration for sterile bacteria by DBD is 10 minutes and the efficiency of the gas plasma was confirmed by Optical Emission Spectroscopy (OES).

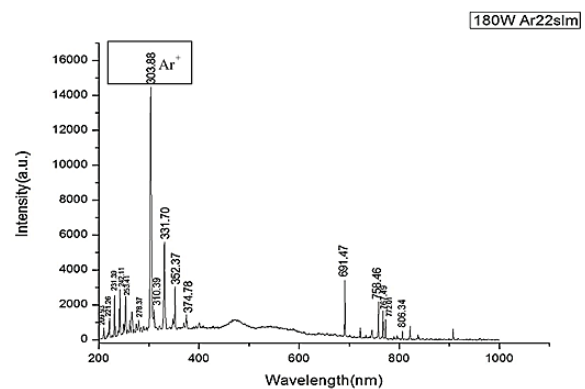


Fig3. The graph shows the relationship of Wavelength (nm) and Intensity (a.u.).

From Fig3, The results demonstrate the effectiveness of the plasma gas that reacts with the cells of the bacteria on the scalpel handle by argon gas affects the rate of growth of bacteria, which can react with the cell walls of bacteria, both species. When the Power RF at 180-watt argon gas in the state and region will be accelerated into a state stimulus. By nature, electrons are stimulated to try to return to the ground state and emit energy in the form of magnetic waves [4-5], which appears as a range of light can be observed. Inspection techniques spectroscopy, according to the graph, Fig3, which has a capacity of argon gas, compared with the standards. The charged that the gas reacts with the bacterial cell wall actually.

ACKNOWLEDGMENT

The authors would like to thanks Department of Industrial Engineering, Faculty of Engineering, and Department of Biology, Faculty of Science, Chiangmai University for collaboration and equipment supported.

REFERENCES

- 1 Chu, N. S., H. Chan-Myers, N. Ghazanfari, and P. Antonoplos, 1999, Levels of naturally occurring microorganisms on surgical instruments after clinical use and

- after washing: *American Journal of Infection Control*, v. 27, p. 315-319.
- 2 Kostov, K. G., V. Rocha, C. Y. Koga-Ito, B. M. Matos, M. A. Algatti, R. Y. Honda, M. E. Kayama, and R. P. Mota, 2010, Bacterial sterilization by a dielectric barrier discharge (DBD) in air: *Surface and Coatings Technology*, v. 204, p. 2954-2959.
 - 3 Heuer, K., M. A. Hoffmanns, E. Demir, S. Baldus, C. M. Volkmar, M. Röhle, P. C. Fuchs, P. Awakowicz, C. V. Suschek, and C. Opländer, 2015, The topical use of non-thermal dielectric barrier discharge (DBD): Nitric oxide related effects on human skin: *Nitric Oxide*, v. 44, p. 52-60.
 - 4 Yang, L., Chen, J., Gao, J., & Guo, Y. (2009). Plasma sterilization using the RF glow discharge. *Applied Surface Science*, 255(22), 8960-8964.
 - 5 Adler, S., Scherrer, M. & Daschner, F. D. 1998, 'Costs of low-temperature plasma sterilization compared with other sterilization methods', *Journal of Hospital Infection*, vol. 40, no. 2, pp. 125-34.

Speech Performance of Fricative Sounds by the Talking Robot

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Abstract- Human vocal sounds are generated by the complex movements of vocal organs. The authors are developing a talking robot based on the physical model of human vocal organs in order to reproduce human speech mechanically. In this study, an unvoiced sound input system is added to the mechanical vocalization system for fricative sound production of the talking robot. The unvoiced sound input system includes an airflow control valve to control the amount of airflow input and an air buffer chamber to provide enough pressure for fricative sound regeneration. The talking robot articulatory mechanism is programmed to have appropriate movements and positions for vocalizing five Japanese fricative sounds /sa/, /si/, /su/, /se/, /so/ using a Matlab-based control system.

INTRODUCTION

Speech is the most common and fastest communication way of a human. Vocal sounds are generated by the operation of vocal organs such as the lung, trachea, vocal cords, vocal tract, tongue and muscles. The complex movements of vocal organs generate different vocal sounds. The authors are developing a talking robot based on the physical model of human vocal organs in order to reproduce human speech mechanically. The talking robot was previously constructed to reproduce simple Japanese sounds. However, it could not produce fricative phonetics yet, due to the lack of unvoiced input airflow. In this study, an unvoiced sound input mechanism is added for the generation of fricative phonetics.

MECHANICAL CONSTRUCTION OF THE TALKING ROBOT AND FRICATIVE SOUND GENERATION

The talking robot consists of an air pump, an artificial vocal cord, a resonance tube, an artificial nasal cavity, and a microphone connected to a sound analyzer, which represent a lung, vocal cord, vocal tract, nasal cavity and the auditory feedback of a human, respectively [1]. Twelve motors are employed to control the movements of the robot articulatory



Fig. 1. The talking robot

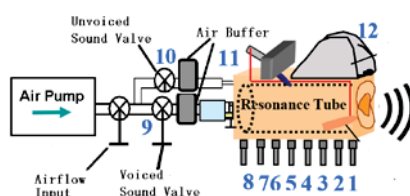


Fig. 2. System configuration

mechanism. Command-type servomotors (Futaba) are used for driving the mechanisms of this robot. Picture of the talking robot is shown in Figure 1.

In the previous version, the talking robot was constructed to reproduce simple Japanese sounds including all vowels /a/, /i/, /u/, /e/, /o/ and some consonant sounds such as /k/, /n/, /r/, /g/, /m/. However, it could not produce unvoiced sounds such as /sa/, /shi/, /su/, /se/, /so/ yet, due to the lack of unvoiced input airflow. In this study, an unvoiced sound input mechanism is added to the existing system for fricative phonetics generation as shown in Figure 2. The airflow supplied from the air pump is led to two valves controlled by motor 9 and 10 for voiced and unvoiced sound inputs, respectively.

To find the appropriate movements of the robot motors for pronouncing /sa/, /shi/, /su/, /se/, /so/, which are recognized as Japanese fricative phonetics, the authors refer to an online 2D vocal tract animation software from U Iowa university (<http://soundsofspeech.uiowa.edu/english/english.html>). The talking robot is programmed to speak Japanese fricative phonetics by firstly letting the unvoiced sound going through the narrow cross sections of the resonance tube, then followed by the vowel generation.

RESULTS AND DISCUSSIONS

The talking robot was programmed to produce 5 Japanese fricative phonetics, and then these phonetics were compared with those of a human. The sounds of the talking robot and a human for /sa/ phoneme was shown in Figure 3. We can see an unvoiced part, a transition part and a vowel part in both sounds, and the robotic sound has shorter transition part by the comparison to the human one. Thus, the result of the fricative phonetics of the talking robot is a little less clear to be recognized. This limitation may come from the artificial vocal cords, which doesn't have a smooth transition from lower frequency to higher frequency.

REFERENCES

- [1] H. Sawada, "Talking Robot and the Autonomous Acquisition of Vocalization and Singing Skill," *Robust Speech Recognition and Understanding*, Vol. 22, pp.385-404, 2007.

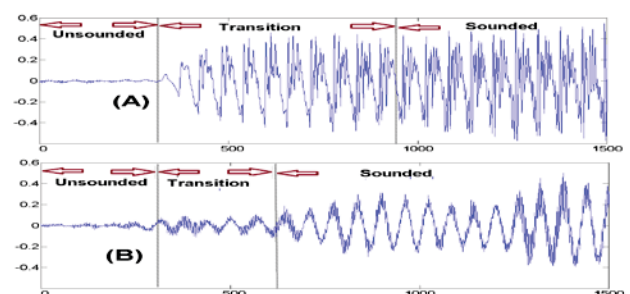


Fig. 3. /Sa/ sound of human (A) and robot (B)

A Document Editor with Machine Learning and Language Processing Facilities for Risk Management Handling

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When we have a duty to write and fulfill some document in a short period, we sometimes need to refer samples or prototypes in order to do such a job suitably. Particularly, we would like to investigate precise and smart terminology or vocabulary in the similar documents for our choice in relatively same context. Such a tool would be very useful and convenient for us to look for item/ terminology/ vocabulary, select it for construction of sentence, and accomplish reader-friendly paragraph/chapter/article in a relatively short time by ourselves. We have designed user-centered document-writing support editor and begun to evaluate it in the practical situation. Now it will be used in editing of risk management documents. And it will be also expected that users, including beginners can write and edit such documents by themselves.

I. INTRODUCTION

Recently, ICT (information and communications technology) has been one of the lifelines in our daily activities, and it has become very important, valuable and "must-be-sustainable". We must prepare useful scheme and procedure against arising of the risks where we will be suddenly attacked by natural disasters and/or human-caused some kinds of destructions.

BCP (business continuity plan) will be more and more necessary because people-in-lost need to keep useful guidance to overcome adverse challenges. In Taiwan and Japan, unfortunately, we have experienced a lot of damages from natural disasters. So we must prepare BCP and particularly ICT-BCP for your sustainable daily life. However, it is really time-consuming and very difficult for us to write suitable documents for ICT-BCP which would be able to provide us with useful guidelines and instructions at the situation in natural disasters and human-caused destructions such as cyber-attacks, huge contamination from computer viruses, and so on.

In this paper, we propose a document-writing support system to write ICT-BCP even for beginners to use. We have designed and implemented document-writing support editor, just like smart-editing navigation system with word/expression recommendation of candidates. A questionnaire is carried out in order to perform evaluation in the relatively practical usage of the system.

II. SYSTEM CONFIGURATION

Fig. 1 shows concept of our document writing support system. We have employed word2vec[1] for dictionary construction and MeCab as natural language processing facility. Dictionary is the dedicated one for users to refer and obtain the recommended candidate(s) to help them to write a document by themselves. Just like we investigate keywords by retrieval engine, select a suitable candidate from the

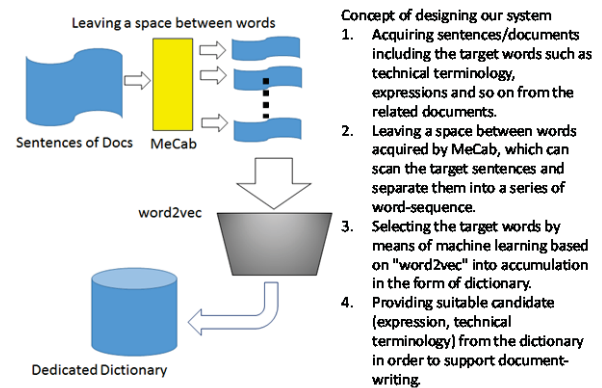


Fig. 1. Concept of designing our document-writing support system.

retrieved results by ourselves, and perform copy-and-paste it onto our document, our system can search the dictionary to pick up some candidates from it, show the list of candidates on the sub-display, waiting the specification for selection, and place the selected expression onto the document.

III. APPLICATION TO DOCUMENT EDITING AND RISK MANAGEMENT

Two case example is performed to demonstrate proposed system. At the first time, we had designed and implemented our system as document-writing support for beginners to begin describing "novel" in a relative short period. In a case of general application it has been useful for beginners to write document as a novel.

Next, we have applied our system to ICT-BCP document-writing task. In the case of our attempt to apply this system to write ICT-BCP document, we have carried out a simple questionnaire in order to perform evaluation in the relatively practical usage of the system. The result of questionnaire is only on-going experiment of our attempt to apply the system to practical ICT-BCP document writing task. So we must improve our system to be costumed for more professional use and to be more clearly useful for real utilization.

IV. CONCLUSION

This paper describes document-writing support system. Our system totally facilitates document-writing support service by means of recommendation of suitable candidates for given sentence which are replaceable and potentially improved for document writing. In the near future, we will carry out more wide-scale questionnaire to perform quantitative and qualitative evaluation of our system.

REFERENCES

- [1] word2vec: <https://code.google.com/archive/p/word2vec/> accessed on 20th of March, 2016

A Tool Supporting Shogi's Post-Game Discussion on the Internet

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Along with the progress of information technology, many systems for Shogi (Japanese Chess) have been developed; for example, game record database and Shogi AI programs. However, these systems have two weak points. They are basically stand-alone, and do not support post-game discussions. Therefore, we have developed a system supporting post-game discussions on the Internet.

I. INTRODUCTION

A. *Shogi and Kansousen*

Shogi is a famous and popular board game among Japanese people. Shogi is a variant of chess-like games. However, Shogi is more complex than the international chess, mainly because it allows reuse of captured pieces.

Some of the players do post-game discussions after playing games. Players discuss actually played moves and consider better moves in their game to improve their playing skill. Post-game discussions are called “Kansousen” in Japanese.

B. *Background*

Many systems and programs for shogi have been developed. For example, game servers on the Internet, software to play shogi, databases to record shogi games, and AI programs which play shogi, etc.

However, these systems are basically stand-alone and cannot communicate with each other. In order to better utilize such systems, we need a platform to incorporate them. Especially, AI programs could be used for other purposes than playing shogi games, if they are connected to the platform. In addition, there are few systems which focus on post-game discussions.

Thus, we are developing a platform which support post-game discussions. We have named it SAKURA (Shogi Archives and Kansousen Utilities for Research and Advice) [1]. SAKURA provides shogi players with necessary functions for post-game discussions.

C. *Related Works*

“81 Dojo” [2] is popular game servers on the Internet. This service also supports post-game discussions. It provides chatting service and graphical interfaces to draw arrows on the board. However, it is not enough to discuss on the Internet. In order to better discussions, it is necessary for a function of dealing with variations of games, and a function of saving comments given in discussions and sharing them with other players on the net.

II. DESIGN OF SAKURA

A. *Client Software*

SAKURA provides users with client software to have post-game discussions on the Internet. We have been developed various functions utilized during post-game discussions for

client software. A tree view function to display moves and variations in games, a shared game board to share a board and captured pieces among players, a personal board used by players to ponder hard alone about specific position, and functions for saving comments on game records or positions.

B. *A Game Server*

A game server communicates with client software, and a supporting module for post-game discussions with shogi AI programs. This server controls each client software and the supporting module. In addition, this server is connected with SAKURA’s database via API to retrieve or store record of post-game discussions.

C. *Databases*

SAKURA’s database consists of two databases – a game record database and a position database. These databases store game records and records of post-game discussions. In addition, these databases have links to each other. This structure reduces retrieval time to find candidate moves.

Mutual links between databases of SAKURA make it complex to operate the database. Therefore, SAKURA provides API. API makes it less complex to operate the database.

D. *Supporting Module embedding Shogi AI programs*

Shogi AI programs are developed by many researchers, and top-level AI programs won against professional players. We are developing a module embedding these shogi AI programs to give advice to players during post-game discussions. In addition, this module has other functions which generate variations and evaluate the score of positions, and store these data in the database.

III. CONCLUSION

We have developed a system supporting post-game discussions for Shogi, named SAKURA. SAKURA provides users with various necessary functions for post-game discussions, and enables post-game discussions on the Internet.

ACKNOWLEDGMENT

This research is partially supported by KAKENHI (25540169).

REFERENCES

- [1] Miura, R., Kinuhata, T., Ohara, S., Tarumi, H., Hayashi, T., and Ichino, J.: Design and Evaluation of Database and API Supporting Shogi Learners on the Internet, Proceedings of 16th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD 2015), pp.307-312 (2015).
- [2] 81 Dojo : <http://81dojo.com/>

Internet Streaming of Music Live Performance and Supports for Remote Audiences

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Abstract-Live music performances on the streaming service are getting popular. However, real time communication between performers and remote audiences is insufficient. We have developed a system supporting the communication and implemented three input methods and evaluated them.

I. INTRODUCTION

Many musicians often make use of internet streaming channels to show their live music performances. Ustream [1] and NicoNico Live [2] are popular live streaming services. They have functions for audiences to communicate with performers by the text chat. However, text chat is not easy to read for performers. We need a non-verbal communication channel from the audiences to the musicians. We have developed a system using animation supporting communication between performers and remote audiences.

Our research is focusing on these problems: how to support remote audiences to give their responsive actions and how to let musicians perceive the responses. In this paper, we focus on the input methods for remote audiences. We have implemented three methods to input their responsive actions and evaluated them.

II. SYSTEM DESIGN

We have implemented input methods using smartphones. With the three types of actions (Fig. 1), audiences represent their responses. They are: wave (wide movement of one hand), push-up, and joggle (rhythmical shakes of one hand). Fig. 2 shows the system configuration.

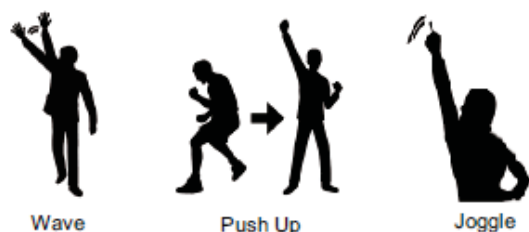


Fig. 1. Three responsive actions

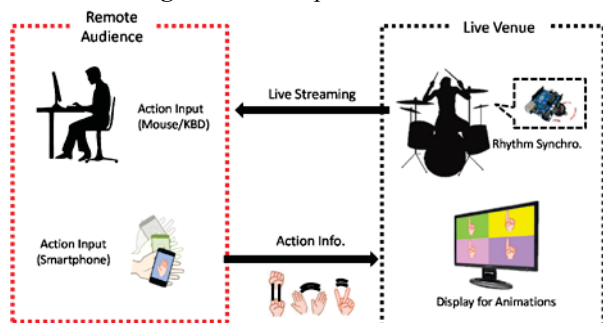


Fig. 2. System Configuration

Remote audiences watching the live streaming video can input three types of responsive actions by one of the three methods: moving mouse pointers, typing keyboard, or using smartphones. The information of actions is sent back to the computer at the live venue. The format of action information is very simple. It does not show analog values of each motion, but shows only the type of actions by each audience.

The actions taken by each audience are displayed to the musicians during their play by animations. The animation is represented by avatars by illustrations of hands. The motions of animations are synchronized with the music played at the live venue, by detecting the drum beats with a vibration sensor. The synchronization technique is still under research to pursue a better solution, but we support a very simple synchronization technique for the current prototype.

III. EVALUATION AND RESULT

We have compared and evaluated three input methods for remote audiences. In case of the smartphone, the input method is illustrated in Fig. 3.

Subjects were selected from students who had experiences in participating in music lives. Audiences watched a music live video and input their actions with the three input methods. After that we gave a questionnaire.

As a conclusion, smartphone was highly evaluated with respect to concentration and a sense of participation.

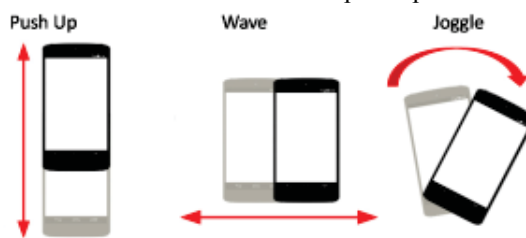


Fig. 3. Motion sensing with smartphones

IV. CONCLUSION

By smartphone, remote audiences were able to send the responses to the player with higher concentration and sense of participation.

ACKNOWLEDGMENT

This research is partially supported by KAKENHI (15K00274).

REFERENCES

- [1] Ustream, <http://www.ustream.tv/>
- [2] NicoNico live, <http://live.niconivideo.jp/>

E-Learning system for scheduling algorithms visualization in JavaScript

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Abstract-In this paper, we will introduce a visualizer for CPU scheduling algorithms implemented in JavaScript. We also carried out a questionnaire to evaluate the achievement of the design objectives and obtained positive response from users.

INTRODUCTION

Along with the spreading of smart devices, such devices are more and more used in various situation of classes such as preparation to access online teaching materials. Until recently, Java applets were popular as a platform of visualization, especially, Web-based visualization systems. However, they are not available on iOS or Android OS. Adobe Flash has a similar problem too.

Though we already had an Adobe Flash-based visualizer for CPU scheduling algorithms [1], we decided to implement a new system using JavaScript considering the future prospect. We aim at a system which is handier for teachers to improve and easier for learners to grasp by taking advantages of JavaScript.

THE DESIGN OF THE PROPOSED SYSTEM

The proposed scheduling algorithms visualizer is implemented in HTML5 and JavaScript. It only consists of client-side programs and therefore does not employ server-side programs.

The user interface of the system consists of the chart part which displays the output of algorithms as timeline and the input part to let users select parameters such as the arrival time and the duration of processes. The chart part uses the canvas tag and therefore the HTML5 canvas API. The input part uses the table tag. Fig. 1, shows a screenshot of the system in the middle of displaying animation, where the system shows the result of scheduling four processes using the FCFS (First Come First Served) algorithm. The servicing period is filled with vivid colors while the waiting period is filled with pale colors.

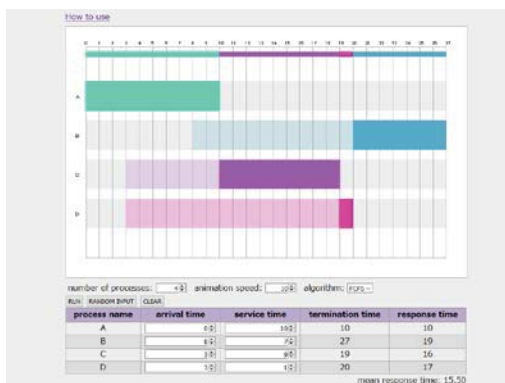


Fig. 1. Screenshot of the proposed system

EVALUATIONS

To evaluate the proposed system, we asked the students of the class “Operating Systems” to fill out questionnaires on November 15th, 2015, when 34 students answered the question among about 50 attendees with the Likert scale (1-very positive, 5-very negative). Unfortunately only one participant uses the system with a smartphone and that the rest use it with ordinary PCs.

Questions are roughly divided into three categories: “Ease of use of a system”, “Ease of understanding of user interface”, and “Level of understanding of scheduling algorithm”. “Ease of use of a system” gets good scores. It seems that attendees much appreciate the tutorial given by intro.js (<http://introjs.com>). From the score of “Ease of understanding of user interface”, we can see that users are content with the user interface provided by HTML5 and JavaScript. From the score of “Level of understanding of scheduling algorithm”, the system seems to achieve the initial educational purpose at least subjectively.

RELATED WORK AND FUTURE DIRECTIONS

There are already several JavaScript-based educational visualization systems. Some of them work together with server-side programs written in Java or other languages. For example, Python Tutor [2] and JSAV [3].

In this paper, we have proposed a JavaScript-based visualization system for CPU scheduling algorithms. Though it is designed with smart devices in mind, this time, we could not obtain enough response to evaluate comfortableness of the system when used with smart devices. Despite this, obtained response from users is encouraging. Especially, tutorials introduced by intro.js are much appreciated by first users. We want to provide more simulation and visualization tools in other topics of computer science in JavaScript using libraries, tools and languages with modest help of server-side programs.

REFERENCES

- [1] K. Takeichi and Y. Imai, “Development and Evaluation of Adobe Flash based CPU Scheduling Simulator Executable on Major Multiple Web Browsers,” 2015 International Conference on Intelligent Networking and Collaborative Systems, Taipei, TAIWAN, pp. 149-155, 2015.
- [2] P. J. Guo, “Online Python Tutor: Embeddable Web-Based Program Visualization for CS Education,” The 44th ACM Technical Symposium on Computer Science Education, pp. 579-584, 2013, ACM.
- [3] V. Karavirta and C. A. Shaffer, “JSAV: the JavaScript algorithm visualization library”, Proceedings of the 18th ACM conference on Innovation and technology in computer science education, pp. 159-168, 2013.

Social Sciences and Humanities 2

- Social Science and Quality of Life -

Monday 29 August, 2016

13:00-15:00

Room C, North Block

Case study of a naturalistic learner of English with a focus on communication strategies

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INTRODUCTION

This presentation introduces and analyses the communication strategies used by a naturalistic learner of English in Thailand, that is, someone who learnt their English outside of formal learning settings. I will introduce the vocabulary and range of strategies that this untutored learner and user of English used in his shop to communicate very successfully with English-speaking customers.

Several case studies of learners of English are to be found in the research literature, such as those focusing on the acculturation model (Schmidt, 1983) or pidginization (Schuman, 1999), as well as other examples in *The Good Language Learner* (Griffiths, 2008).

This user of English, whom I will call Somchai, was observed over a ten-month period in which his vocabulary and communication strategies were tabulated and analysed. He could communicate successfully for the goals at hand in his shop. What is of interest to the researcher perhaps, is the contrast between his poor grammatical and syntactic performance, and his relatively successful actual use of the language to express himself: a goal that many learners find quite challenging. As such, this data can be interpreted to assert the importance of instruction in and use of communication strategies to help create successful communicators in English.

RESULTS AND DISCUSSIONS

Willis and Willis have stated that “it is possible to have some knowledge of how the grammar works without being able to apply that knowledge. On the other hand it is possible to communicate effectively in a language for all kinds of purposes without conforming closely to a standard grammar” (Willis and Willis, 2009, 3). In his study of Wes, a Japanese speaker of English in Hawaii, Schmidt (1983, 143) noted, “Wes had been committed to learning English through natural interaction, while avoiding as much as possible any analytic study of the language code itself.” The purpose of this presentation is to look at a similar user/learner of English as a second language, a Thai learner of English who has essentially learned English in a naturalistic manner. This learner has reached a level of basic communicative competence that many beginner students in Japan would envy, yet still has only a limited range of vocabulary and knowledge of the conventions of English grammar. In this presentation, unlike the previous studies, the functional lexicon and in particular the compensatory and learning

strategies of a non-formally educated speaker of English are discussed.

Despite a lack of interest in any more formal style of instruction, Somchai has learnt enough English to be understood and to be able to express himself in the fields he has chosen. In the area he lives in this is a marketable skill and he has indeed found work using that acquired skill.

With his mix of barely competent grammar, basic vocab skills and competent communication skills, he has learnt how to use English to communicate and learnt to improve his language in real time by himself.

Of course, the drive for him is employment, by means of his skills in English. However, he does also have a keen interest in other languages and people. In this sense, he has both instrumental and integrative motivation.

Somchai’s communicative success, especially regarding his assertive use of compensatory strategies, draws attention to the importance of these skills for learners of levels of learners and in all learning environments.

As an example of a naturalistic learner with a limited but active vocabulary, Somchai is a good example that even with only relatively few words, in a sense, a low-level learner communicate competently.

Given this, one might consider whether a more balanced approach focusing on these three aspects (vocab, grammar, and communication and compensatory strategies; as well as fluency practice) would not improve many students’ sense of ability, confidence, and autonomy, in English. An ideal for the outcome for a language course in one in which learners can boot themselves up, use, and learn independently in the target language after the course. As an example of someone who has learnt a second language through listening and practicing with a fairly limited repertoire, Somchai gives us some insight into which skills can be focused on to enable learners to help themselves to learn, and also to gain some confidence in negotiating their L2 by themselves.

REFERENCES

- [1] R. W. Schmidt, “Interaction, acculturation, and the acquisition of communicative competence: a case study of an adult,” *Sociolinguistics and language acquisition*, Rowley, MA: Newbury House, 1983, pp. 137-174.
- [2] J. H. Schumann, “Second language acquisition; the pidginization hypothesis,” in *Language Learning*, vol. 26, Issue 2, pp. 391-402, December 1976.
- [3] C. Griffiths. (2008). *The Good Language Learner*. Cambridge: CUP.
- [4] D. Willis and J. Willis. 2009. Why do we need TBLT? *The Language Teacher*, 33, 3, March 2009.

Learning Characteristics of Thai Elementary Students with Learning Disabilities in Inclusive Mathematics Classrooms

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INTRODUCTION

Recent evidences from our first phase of a research study, *Mathematics Teaching Accommodations and Modifications for Students with Learning Disabilities in Elementary Inclusive Classrooms* (the pilot project was conducted in 6 schools funded by Chiang Mai University in an academic year 2012, and the first phase of our research study was conducted in 18 schools funded by the government fund in an academic year 2014), revealed that most Thai teachers did not use the special teaching method, extra instructional plan and novel media for students with learning disabilities in inclusive mathematics classroom. Moreover, the results about the students' performances and their behaviors showed that they could learn through the same way with normal students including little more time for doing assignments and extra teachers' individual exposition (Nutjira et al., 2016).

The objective of this research study was to investigate the learning characteristics of Mathematical problems in students with learning disabilities in order to find the basic data to develop Mathematics teachers' instructional management skills for the students with learning disabilities in phase II of the research study. The participants were 34 elementary students with learning disabilities from 18 schools in Chiang Mai province, the Northern of Thailand. The research instrument was a behavior observation form of students with learning disabilities in Mathematics. The observers were the mathematics teacher who taught and familiar with those students. This behavior observation form composed of 20 checklists about the learning characteristics of Mathematical problems in students with learning disabilities as follow:

- 1) had misconceptions in base number
- 2) delayed in calculating
- 3) were nervous, irritable, not confident or anxious while doing exercise
- 4) could not interpret the Mathematics problems
- 5) had misconceptions in the lesson of borrowing
- 6) miscalculated
- 7) had no mental calculation skills
- 8) did wrong sequence in operating
- 9) could not understand how to read the time
- 10) had errors in calculating the problem and in doing exercise
- 11) were confused and could not understand mathematical symbols such as $<> = \neq$

- 12) were unable to memorize multiplication table
- 13) wrote the number incorrectly such as 69 to 96
- 14) could not understand the arithmetic
- 15) could not order of ascending and descending
- 16) could not understand the measurement
- 17) could not apply the mathematics formula
- 18) could not estimate the correct answer
- 19) could not recheck the answer
- 20) had lower abilities in calculating than average

RESULTS AND DISCUSSIONS

The result was showed in figure 1 the percentage of students with learning disabilities in each type of the learning characteristics of Mathematical problems as below.



Fig 1. The percentage of students with learning disabilities in each type of the learning characteristics of Mathematical problems

The figure 1 showed that 11 learning characteristics of Mathematical problems were always found in the students with learning disabilities (high level), 6 learning characteristics of Mathematical problems were found in the middle level, and 3 learning characteristics of Mathematical problems were found in the low level.

The finding indicated that most of the students with learning disabilities had problems in computing, i.e., they could not interpret the Mathematics problems (82.35%), had errors in calculating the problem and in doing exercise (82.35%), delayed in calculating (79.41%), miscalculated (79.41%), could not estimate the correct answer (79.41%), had misconceptions in the lesson of borrowing (76.47%), and were unable to memorize multiplication table (76.47%). The

lowest learning characteristic of Mathematical problem in the participants was they wrote the number incorrectly (11.76%).

Moreover, the data in each gender was showed in figure 2 as below.

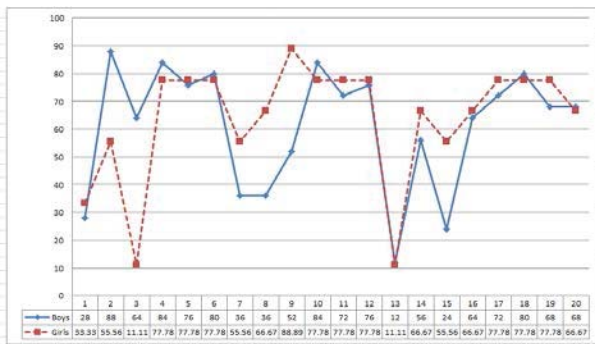


Fig2. The percentage of students with learning disabilities classified by gender in each type of the learning characteristics of Mathematical problems

The findings indicated that 13 learning characteristic of Mathematical problem found in boys and girls were not different (the numbers of percent of boys and girls were different less than 10%) and 5 learning characteristic of Mathematical problem found in boys and girls were different (the numbers of percent of boys and girls were different more than 30%), i.e., boys delayed in calculating and were nervous, irritable, not confident or anxious while doing exercise more than girls while girls did wrong sequence in operating, could not understand how to read the time and could not order of ascending and descending more than boys.

From the results, more than 50% of the students with learning disabilities had 15 out of 20 learning characteristics of Mathematical problems. It is an urgent and extremely important problem which teachers, parents and the people who involved in developing the students with learning disabilities have to concern, try to find out the causes and seek for the appropriate ways to solve those problems in order to develop the students' learning.

The data in each gender was showed that the boys had the behavioral and emotional problems in learning mathematics while the girls had the contents knowledge problems in learning Mathematics. Hence the teachers should be aware of this and may help the 2 groups with different approaches.

Suggestions for helping the students' with learning disabilities who cannot help themselves in learning Mathematics or the others subjects were to develop and train Mathematics and special education teachers, and to ask for cooperation from relevant people and organizations as administrative, teachers, parents, and the educational area offices (Nutjira & Verapong, 2015).

ACKNOWLEDGMENT

This research study cannot succeed without the extremely attentive support of all participants. We are grateful for the financial support of Chiang Mai University and the National Research Council of Thailand (NRCT) collaborated with the Thailand Research Fund (TRF).

REFERENCES

- [1] B. Nutjira, and S. Verapong, "Mathematics Teaching Accommodations and Modifications for Students with Learning Disabilities in Elementary Inclusive Classrooms: Pilot Project," Faculty of Education, Chiang Mai university, April 2015.
- [2] B. Nutjira, N. Sunee, L. Suchitporn, T. Ratchaneekorn, T. Wilaiporn, V. Soisuda, T. Rajchukarn, S. Sira, C. Supaporn, S. Verapong, and S. Weerayuth, "Mathematics Teaching Accommodations and Modifications for Students with Learning Disabilities in Elementary Inclusive Classrooms," unpublished.

Analyzing the Effects of ESL Communication Strategy Training

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INTRODUCTION

Communication strategies (CSs) are the techniques and methods we use when we are faced with a problem in communication, either because we cannot express what we want or because we cannot understand what is being said to us. CSs can be divided into two main categories 1. reduction strategies; 2. achievement or compensatory strategies. A substantial amount of research over the past 40 years has examined the use of CSs to alleviate or help avoid learners' communication difficulties (e.g., Tarone 1980; Faerch & Kasper, 1983; Dörnyei 1995; Nakatani 2010). The majority of these have focused on helping learners to use achievement strategies rather than reduction strategies. Some researchers such as Dörnyei (1995) and Russell and Loschky (1998) have confirmed that it is beneficial for students to receive explicit instruction in CSs and that this develops both the quality and quantity of learners' use of CSs. Nakatani (2005), and Batten and McCrohan (2011) found that explicit training in CSs significantly improved learners' oral proficiency test scores. This one-year study examined the effects of the explicit teaching of communication strategies (CSs) on Japanese university students' strategy use.

RESULTS AND DISCUSSIONS

It had been expected to see a gradual increase in the usage of CSs over the course of the academic year reinforcing the belief that strategy is developmental (Willems, 1987) and generally speaking, this is what the results from this study show. Certain strategies such as fixed phrases were easier for all students to acquire and use, even those those with lower proficiency, while other CSs required a higher level of proficiency in order for the students to successfully use them.

Meaning-expression strategies such as synonyms and antonyms, approximations, and paraphrasing were all picked up rapidly by students and by the end of the first semester, most students were using these well. However, paraphrasing and circumlocution did not show the same rates of successful usage. At the beginning of the academic year no students reported that they regularly used either of these strategies but by the end, 57% of students reported using these.

Meaning-negotiation strategies are techniques used by both participants in a conversation to establish meaning through the use of "appeals for help", asking for spelling, repeating, summarizing, or paraphrasing etc. CSs in this category also showed an increase in usage from the start to the end of the year. The set phrases used in the speaker-to-listener confirmation checks and "asking directly for help" were used quickly and readily by 70% of students by the end of the first semester but even at the end of the academic year, many students (62%) were reluctant to use summarizing, or paraphrasing.

Conversation-management strategies techniques that are useful in handling particularly difficult aspects of a

conversation such as speed and volume, opening and closing conversations, and methods used to "gain time". All students were familiar with some of these strategies and were already using these at the start of the year. Some other strategies, while often familiar to students, were not being used e.g., "adding comments and exclamations" and "sympathizing". One skill that most students were reluctant to use was "shadowing". Some students said that they felt uncomfortable doing this. An interesting point was that "asking other speaker to repeat" showed a 30% decline in usage by students from the start to the end of the first semester and a further 48% decline by the end of the year.

Overall, the results of this study show that students benefitted greatly from explicit training in the use of CSs. Students learned not only the skills to manage communication breakdowns when and if they occur, but the training in the use of CSs also strengthened their overall communicative competence which may assist them in completely avoiding communication breakdowns in situations where they do not have the L2 language skills to handle the situation with ease (Canale & Swain, 1980).

As students' competence level in their L2 increase their reliance on CSs decreases but "the effective use of coping strategies is important for communicative competence in all contexts and distinguishes highly effective communicators from those who are less so" (Savignon, 2002, p 10). In this study, explicit training in CSs use resulted in students using a wider variety of CSs and were less reliant on "fixed phrases" by the end of the academic year. Moreover, students were less likely to resort to message abandonment and it could be said that their overall communicative abilities increased.

REFERENCES

- [1] Batten, P., & McCrohan, G. (2011). Teaching and testing compensatory strategies in university classes. *JACET Chugoku-Shikoku Chapter Research Bulletin* (8), 97-109
- [2] Canale, M., & Swain, M. (1980). Theoretical bases of communicative approaches to second language teaching and testing. *Applied Linguistics*, 1, 1-47.
- [3] Dörnyei, Z. (1995). On the teachability of communicative strategies. *TESOL Quarterly*, 29(1), 55-58.
- [4] Faerch, C., & Kasper, G. (1983). Plans and strategies in foreign language communication. In Faerch, C. & Kasper, G. (Eds.), *Strategies in interlanguage communication*. (pp. 20-60). London: Longman.
- [5] Nakatani, Y. (2005). The effects of awareness-raising training on oral communication strategy use. *The Modern Language Journal*, 89, 76-87.
- [6] Nakatani, Y. (2010). Identifying strategies that facilitate EFL learners' oral communication: A classroom study using multiple data collection procedures. *The Modern Language Journal* 94(1), 116-136.
- [7] Russell, G., & Loschky, L. (1998). The need to teach communicative strategies in the foreign language classroom. *JALT Journal*, 20, 100-113.
- [8] Savignon, S. (2002). *Interpreting communicative language teaching*. New Haven: Yale University Press
- [9] Tarone, E. (1980). Communicative Strategies, foreigner talk, and repair in interlanguage. *Language Learning*, 30, 417-431.
- [10] Willems, G. (1987). Communication strategies and their significance in foreign language teaching. *System*, 15, 351-364.

Inclusive Education Challenges for Students with Hearing Impairments: Case Study at Chiang Mai University

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INTRODUCTION

A growing number of four-year colleges and universities are now including students with disabilities in their student population. This trend is influenced by the awareness of the advocates and the educators, the National Education Act (1999) and the authorization of the Education Provision for Individuals with Disabilities Act (2008). They all call for educational institutions to help provide opportunities that are essential in removing barriers that prevent students with disabilities from receiving proper education and gainful employment. Currently, four strategies regulated by Office of the Higher Education Commission (OHEC, 2005), are used as guidelines for all higher education institutions in Thailand, i.e., higher education accessibility, disability support services, research and development relevant to individuals with disabilities, and career opportunities.

Chiang Mai University (CMU) has been actively involved through the Special Education Program and the Center for Special Education Research and Services, Faculty of Education from 2005-2008 and after that through the Disability Support Services (DSS), Student Development Division, Chiang Mai University. Staff members have heartily worked side by side with students with disabilities, instructors, administrators, parents, and potential employers to promote educational equity and excellence, self-sufficiency, and a better future for them. In this academic year of 2015, Of the 55 students with disabilities 20 are students with hearing impairments enrolled in six different faculties.

The purpose of this research study was to examine situations and ways in which academic enhancement of students with hearing impairments is provided by the DSS. The methods included review of IEP, observation, in depth interview, and focus group with relevant stakeholders (n=20), including students with deafness and hard of hearing, their parents, current academic advisors, instructors, interpreters, classmates, and the individualized education program (IEP) staff were conducted and analyzed. Data were categorized into major themes and explained descriptively.

RESULTS AND DISCUSSIONS

Demographically, there were 13 undergraduate students with deafness and 7 with hard of hearing. Six students with deafness received secondary education from Public Boarding Schools for the Deaf and another six were from Public Boarding Schools for Persons with Intellectual Disabilities. Most of students with hard of hearing (n=6)

were from various inclusive schools. They were enrolled in the Faculty of Education (n=4), the Faculty of Fine Arts (n=12), and one student at each of the following faculties, i.e., Faculty of Social Sciences, Faculty of Political Sciences, Faculty Humanities, and Faculty of Associated Medical Sciences. Most of these students were from low and moderate income families. Of the 20 students participating in this study, 90% (n=18) were born with the disability.

The findings revealed that these students with hearing impairments had some challenges with them. These included lack of academic skills. All students with hearing impairments graduated from either the School for the Deaf or the Schools for Persons with Intellectual Disabilities. These students had relied mainly on teachers who always assisted them. The schools' culture may also have affected the way these students have become dependent in their personal living and learning. Therefore, they had limitations in their academic foundation skills necessary to meet the requirements of higher education and to build on this knowledge in order to remain successful in their studies. Along with these poor academic skills, some students had low personal and social skills that are essential to be able to manage their educational endeavors. Many of them were even unaware that some of the academic demands of university were rigorous and different from those of their high schools. For example, at CMU, students undertake greater amount of reading, as well as more independent work outside classroom; have less contact with teachers; are expected to have a higher levels of academic capability; take fewer tests, but cover a large amount of material; experience change in the support systems available to them than they previously had in high school; experience higher expectations to achieve independently; and also experience changes in social and independent living demands.

Moreover, students with disabilities are significantly underrepresented in college or university population for multiple reasons. These include low expectations for themselves and from people around them, poor high school preparation and transition planning, lack of communication or support services from personnel with suitable knowledge and skills, and ineffective or inadequate support from schools, parents, and community.

Unfortunately, students with hearing impairments have less sign language skills and vocabularies which limit their effective communication and as a consequent, affect their learning abilities, even after they have received a tremendous help from interpreters.

Several flexible academic remediation and personal consultation were identified and treated directly to specific

individual weakness. In addition, positive understanding and two-way communication with parents, instructors, interpreters, classmates, and staff from CMU-DSS had strongly affected students' commitment for success. Teamwork with understanding of special education and individual student's strength and weakness, creative solution, and follow-up are keys to overcome challenges encountered when serving students with hearing impairments.

At the closing remark, from the authors' perspectives, there are two primary reasons for having disability support services at CMU. First, law requires the provision of equal access to individuals with disabilities and, second, educators and relevant professionals are concerned with students' learning, and the disability support services help to ensure that all students have an equal opportunity to learn with proper pedagogy in the least restrictive environment. However, disability support services can most effectively fulfill these roles when CMU has a strong institutional commitment, pursues a clearly articulated mission, develops and disseminates clear, concise, and equitable policies, and judiciously expands adequate funding. More importantly, students' success remains dependent on each individual's qualities. Student's self-determination and student's strong involvement are all of paramount importance in guaranteeing individual's academic success.

ACKNOWLEDGMENT

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REFERENCES

- [1] Albertini, J.A., Kelly, R.R., and Matchett, M.K. (2011). Personal factors that influence deaf college students' academic success. *Journal of Deaf Studies and Deaf Education*, 10(1093), 1-17.
- [2] Disability Support Services, Student Development Division, Chiang Mai University. (2016). *Current students with disabilities*. Chiang Mai: Disability Support Services.
- [3] Getzel, E.E. and Wehman, P. (2005). *Going to college*. Baltimore: Brookings Publishing CO.
- [4] Office of the Higher Education Commission (2014). *Annual report*. Bangkok : Office of the Higher Education Commission.
- [5] Thagard, E.K., Hilsmier, A.S., Easterbrooks, S.R. (2011). Pragmatic language in deaf and hard of hearing students: Correlation with success in general education. *American Annals of the Deaf*, 155(5), 526-34.
- [6] Parasnis, I., Samar, V.J., Fischer, S.D. (2005). Deaf college students' attitudes toward racial/ethnic diversity, campus climate, and role models. *American Annals of the Deaf*, 150(1), 526-34.
- [7] Wehman, P. (2001). *Life beyond the classroom*. Baltimore: Brookings Publishing CO.

Trial production of a motion sensor for supporting disabled people

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I. Introduction

Touch panels have been spreading due to the increase of smartphones, tablets, etc. However, some people have difficulty using touch panels for various reasons, and this has caused a digital gap [1].

In this study, we developed an interface that tracks motions of arbitrary parts which are selected with a mouse from a webcam screen. This is composed of a virtual keyboard and a virtual mouse, which utilize a webcam and a microcontroller, instead of ordinary keyboards and mice. An arbitrary motion of a user functions as a trigger for the interface, through the analysis of moving pictures taken by a webcam.

Such a trigger activates the virtual keyboard and mouse. Therefore, it became possible to operate a computer with moving pictures taken by a webcam. Since it gets triggered only by parts which a user can move voluntarily, it was indicated that it is possible to provide an interface that detects users' purposed motions.

II. Tracking System

BoofCV [2], which is a computer vision library for Java, was used for tracking. In this study, "Tracking Object," which is a demo program, had its function extended, and detected the user's vertical and horizontal motions as a 4-direction trigger.

The actual program execution screen is shown in Fig. 1. Panel (a) is a startup screen, and a user first selects tracking areas with a mouse by dragging. Panel (b) is a tracking screen, and the system tracks only the area inside the square. If the tracking areas move a predetermine distance (pixels), the system detects it as a trigger. In Panel (b), it detected rightward motion.

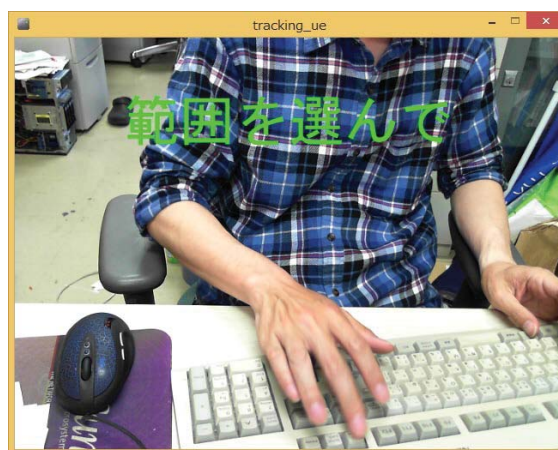
By applying this, it is possible to have control of external devices by controlling the microcomputer board through mouse operation, key input and serial ports.

III. Conclusion

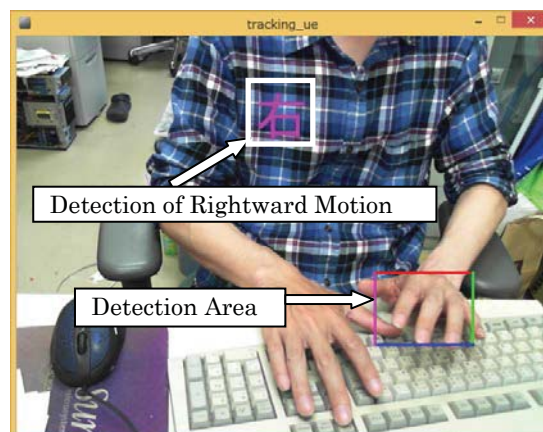
We developed a prototype motion tracking system with a webcam and a computer in this study, and found that motion only in chosen areas can be provided as an interface input. From now on, we would like to get feedback of the system, select the control device, etc. and the control of home appliances, to "improve the quality of daily lives" of users in various scenes [3].

Acknowledgements

This study was conducted as part of Year 2016



(a) Startup Screen



(b) Motion Detection

Fig 1. Tracking Screen

Grants-in-Aid for Scientific Research (Basic Research Program (C)), "Elucidation of Physically Disabled Children's Communication Mechanism with Multimodal Interface" (Project Number 15K01460), and we would like to express our heartfelt gratitude.

Reference

- [1] Eiichi Miyazaki, Satoshi Sakai, "A Study on the One Device Systems that Support the Motility Disturbance and Developmental Disability", The 5th CMU-KU Joint Symposium, 2015, pp. 78-79.
- [2] <http://boofcv.org/> (Reference 2016-5-24).
- [3] Da Vinci 32Uw/ Arduino Bootloader/ATMEGA32U4 , <https://strawberry-linux.com/catalog/items?code=25005> (Reference 2016-5-24).

Happiness management and Caregiving management for elderly in Chiang Mai, Thailand

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This research aim to evaluate the level of happiness management and the factors that affect to the happiness of the elderly in the semi-urban society, by 400 questionnaires from Suthep and Changpuak community, Mueang district, ChiangMai, Thailand.

The results showed that the overall average of the elderly happiness in 8 categories was in the level "good". The high score of happiness source that affect to the elderly were from could be access the religion and culture, to have a healthy body and mind and have life insurance. The low score of happiness source of the elderly was about had the freedom, warm family and self-proud. And the factors that affect to the level of happiness was up to age, marital status, occupation, average income per month, size of family, debts and access the medical service.

INTRODUCTION

Happiness is essential and basis of living demand on every human life. The Important of factors of happiness including with life happiness, by living with the family and others in the society. Especially, the elderly who sensitive and must trust on others, they need people in the community maintain their happiness. From Kingdom survey reports [1], the elderly feel unhappiness when their physical changes and many losses e.g. loss of beloved persons, loss of social role and status, etc. That will affect to the elderly's mind, affection and society directly. In addition from Tongtang et.al.[2] work was found that depression of Thai elderly[3] were including with financial problem, family relationship and physical health tend to commit suicide[4]. A main reason of elderly's suicide is family problem. Thus the lower life happiness of the elderly will cause by the change of physical body, mind, family and society.

The number of older persons in Thailand has grown rapidly and will continue to do so in future decades. Since 1960 the number of older people in the Thai population has increased seven-fold from approximately 1.5 million to 10.7 million by 2015 or 16% of the total population. Same as ChiangMai the number of elderly was increasingly. Suthep and Chang-puak community was located in the semi-urban society. The families change from big to small family, 2-5 people in a family. And they have less collaborative activities in the community, cause to unhappiness lifestyles.

Accordingly, this research was evaluating the level of happiness management and the factors that affect to the happiness of the elderly in the semi-urban society. The results will be used as the community policy to promote the elderly service and caregiving management for elderly happiness lifestyles.

RESULTS AND DISCUSSIONS

Level of elderly happiness in semi-urban community.

The results showed that the overall of elderly happiness in every category was in a "high" level. The first priority of happiness category of this community was about "To access the religion and culture", they have strong idea in this because of most of them were Buddhism. They feel happy when they joined the Buddhism activity in the temple, could

donate or help other people and Co-exist peacefully with the community. Second, in details of "Have a healthy body and mind" they strong agree and acceptable of physical of body changes. Have medicine to cure when sick, annual health check and have longevity. Third, in case of "have a life insurance" they focus in must to have their own homes and land.

TABLE I LEVEL OF HAPPINESS OF THE ELDERLY FROM 8 SOURCES. (n=400)

SOURCE OF HAPPINESS	SUTHEP	CHANGPUAK	AVERAGE
TO HAVE A HEALTHY BODY AND MIND.	4.52 ±0.06	4.14±0.06	4.33+ 0.06
TO HAVE A LIFE INSURANCE.	4.32 ±0.03	4.30±0.06	4.31± 0.04
TO HAVE A WARM FAMILY.	3.44 ±0.07	4.21±0.06	3.83± 0.06
TO HAVE A FREEDOM.	3.23 ±0.07	4.09±0.03	3.66± 0.04
TO ACCESS THE RELIGION AND CULTURE.	4.57 ±0.07	4.37±0.06	4.47± 0.06
TO HAVE SELF-PROUD	3.42 ±0.06	4.27±0.03	3.85± 0.04
TO HAVE A GOOD ENVIRONMENT.	3.56 ±0.06	4.41±0.05	3.99± 0.05
TO HAVE A STRONG COMMUNITY	3.66 ±0.08	4.38±0.06	4.02± 0.07
TOTAL AVERAGE	3.84 ±0.06	4.31±0.06	4.08± 0.04

The low score of happiness source of the elderly was about had the "freedom", "warm family" and "self-proud". In case of "to have a freedom" they focus in they can do what they want and without the infliction on others e.g. selling their farm products in Friday and Saturday market. The factors that affect to the level of happiness was up to age, marital status, occupation, average income per month, size of family, debts and access the medical service.

Elderly caregiving management policy related happiness.

Many community policy to enhance the elderly happiness such as, National Seniors Day, elderly welfare payment, recreational activities to share a smile for elderly. Elderly Suthep club, as dental care activity. Sports and exercises activity. Local dancing and musical club.

ACKNOWLEDGMENT

This research was granted by faculty of Humanities. ChiangMai university.

REFERENCES

- [1] The National Statistics Office. Survey of working conditions among Populations across the Kingdom, July-August 2005, Bangkok.
- [2] O. Thongtang, et al. "Prevalence and incidence of depression in Thai elderly". J. Med. Assoc Thai, 2002; 85(15) : 540-544.
- [3] N. Yuhan-ngor. "Torture to the elderly in Thai society". J. Sociology and Humanities, Huachiew Chalermprakiet University, 2003; 7(13): 43-50.
- [4] S. Kuptiwut and S. Yantadilok. "Suicide attempts and suicidal thought in elderly patients". J. the Psychiatric Association of Thailand, 2000; 43(1) ; 39-55.

Medicine and Nursing 5

- Aging and Lifestyle Related Diseases -

Monday 29 August, 2016

15:00-16:40

Room A, North Block

Evidence of absorption of 3,4-DHPEA-EDA, valuable ingredients in olive oil and fruit by free-moving rats.

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Absorption, metabolism, and excretion of 3,4-DHPEA-EDA (EDA), oleuropein (Ole), and hydroxytyrosol (HT) isolated from olive fruits were newly evaluated in freely-moving rats cannulated in the portal vein, jugular vein, and bile duct.

INTRODUCTION

Absorption is a key step for development and understanding of the metabolism and utilization of functional food components in human body. Some aldehydes and epoxides [1,2] which have physiological effects in vitro experiments to keep healthy life may bond or make bridge with biologically important proteins and DNA fragments. Active aldehydes make schiff base easily with primary amino group likely lysine, adenines and so on. Those aldehydes are very hard to be detected in blood flow when it is injected to our body or when it will be absorbed from small intestine. Therefore, we tried to get evidence for absorption of target compounds in our bodies. Target compounds in this paper are 3,4-DHPEA-EDA (EDA), oleuropein (Ole), and hydroxytyrosol (HT) from olive fruits

RESULTS AND DISCUSSIONS

The major component in olive is EDA but it not observed in the portal plasma, urine, and bile after oral and intravenous administration. We can't calculate the bioavailability of EDA. Instead, the bioavailability of HT and Ole for 4 hours was 13.1% and 0.5%, respectively. In this case, EDA may not be absorbed into our bodies even though HT can do it. However, in our experiment, metabolites (HT, homovanilic acid and homovanilly alcohol) from EDA at portal vein were detected by living rats. The detection of those chemicals at portal vein would be indirect evidence of chemical absorption and it is

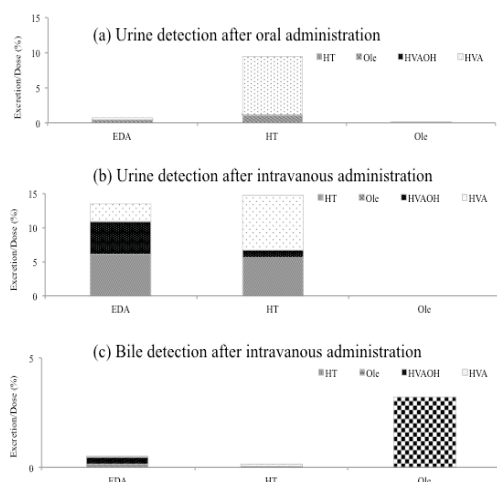


Fig. 1. Metabolites in urine and bile after oral and intravenous administration of EDA, HT, and oleuropein. Excretion rates are expressed as excretion/dose ratios.

too hard to determine the metabolites in case of human

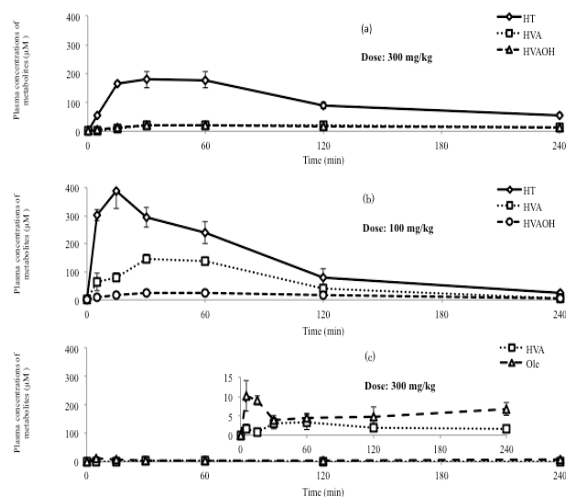


Fig. 2. Metabolites from 3,4-DHPEA-EDA (a), HT (b), and Ole (c) in plasma from the portal vein over time after oral administration. In triplicate.

bodies. Thus, cannulation technique at rat portal vein realized the monitoring of EDA and its metabolites after oral administration. From following three evidences, we concluded that EDA is absorbed and circulated in the jugular vein, 1) the amounts of HT and homovanilic acid at urine from oral administration and intravenous administration of EDA and HT showed different ratios (Fig. 1), meaning metabolic pathway of EDA and HT should be different, 2) HT amount decreased slowly after intravenous administration of EDA but HT amount decreased quickly after intravenous administration of HT (data not shown). 3) HT was observed for a long period in portal plasma after oral administration of EDA (Fig. 2). We could deny the hypothesis that metabolism of EDA to HT may happen at the small intestine and found that EDA metabolized in jugular vein and other places. In consequence, HT is too easy absorption and secretion to urine. Ole is not absorbed and secret to bile. Both metabolites is useless but EDA might stay jugular vein and organs for a long period and act as functional component there.

REFERENCES

- [1] D. Siriwan, T. Naruse, and H. Tamura, "Effect of epoxides and α -methylene- γ -lactone skeleton of sesquiterpenes from yacon (*Smallanthus sonchifolius*) leaves on caspase-dependent apoptosis and NF- κ B inhibition in human cervical cancer cells" *Fitoterapia*, 1093-1101 (2011)
- [2] A. Sato, N. Shinozaki and H. Tamura, "Secoiridoid Type of Antiallergic Substances in the Pomace, Wasting Materials in Three Varieties of Japanese Olive (*Olea europaea*)," *J. Agric. Food Chem.*, 62(31), 7787-7795 (2014).
- [3] S. Kano, H. Komada, L. Yonekura, A. Sato, H. Nishiwaki and H. Tamura, "Absorption, metabolization, and excretion by freely-moving rats of a typical compound, 3,4-DHPEA-EDA and its related polyphenols from olive fruit (*Olea europaea*)." *Journal of Nutrition and Metabolism*, 2016, Article ID 9104208, 10 pages (2016).

Effects of Kampo Medicine Rokumigan on the Pharmacokinetics of Soy Isoflavone Genistein in Postmenopausal Women

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INTRODUCTION

A combination of soy isoflavone genistein¹ and the Kampo medicine Rokumigan² (六味丸) is a potentially effective modality in alleviating vasomotor episodes through a synergistic pharmacodynamic effect in postmenopausal women; however, no study of the pharmacokinetic interaction between the two interventions has been done. The objective of this open-label, fixed-sequence, three-phase study was to determine the influence of both single and multiple oral doses of Rokumigan on genistein pharmacokinetics in healthy postmenopausal women.

RESULTS AND DISCUSSIONS

Eleven subjects were allocated to receive the following regimens in a fixed sequence with wash-out periods of at least one week: **Phase A** - a single oral dose of 375 mL of soy milk; **Phase B** - a single oral dose of 6 g Rokumigan co-administered with a single dose of 375 mL of soy milk; and **Phase C** - multiple oral doses of Rokumigan (6 g, three times daily for 14 days) followed by a single oral dose of 375 mL of soy milk on the next day. Blood samples were collected before administration of soy milk and at 0.5, 1, 2, 4, 6, 8, 10, 12, 24, and 32 hours after administration of soy milk. Each blood sample was mixed with β -glucuronidase/sulfatase to hydrolyze glucuronide and sulfate metabolites of genistein to genistein aglycone. Plasma genistein concentrations were quantified using high performance liquid chromatography³.

The mean plasma concentration-time curves of genistein from the 11 participants are shown in Fig. 1.

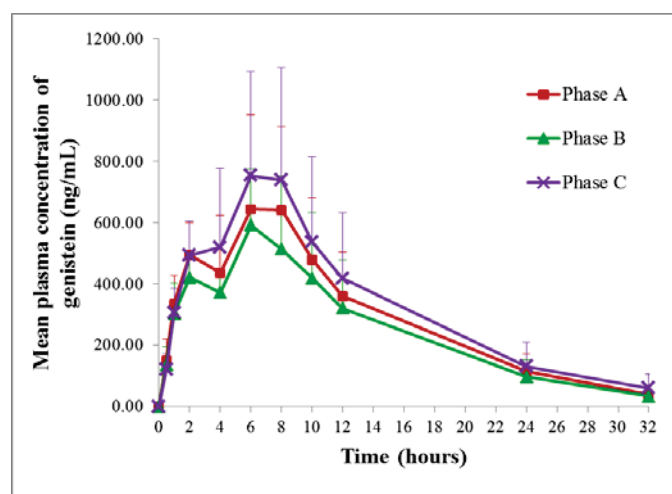


Fig. 1. Mean plasma genistein concentration-time curves from the 11 participants receiving the three regimens during the respective study phases. Error bars represent standard deviation (SD).

The pharmacokinetic parameters of genistein obtained following each of the three study phases are demonstrated in Table I. The mean values of the pharmacokinetic parameters of genistein did not statistically differ among the three study phases.

TABLE I Pharmacokinetic parameters of genistein obtained following the three study phases in the eleven participants enrolled in the study.

Pharmacokinetic parameters	Treatment phase			P value*
	Phase A	Phase B	Phase C	
C_{max} (ng/mL)	734.36 (371.67)	670.36 (171.53)	873.18 (336.34)	0.09
T_{max} (h)	5.36 (2.54)	5.73 (2.28)	6.00 (2.19)	0.64
AUC_{0-32} (ng.h/mL)	9062.53 (5237.58)	7871.89 (3054.41)	10534.08 (4730.12)	0.53
$AUC_{0-\infty}$ (ng.h/mL)	9956.56 (5441.06)	8544.75 (3053.48)	11291.46 (5030.50)	0.53
$t_{1/2}$ (h)	6.80 (0.62)	6.69 (0.80)	6.90 (0.89)	0.91

Data represent mean (SD). C_{max} =maximal plasma concentration, T_{max} =time to reach the peak concentration, AUC_{0-32} and $AUC_{0-\infty}$ =area under the plasma concentration-time curve from time 0-32 hours and 0- ∞ hours, respectively, and $t_{1/2}$ =terminal half-life. *Nonparametric Friedman's test.

Neither co-administration of single-dose Rokumigan nor pretreatment with multiple-dose Rokumigan significantly alter the pharmacokinetics and bioavailability of genistein. Therefore, concurrent use of Rokumigan and isoflavones (from various soy products) is likely to be a simple method of enhancing adherence to treatment. Nonetheless, well-controlled clinical trials to investigate and verify the additive or synergistic efficacy of this combination should be conducted.

ACKNOWLEDGMENT

Financial support from Faculty of Medicine, Chiang Mai University, is gratefully acknowledged.

REFERENCES

- [1] R. D'Anna, M. L. Cannata, H. Marini et al., "Effects of the phytoestrogen genistein on hot flushes, endometrium, and vaginal epithelium in postmenopausal women: a 2-year randomized, double-blind, placebo-controlled study," *Menopause*, vol. 16, pp. 301-306, Mar-Apr 2009.
- [2] S. Kwee, H. Tan, A. Marsman, and C. Wauters, "The effect of Chinese herbal medicines (CHM) on menopausal symptoms compared to hormone replacement therapy (HRT) and placebo," *Maturitas*, vol 58, pp. 83-90, Sep 2007.
- [3] P. Timan, N. Rojanasathien, M. Manorot, C. Sangdee, and S. teekachunhatean, "Effect of synbiotic fermented milk on oral bioavailability of isoflavones in postmenopausal women," *International Journal of Food Sciences and Nutrition*, vol. 65, pp. 761-767, Sep 2014.

Role of (Pro)renin receptor in the pathogenesis of colon cancer

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INTRODUCTION

Canonical Wnt signalling through β -catenin is of particular importance for the development of colorectal cancer, with more than 80% of tumours carrying loss-of-function mutations in adenomatous polyposis coli (APC) and about 5% carrying activating mutations in β -catenin; Cells with mutations in APC or β -catenin also depend on Wnt secretion by auto/paracrine for a sufficient level of Wnt/ β -catenin signaling [1]. (Pro)renin receptor ((P)RR) is reported to act as part of the Wnt receptor complex and activate Wnt/ β -catenin pathway independent of renin-angiotensin system [2].

The (pro)renin receptor is essential for Wnt/ β -catenin-dependent tumorigenesis of pancreatic ductal adenocarcinoma. [3]. Therefore, we supposed that (P)RR promotes colon cancer through canonical Wnt/ β -catenin pathway despite of intrinsic mutations.

RESULTS AND DISCUSSIONS

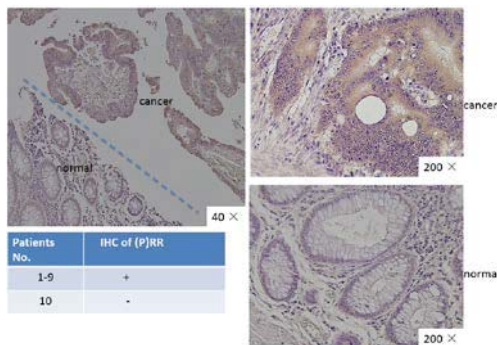


Fig. 1 (P)RR expression in human colon tissues (IHC, brown: (P)RR).

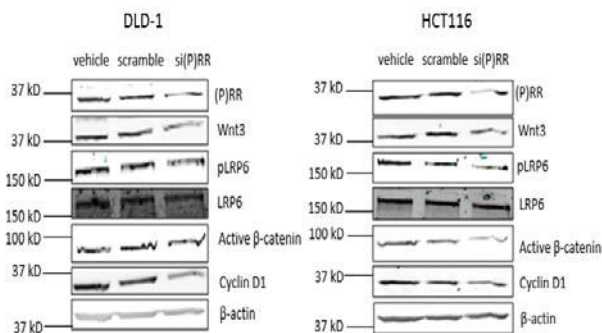
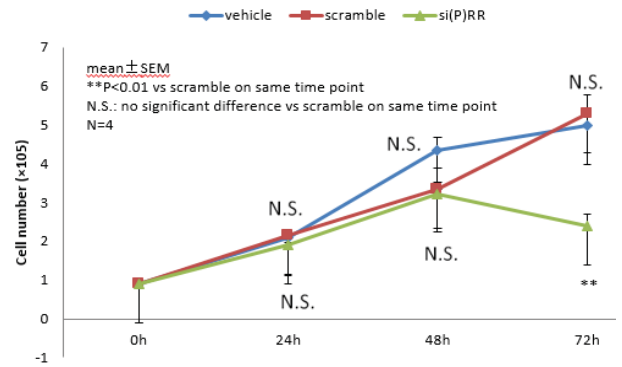


Fig. 2 Effects of (P)RR knockdown on Wnt signaling components.

DLD-1 cell number counting



HCT116 cell number counting

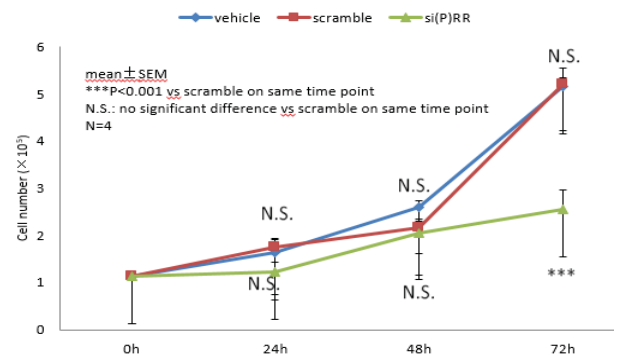


Fig. 3 Cell proliferation after (P)RR knockdown.

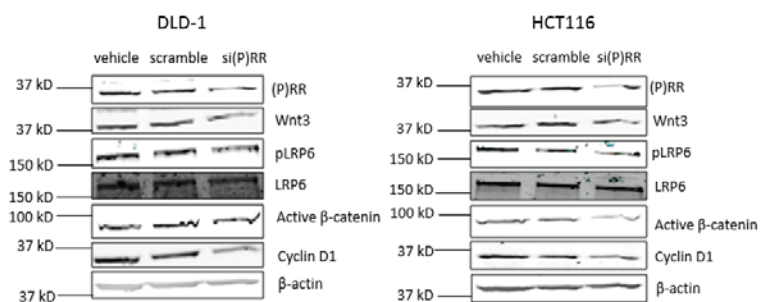


Fig. 4. Effects of (P)RR knockdown on Wnt signaling components.

REFERENCES

- [1] Voloshanenko O et al. Wnt secretion is required to maintain high levels of Wnt activity in colon cancer cells. Nature Communications 2013; 4, 2610.
- [2] Cristina-Maria Cruciat et al. Requirement of prorenin receptor and vacuolar H⁺-ATPase-mediated acidification for Wnt signaling. Science 2010; 327, 459.
- [3] Yuki Shibayama et al. (Pro)renin receptor is crucial for Wnt/ β -catenin-dependent genesis of pancreatic ductal adenocarcinoma. Sci Rep. 2015; 5: 8854

Analysis of the regulatory mechanism of D-allose-inducible tumor suppressive factor TXNIP (thioredoxin interacting protein) for development of a new cancer therapy

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INTRODUCTION

D-allose, the C3-epimer of D-glucose (Fig. 1), has an anti-proliferative effect on various cancer cell lines [1, 2]. We have reported that D-allose treatment caused up-regulation of thioredoxin interacting protein (TXNIP), an anti-tumor protein down-regulated in cancer cells. The anti-proliferative effect of D-allose is due to the up-regulation of TXNIP which causes cell cycle arrest at the G1/S checkpoint [3].

RESULTS AND DISCUSSIONS

We analyzed the signaling mechanisms of TXNIP up-regulation caused by D-allose in hepatocellular carcinoma cell line HuH-7. D-allose activated the p44/p42 MAPK-p90RSK signaling pathway. The inhibition of this pathway by PD98059 repressed the TXNIP up-regulation. D-allose also activated p38MAPK, and inhibition of p38MAPK by SB203580 repressed the TXNIP up-regulation. Several other proteins including transcription factors possibly participate in the TXNIP up-regulation through these two MAPK pathways. Meanwhile, it has been reported that a glycolysis inhibitor 3-bromopyruvate blocked the TXNIP up-regulation caused by D-allose in HA1ER, a human kidney epithelial cell line [4]. Our analysis in HuH-7 revealed that the 3-bromopyruvate did not have any effect on the TXNIP up-regulation caused by D-allose. Overall, TXNIP is up-regulated through both p44/p42 MAPK pathway and p38MAPK pathway, but not through the glycolytic pathway in the hepatocellular carcinoma cell line.

We also examined the mechanism of TXNIP decrease in HuH-7. TXNIP rapidly decreased upon the stimulation by fetal calf serum. The inhibition of p44/p42 MAPK pathway by PD98059 repressed the TXNIP decrease. The inhibition of ubiquitin-proteasome pathway by MG132 also repressed the TXNIP decrease. These results showed that TXNIP decreased through both p44/p42 MAPK pathway and ubiquitin-proteasome pathway upon the serum stimulation.

These works using cultured cells elucidated the regulatory mechanisms of TXNIP in cancer cells. To develop a new cancer therapy using D-allose, we performed *in vivo* administration analysis of D-allose. The oral squamous cell carcinoma cell line HSC-3 cells were used in a xenograft model with nude mice (BALB/c nu/nu). The results showed that the tumor volume of the D-allose-treated group was reduced compared to that of the control group. This study

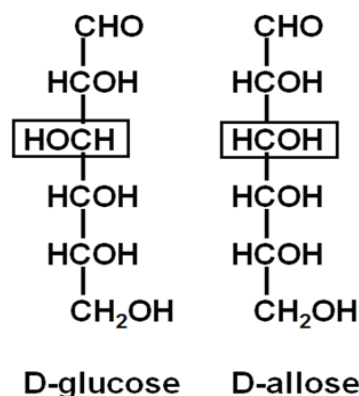


Fig. 1. Structure of D-glucose and D-allose

revealed that D-allose exerts growth inhibitory effects on cancer cells *in vivo*.

Overall, present *in vitro* and *in vivo* works would make a great contribution to the establishment of a new strategy of cancer therapy utilizing D-allose and TXNIP.

ACKNOWLEDGMENT

We are grateful to Kasumi Kozai and Miyako Daike for their technical assistances.

REFERENCES

- [1] L. Sui, Y. Dong, Y. Watanabe, F. Yamaguchi, N. Hatano, K. Izumori, M. Tokuda, "Growth inhibitory effect of D-allose on human ovarian carcinoma cells *in vitro*," *Anticancer Res.* 25:2639-2644 (2005)
- [2] L. Sui, Y. Dong, Y. Watanabe, F. Yamaguchi, N. Hatano, I. Tsukamoto, K. Izumori, M. Tokuda, "The inhibitory effect and possible mechanism of D-allose on cancer cell proliferation," *Int. J. Oncol.* 27:907-912 (2005)
- [3] F. Yamaguchi, M. Takata, K. Kamitori, M. Nonaka, Y. Dong, L. Sui, M. Tokuda, "Rare sugar D-allose induces specific up-regulation of TXNIP and subsequent G1 cell cycle arrest in hepatocellular carcinoma cells by stabilization of p27kip1." *Int. J. Oncol.* 32:377-385 (2008)
- [4] C.A. Stoltzman, M.R. Kaadige, C.W. Peterson, D.E. Ayer, "MondoA senses non-glucose sugars: regulation of thioredoxin interacting protein (TXNIP) and the hexose transport curb," *J. Biol. Chem.* 286:38027-38034 (2011)
- [5] K. Indo, H. Hoshikawa, K. Kamitori, F. Yamaguchi, T. Mori, M. Tokuda, N. Mori, "Effects of D-allose in combination with docetaxel in human head and neck cancer cells," *Int. J. Oncol.* 45:2044-2050 (2014)

Preparation of ^{18}F -labeled rare-sugar D-allose for PET assessment of behavior *in vivo*

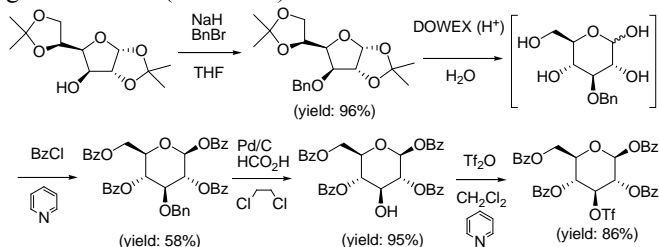
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INTRODUCTION

Applicability of rare-sugars, such as D-allose, for diagnostic and therapy purpose is focused on recently. It would be important to make reveal their behaviors *in vivo*. ^{18}F -Fluorinated D-allose derivatives, namely [^{18}F]3-Deoxy-3-fluoro-D-allose ([^{18}F]3FDAllo) and [^{18}F]6-Deoxy-6-fluoro-D-allose ([^{18}F]6FDAllo), are epimers of corresponding D-glucose derivatives with respect to carbon atom 3, [^{18}F]3-deoxy-3-fluoro-D-glucose ([^{18}F]3FDG) [1] and [^{18}F]6-deoxy-6-fluoro-D-glucose ([^{18}F]6FDG) [2], respectively. Preparation of [^{18}F]3FDAllo and [^{18}F]6FDAllo is of great significance because of their potential utility as PET (positron emission tomography) probe molecules to investigate metabolic dispositions of a rare-sugar, D-allose.

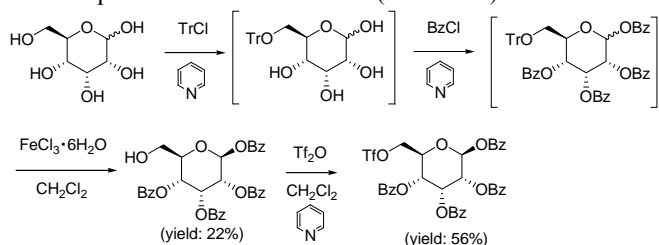
MATERIALS AND METHODS

A precursor for [^{18}F]3FDAllo, 1,2,4,6-tetra-*O*-benzoyl-3-*O*-triflyl- β -D-glucopyranose, was prepared by 5-step reactions from 1,2:5,6-*O*-diisopropylidene- α -D-glucofuranose (Scheme 1).



Scheme 1. Preparation of a precursor for [^{18}F]3FDAllo

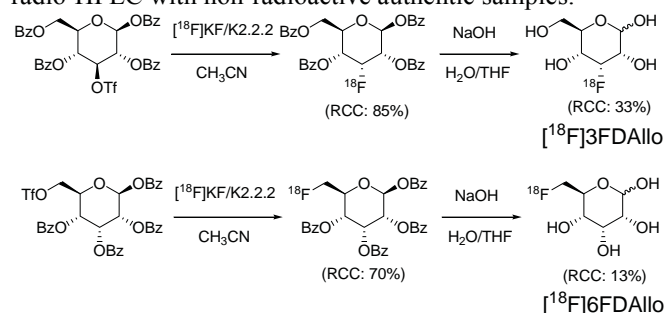
On the other hand, a precursor for [^{18}F]6FDAllo, 1,2,3,4-tetra-*O*-benzoyl-6-*O*-triflyl- β -D-allopyranose was prepared via 4-step reactions from D-allose (Scheme 2).



Scheme 2. Preparation of a precursor for [^{18}F]6FDAllo

Typical ^{18}F -labeling preparations of [^{18}F]3FDAllo and [^{18}F]6FDAllo are as follows (Scheme 3): 50-60 MBq of non-carrier added [^{18}F]fluoride was absorbed on QMA (anion-exchange resin cartridge) and then desorbed by mixing with K_2CO_3 (17 μmol)/ $\text{K}_2.2.2$ (53 μmol)/ H_2O (0.2 mL)/ CH_3CN (0.7 mL). After evaporation, another 1 mL of CH_3CN was added, and then it was evaporated again. 3 mL CH_3CN solution of a precursor (42 μmol) was added to it. The mixture was heated at 85 $^\circ\text{C}$ for 5 min, and concentrated.

Deprotection reaction was carried in 0.3 mol/L aq. $\text{NaOH}/\text{THF}=1:1$ at rt for 30 min. Then the reaction mixture was neutralized by 1 mol/L aq. HCl and concentrated. [^{18}F]3FDAllo and [^{18}F]6FDAllo were purified by semi-preparative HPLC (column: Nakarai Sugar-D: ID10 x 20+250 mm, eluent: $\text{CH}_3\text{CN}/\text{H}_2\text{O}=75:25$, flow rate: 2 mL/min). The products were determined by radio-TLC and radio-HPLC with non-radioactive authentic samples.



Scheme 3. Preparation of ^{18}F -labeled D-allose derivatives

RESULTS AND DISCUSSIONS

[^{18}F]1,2,4,6-tetra-*O*-benzoyl-3-deoxy-3-fluoro- β -D-allopyranose and [^{18}F]1,2,3,4-tetra-*O*-benzoyl-6-deoxy-6-fluoro- β -D-allopyranose were obtained 85% and 70% radiochemical conversions (RCCs), respectively. [^{18}F]3FDAllo and [^{18}F]6FDAllo were obtained by 33% and 13% RCCs, respectively. RCCs were determined by radio-TLC. ^{18}F -Fluorination reactions of precursors proceeded by good RCCs (85% and 70%). However, deprotection reactions of benzoyl group proceeded by not so good RCCs (33% and 13%). About protecting groups, they may need some improvements like changing to acetyl groups.

CONCLUSION

Basic synthetic procedures for [^{18}F]3FDAllo and [^{18}F]6FDAllo have been established and those would be applied to make reveal their behavior *in vivo*, though still some improvements might be required for deprotection reactions process.

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REFERENCES

- [1] T. J. Tewson, M. J. Welch, M. E. Raichle, *J. Nucl. Med.*, 1978, **19**, 1339-1345.
- [2] T. R. Neal, W. C. Schumann, M. S. Berridge, B. R. Landau, *J. Label. Compd. Radiopharm.*, 2005, **48**, 845-854.

Agriculture 3

*- Agriculture, Bioscience, Food Science and
Environmental Science for a Healthy and
Sustainable Society -*

Monday 29 August, 2016

15:20-17:00

Room B, North Block

Impregnation of lactobacilli in dried Hom Dok Mali rice

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ABSTRACT

Lactobacillus spp. are known as microorganisms that do not give an adverse effect on human health and have widely been used in different fermented food products. In this study, three species of lactobacilli, namely *Lactobacillus casei*, *Lactobacillus acidophilus* and *Lactobacillus plantarum*, at two inoculation levels were inserted into cooked Hom Dok Mali rice and dried in a vacuum oven at 60°C with a pressure of 83 mbar for 5.5 h. Analyses of the dried rice samples showed that physical properties of the final rice were not significantly affected by different treatments of lactobacilli addition. High inoculation level of the lactobacilli produced a lower pH value in rice samples than that of the sample with low inoculation level. For the presence of the lactic acid bacteria, the supplementation of *L. acidophilus* at the high level could generate a sample with the highest lactic acid bacteria number of 6.24 ± 0.20 log cfu/g. This finding indicated the importance of selecting appropriate microbial species to increase the nutritional value of rice product.

INTRODUCTION

Rice is recognized as the staple food in Asia countries that contributes to 80-90% of the daily calorie intake for some people [1]. In Thailand, rice is utilized in domestic uses for family consumption and in industrial application, such as feed and others. Rice is an important economical agriculture product of Thailand that gives a revenue to the country for over 80,000 – 100,000 million ฿ each year from its export to other countries [2]. Although rice is a major carbohydrate source for Asia people, the diet pattern in the young generation of Asia population has been slowly changed to other convenient food products, such as bread and noodles, in the commercial market. To compete with the modern life-style of new generation, a production of an innovative rice product is needed.

Probiotic is recognized as live microbial food ingredients that have a beneficial effect on human health [3, 4]. At the moment, the probiotics are commonly incorporated in dairy products. However, there were some drawbacks with the products due to allergies and intolerances, low cholesterol diets and vegetarian consumption [5]. Since the probiotic could deliver various health benefits, including maintenance of normal intestinal microflora, protection against gastrointestinal pathogens, enhancement of immune system, reduction of serum cholesterol level and blood pressure, anti-carcinogenic activity, improved utilization of nutrients and improved nutritional value of food [6], the supplementation of the microorganisms in cereal products might increase its consumption in daily intake. Some previous research works that incorporated probiotics in cereal products were fermentation of malt suspension with yeast and *Lactobacillus reuteri* [7], growth of *Lactobacillus acidophilus*,

Bifidobacterium animalis or *Lactobacillus rhamnosus* in milk- and water-based puddings containing maize and rice flours [8] and fermentation of *Lactobacillus plantarum* in a whole grain oat substrate [9]. Since Asian people are familiar with rice consumption, this study utilized the commodity as an agent to deliver a beneficial microorganism, such as lactobacilli. Some species of the genus that have been recognized as probiotic microorganisms were *L. acidophilus*, *Lactobacillus delbrueckii*, *Lactobacillus fermentum*, *Lactobacillus lactis*, *L. plantarum* and *L. reuteri* [6]. For *Lactobacillus casei*, it has been added in milk, vegetables, fruits and apple juice [10]. The aim of the project was to assess the survivability of different lactobacilli species and inoculation levels in dried Hom Dok Mali rice.

MATERIALS AND METHODS

A. Raw Materials

Half to full grain (3/4 or broken big grain) of Hom Dok Mali rice was purchased from Mae Hia market in Chiang Mai, Thailand and kept refrigerated until used.

B. Stock Cultures and Cultivation of *Lactobacillus* spp.

Lyophilized cultures of *L. acidophilus* TISTR 1338, *L. casei* TISTR 1340 and *L. plantarum* TISTR 543 were obtained from Microbiological Resources Centre (Bangkok, Thailand). Young cultures of the lactobacilli strains were kept in deMan Rogosa Agar (MRS) broth (Merck, Germany) combined with sterile glycerol (Merck, Germany) at ratio 1:1. The solution was then stored at -20°C until used.

Cultivation of lactobacilli stock cultures was done by transferring a loop of microbial culture from frozen cultures into fresh MRS broth and incubating the broth for 24-42 h at 37°C [11]. The cells of lactobacilli culture or its dilution were centrifuged at 4,000 rpm at 4°C for 20 min and the collected microbial cells were washed twice with sterile Maximum Recovery Diluent (Oxoid, England) [12]. After the final washing step and centrifuge, the lactobacilli cultures were aseptically added in a VI solution for the next processing step. The VI solution was prepared from sterile distilled water (Chiang Mai Polestar, Thailand) added with salt (Thai Refined Salt, Thailand) to adjust the a_w of the solution to be similar with the a_w of cooked rice, which was 0.992.

C. Production of dried rice containing *Lactobacillus* spp.

Hom Dok Mali rice was cooked in a rice cooker (Tefal, France) using drinking water (Tesco Lotus, Thailand) at ratio 1:1.5. The cooked rice was cooled down at room temperature for around 10 min and impregnated with one species of *Lactobacillus* using a vacuum impregnation condition at 50 mbar for 10 min in a vacuum oven (Binder VD23, Germany), followed by 10 min relaxation time at atmospheric

temperature. The vacuum impregnation process was carried out at 25°C. Each of the lactobacilli species was studied at two addition levels, a high level of 10⁹ cfu/ml and a low level of 10⁷ cfu/ml. The vacuum impregnated rice was then separately from the solution, dried in the vacuum oven at 60°C using a pressure of 83 mbar for 5.5 h and kept at refrigerator temperature before being analyzed. Each treatment was carried out in triplicate.

C. Physical Analyses of Dried Rice

Rehydration ratio and volume increase of dried rice samples were carried out based on the methods of reference [13] with some modification. Briefly, 1.00 ± 0.05 g of dried rice was added with 10 ml hot distilled water from 100 ml water heated in a microwave (Samsung, Thailand) at 850 watts for 5 min. The hot water was left for 5 min before being drained. The rehydrated rice was weighed. For the volume increase, 1.00 ± 0.05 g of dried rice was used and rehydrated using a similar procedure as the rehydration ratio. The volume of dried rice before and after the rehydration procedure was measured using 10 ml cylinder. The cylinder was tapped for 25-30 times to make uniform compacting of the grain.

Determination of shrinkage for dried rice was carried out using the procedure of reference [14]. Rice hardness was analyzed using a Texture Analyzer (TA-XT.Plus, Stable Micro system, Surrey, UK) that was carried out at 25°C. Rice samples were compressed until 85% strain at a deformation rate of 1 mm/s. A 50 mm diameter plate probe (P/50) with 50 kg load cell was used at 1.0, 5.0 and 10.0 mm/s of pretest, test and post-test speed, respectively. The maximum compressing force (kg force) was recorded as the hardness value of the rice sample. The texture determination was carried out five times for each rice treatment.

For color values of rice samples, they were measured using a colorimeter (Minolta CR-300, Japan) based on reference [14]. Determination of a_w was done using an a_w-meter (Series 3, AquaLab, USA).

D. Chemical and Microbiological Analyses of Dried Rice

Chemical properties of rice samples that were determined were moisture content using an AOAC method no. 943.06 [15] and pH values by a pH meter (Consort C860 CE, Belgium). An amount of 1.00 ± 0.05 g of rice samples was homogenized thoroughly with 10 ml distilled water before pH measurement.

Microbiological analyses of rice samples were carried out for total viable count (total microbial count) and lactic acid bacteria enumeration. For the total viable enumeration, an amount of 5.0 ± 0.1 g rice sample was added with 45 ml Maximum Recovery Diluent, homogenized in a stomacher at room temperature and serially diluted using 9 ml Maximum Recovery Diluent with a proper mixing of the solution. An amount of 1 ml mixed solution from appropriate dilutions was transferred into a petri dish, added with 15-20 ml Plate Count Agar (Difco, USA), mixed thoroughly and incubated invertly at 35-37°C for 48 ± 2 h. Following the incubation, growth colonies were counted. A similar procedure was performed for lactic acid bacteria enumeration. However, instead of Plate Count Agar, rice solution in the petri dishes was added with MRS agar.

E. Statistical Analyses

Collected data was statistically analyzed by Analysis of Variance using Factorial in Completely Randomized Design in SPSS version 17.0 serial number 5068035 (SPSS Inc., Chicago, USA). Differences between treatment means were determined by Duncan's New Multiple Range Test. Statistical significant was declared at p<0.05.

RESULTS AND DISCUSSIONS

For the physical parameters of dried rice containing different lactobacilli species, including rehydration ratio, shrinkage, hardness, color values, a_w values and volume increase, they were found not to be significantly affected by different species and addition levels of *Lactobacillus* (Tables I and II). This finding could mainly be affected by similar drying condition that was applied for all the rice samples, which was a drying temperature of 60°C with a pressure at 83 mbar for 5.5 h. Reference [16] wrote that rehydration was a complex process and indicated the physical and chemical changes induced by drying treatments. The workers found that the rehydration property of pumpkin slices was affected by temperature of hot air drying and microwave power. For shrinkage, the result in this study was similar to the report of reference [14]. They reported that shrinkage of dried cooked rice was not affected by different drying temperatures between 50 and 120°C. In addition, these researchers also found that at drying temperatures below 100°C, the effect of temperature on rice color was not significant. Regarding hardness and volume increase, finding in this study was also consistent with the report of [17], which showed that different drying temperatures at 65-110°C did not significantly affect the hardness and volume expansion of rehydrated instant parboiled rice fortified with turmeric.

Chemical properties of dried rice, including pH and moisture content, were significantly affected by different species and supplementation levels of lactobacilli (Table III). It could be seen that a high inoculation level of lactobacilli significantly caused a lower pH value than those supplemented at low inoculation level. As part of the group of lactic acid bacteria, *Lactobacillus* spp. has been reported to be able to produce organic acids, mainly acetate and lactate, as the end products of carbohydrate metabolism [18, 19]. Since changing in pH value might affect the sensory properties of final dried rice product, this alteration should be reduced to minimize its effect. For the moisture content, the addition of *L. casei* caused higher moisture content in dried

TABLE I REHYDRATION RATIO AND SHRINKAGE OF DRIED RICE PRODUCTS SUPPLEMENTED WITH DIFFERENT INOCULATION LEVELS AND SPECIES OF *LACTOBACILLUS*

Lactic acid bacteria	Inoculation level	Rehydration ratio ^{ns}	Shrinkage ^{ns} (%)
<i>L. casei</i>	High	2.99±0.15	77.81±0.81
<i>L. acidophilus</i>		2.98±0.37	78.00±1.13
<i>L. plantarum</i>		2.87±0.08	76.69±1.17
<i>L. casei</i>	Low	2.80±0.13	78.49±0.76
<i>L. acidophilus</i>		2.71±0.18	77.43±1.85
<i>L. plantarum</i>		2.73±0.03	77.64±1.81

^{ns} not significantly different (p>0.05).

Table II HARDNESS, COLOR VALUES, a_w AND VOLUME INCREASE OF DRIED RICE PRODUCTS SUPPLEMENTED WITH DIFFERENT INOCULATION LEVELS AND SPECIES OF *LACTOBACILLUS*

Lactic acid bacteria	Inoculation level	Hardness ^{ns} (kg force)	Color values			a_w ^{ns}	Volume increase ^{ns}
			L* value ^{ns}	a* value ^{ns}	b* value ^{ns}		
<i>L. casei</i>	High	24.60±4.68	50.87±1.10	0.51±0.38	3.51±0.07	0.397±0.02	1.32±0.05
<i>L. acidophilus</i>		26.21±4.81	52.05±1.88	0.77±0.05	4.18±0.33	0.371±0.07	1.32±0.16
<i>L. plantarum</i>		25.19±4.70	48.42±1.75	0.67±0.05	3.26±0.43	0.422±0.02	1.19±0.06
<i>L. casei</i>	Low	28.05±0.44	51.46±1.69	0.73±0.07	4.02±0.41	0.407±0.04	1.22±0.06
<i>L. acidophilus</i>		30.07±1.21	50.68±0.35	0.74±0.02	3.49±0.49	0.384±0.04	1.19±0.05
<i>L. plantarum</i>		24.63±0.74	51.07±1.60	0.75±0.06	3.96±0.51	0.343±0.04	1.24±0.06

^{ns} not significantly different ($p>0.05$).

rice samples compared to those supplemented with other species. Even though a statistical analysis indicated that different lactobacilli species had a significant effect on the dried rice moisture content, differences of moisture content between rice treatments were only 1.53 – 1.64%. Homogenous results between different rice samples within a rice treatment might contribute to the statistical result. Moisture content of dried rice should mainly be affected by drying temperatures and times applied during a drying process [16].

Microbial properties of dried rice samples were represented by total microbial count and lactic acid bacteria (Table IV). Data showed clearly that higher lactobacilli inoculation level significantly produced higher numbers of total microbial number and lactic acid bacteria in the final rice products ($p\leq 0.05$). Among three *Lactobacillus* spp. studied in this section, *L. plantarum* was found to be the lowest number in the rice samples compared to the other two lactobacilli. References [20, 21] had reported that heat resistance of *L. plantarum* was affected by its strains. A D_{60} value of *L. plantarum* DPC2739 in sterile milk was 32.9 s [21]. Moreover, Reference [22] also reported that heat resistance of *Lactobacillus paracasei* DPC2103 was higher than those of *L. plantarum* DPC1919 and *L. plantarum* DPC2102. In this study, the survival of *L. casei* and *L. acidophilus* in rice samples was better than *L. plantarum* after drying the samples at 60°C for 5.5 h.

TABLE III CHEMICAL PROPERTIES OF DRIED RICE PRODUCTS SUPPLEMENTED WITH DIFFERENT INOCULATION LEVELS AND SPECIES OF *LACTOBACILLUS*

Lactic acid bacteria	Inoculation level	pH value	Moisture content (%)
<i>L. casei</i>	High	6.05±0.02 ^{ab}	9.07±0.48 ^{ab}
<i>L. acidophilus</i>		5.86±0.07 ^c	7.43±0.85 ^c
<i>L. plantarum</i>		5.93±0.02 ^{bc}	8.47±0.39 ^{abc}
<i>L. casei</i>	Low	6.11±0.02 ^a	9.43±0.36 ^a
<i>L. acidophilus</i>		6.13±0.02 ^a	8.00±0.84 ^{bc}
<i>L. plantarum</i>		6.12±0.01 ^a	7.90±0.53 ^c

^{a-c} Different letter in each column indicated significantly different ($p\leq 0.05$).

TABLE IV MICROBIOLOGICAL PROPERTIES OF DRIED RICE PRODUCTS SUPPLEMENTED WITH DIFFERENT INOCULATION LEVELS AND SPECIES OF *LACTOBACILLUS*

Lactic acid bacteria	Inoculation level	Total microbial count (log cfu/g)	Lactic acid bacteria (log cfu/g)
<i>L. casei</i>	High	7.05±0.28 ^a	5.73±0.01 ^a
<i>L. acidophilus</i>		6.10±0.48 ^b	6.24±0.20 ^a
<i>L. plantarum</i>		4.43±0.26 ^c	3.39±0.14 ^b
<i>L. casei</i>	Low	4.43±0.27 ^c	4.11±0.52 ^b
<i>L. acidophilus</i>		5.28±0.65 ^b	5.62±0.86 ^a
<i>L. plantarum</i>		2.77±0.14 ^d	2.53±0.03 ^c

^{a-d} Different letter in each column indicated significantly different ($p\leq 0.05$).

The number of lactic acid bacteria in dried rice containing *L. acidophilus* inoculated at high addition level reached a count of 6.24 ± 0.20 log cfu/g, which was not significantly differed than that of the rice samples supplemented with *L. casei*. This number has compiled with the minimum suggested number of probiotic in dairy and non-dairy food products, which was 10^6 - 10^7 cfu/g [23].

CONCLUSION

This research displayed that rice grains could be utilized to deliver *Lactobacillus* strains to health conscious people. An application of vacuum impregnation could assist to permeate the lactobacilli cells into cooked rice matrices. Dried rice grain with *L. acidophilus* contained lactic acid bacteria of more than 6.0 log cfu/g.

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REFERENCES

- [1] B. S. Luh, "Rice production," in *Cereals Processing Technology*, G. Owens, Ed. Cambridge: Woodhead Publishing Limited, 2001, pp. 79-107.
- [2] S. Saipang, N. Utamaang and Y. Phimolsiripol, "Effect of soaking conditions on physicochemical properties of red-jasmine germinated brown rice flour," *Proceedings of 48th Kasetsart University Annual Conf., Bangkok, Thailand*, 3-5 Feb 2010.
- [3] S. Salminen, A. Ouwehand, Y. Benno and Y. Lee, "Probiotics: How should they be defined," *Trends Food Sci. Tech.*, vol. 10, pp. 107-110, 1999.

- [4] N. Betoret, L. Puente, M. Diaz, M. Pagan, M. García and M. Gras, "Development of probiotic-enriched dried fruits by vacuum impregnation," *J. Food Eng.*, vol 56, no 2-3, pp. 273-277, 2003.
- [5] Y. Rivera-Espinoza and Y. Gallardo-Navarro, "Non-dairy probiotic products," *Food Microbiol.*, vol. 27, pp. 1-11, 2010.
- [6] M.K. Tripathi and S.K. Giri, "Probiotic functional foods: Survival of probiotics during processing and storage," *J. Funct. Foods*, vol. 9, pp. 225-241, 2014.
- [7] G. Kedia, R. Wang, H. Patel and S.S. Pandiella, "Used of mixed cultures for the fermentation of cereal-based substrates with potential probiotic properties," *Process Biochem.*, vol. 42, pp. 65-70, 2007.
- [8] M.H. Helland, T. Wicklund and J.A. Narvhus, "Growth and metabolism of selected strains of probiotic bacteria in milk- and water-based cereal puddings," *Int. Dairy J.*, vol. 14, pp. 957-965, 2004.
- [9] A. Angelov, V. Gotcheva, R. Kuncheva and T. Hristozova, "Development of a new oat-based probiotic drink," *Int. J. Food Microb.*, vol. 112, pp. 75-80, 2006.
- [10] A.L.F. Pereira, T.C. Maciel and S. Rodrigues, "Probiotic beverage from cashew apple juice fermented with *Lactobacillus casei*," *Food Res. Int.*, vol. 44, pp. 1276-1283, 2011.
- [11] L. Bosnea, Y. Kourkoutas, N. Albantaki, C. Tzia, A.A. Koutinas and M. Kanellaki, "Functionality of freeze-dried *L. casei* cells immobilized on wheat grains," *LWT-Food Sci. Tech.*, vol. 42, no. 10, pp. 1696-1702, 2009.
- [12] A. Sohail, M.S. Turner, E.K. Prabawati, A.G.A. Coombes and B. Bhandari, "Evaluation of *Lactobacillus rhamnosus* GG and *Lactobacillus acidophilus* NCFM encapsulated using a novel imping aerosol method in fruit food products," *Int. J. Food Microb.*, vol. 157, no. 2, pp. 162-166, 2012.
- [13] W. Prasert and P. Suwannaporn, "Optimization of instant Jasmine rice process and its physicochemical properties," *J. Food Eng.*, vol. 95, no.1, pp. 54-61, 2009.
- [14] P. Luangmalawat, S. Prachayawarakorn, A. Nathakaranakule and S. Soponronnarit, "Effect of temperature on drying characteristics and quality of cooked rice," *Lebensm. Wiss. Technol.*, vol. 41, pp. 716-723, 2008.
- [15] Association of Official Analytical Chemists, *Official methods of analysis of AOAC International*, 17th ed., Gaithersbury, USA: AOAC International, 2000.
- [16] L. Seremet (Ceclu), E. Botez, O.-V. Nistor, D.G. Andronoiu and G.-D. Mocanu, "Effect of different drying methods on moisture ratio and rehydration of pumpkin slices," *Food Chem.*, vol. 195, pp. 104-109, 2016.
- [17] A. Palamanit, A. Musengimana Sugira, S. Soponronnarit, S. Prachayawarakorn, P. Tungtrakul and V. Raghavan, "Quality and drying kinetics of instant parboiled rice fortified with turmeric using hot air and microwave-assisted hot air drying," *Proceeding the 16th TSAE National Conf. and the 8th TSAE International Conf., Bangkok, Thailand*, pp. 190-198, 17-19 March 2015.
- [18] S.-C. Wu, Y.-S. Su and H.-Y. Cheng, "Antioxidant properties of *Lactobacillus*-fermented and non-fermented *Graptopetalum paraguayense* E. Walther at different stages of maturity," *Food Chem.*, vol. 129, pp. 804-809.
- [19] R. Tabasco, P.F. de Palencia, J. Fontecha, C. Peláez and T. Requena, "Competition mechanisms of lactic acid bacteria and bifidobacteria: Fermentative metabolism and colonization," *LWT-Food Sci. Tech.*, vol. 55, pp. 680-684, 2014.
- [20] V. Ferrando, A. Quiberoni, J. Reinheimer and V. Suárez, "Resistance of functional *Lactobacillus plantarum* strains against food stress conditions," *Food Microbiol.*, vol. 48, pp. 63-71, 2015.
- [21] M. De Angelis, R. Di Cagno, C. Huet, C. Crecchio, P.F. Fox and M. Gobbetti, "Heat shock response in *Lactobacillus plantarum*," *Appl. Environ. Microb.*, vol. 70, no. 3, pp. 1336-1346, 2004.
- [22] K.N. Jordan and T.M. Cogan, "Heat resistance of *Lactobacillus* spp. isolated from Cheddar cheese," *Lett. Appl. Microbiol.*, vol. 29, pp. 136-140, 1999.
- [23] S.A. Bakr, "The potential applications of probiotics on dairy and non-dairy foods focusing on viability during storage," *Biocatal. Agric. Biotech.*, vol. 4, pp. 423-431, 2015.

Recent advances in the research and development of pharmaceuticals and agrochemicals by utilizing bioactive substances of plants produced in South East Asia, and biomass utilization of fast-growing trees

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INTRODUCTION

In tropical and subtropical regions, wide variety of plants is distributed as valuable genetic resources to provide bioactive constituents. Although fast-growing trees are planted for the production of wood-based materials and pulp and paper, the effective use of the waste wood and bark has not been achieved.

At the previous 5th CMU-KU Joint Symposium 2014, one of the authors (T. Katayama) presented the introduction of "Research and development of pharmaceuticals and agrochemicals by utilizing bioactive substances of plants produced in South East Asia, and biomass utilization of fast-growing trees" as the core areas and themes of International Academic Research at Kagawa University from 2014 and some of the research topics until 2013 related to the core areas and themes.

At this 6th KU-CMU Joint Symposium 2016, the authors would like to present recent advances in the same title as above, on the basis of collaboration between Kagawa University and Chiang Mai University, Thailand [1,2] as well as Bogor Agricultural University [3,4] and Hasanuddin University [5], Indonesia.

RESULTS AND DISCUSSIONS

1. Effective utilization of biomass derived from *Jatropha curcas*, an oil plant for biodiesel fuel production: Investigation of antioxidants [1] and α -glucosidase inhibitors [2]

Jatropha (*Jatropha curcas* L.) is an oil plant, a shrub of the Euphorbiaceae, which is cultivated in tropical and subtropical regions throughout Asia, Africa, and Latin America. *Jatropha* oil is favored for biodiesel fuel (BDF) production, because the seeds are not edible. However, studies on the chemistry and utilization of the deoiled residue of the seeds are behind compared with those of the oil in the seeds. In this study, bioactive components such as antioxidants and α -glucosidase inhibitors were investigated from the deoiled residue. It was extracted with ethyl acetate (EtOAc) and then methanol (MeOH). Both extracts were partitioned between EtOAc and water giving four fractions (frs.). The EtOAc fr. of the MeOH extract had the strongest antioxidant activity. From the frs., eight compounds, catechol-type lignan [(+)-3,3'-bisdemethylpinoresinol (**1**)], five neolignans [(-)-isoamericanol A (**2**), (+)-americanol A (**3**), and their derivatives], and two sesqueneolignans [isoprincepin and princepin] were obtained. All of them indicated strong antioxidant activity.

α -Glucosidase inhibitory activity was found in the EtOAc frs. from the EtOAc and MeOH extracts from the deoiled

seed residue and in the synthetic (+)-3,3'-bisdemethylpinoresinol (**1**) and (\pm)-isoamericanol A (**2**).

2. Screening of antioxidant and antihyperlipidemic potencies of Indonesian underutilized fruits [3,4]

Antioxidant and antihyperlipidemic effect of the six Indonesian underutilized fruits (*Baccaurea racemosa*, *Mangifera caesia*, *Pouteria campechiana*, *Phyllanthus acidus*, *Sandoricum koetjape*, and *Syzygium cumini*) were examined. All part of *S. cumini* fruits exhibit antioxidant activity with the strongest of its raw seed acetone extract (IC₅₀ 3.63 μ g/ml). The highest antihyperlipidemic activity was exhibited by *P. acidus* acetone extract (inhibition 80%). The EtOAc fraction from the acetone extract gave strongest activity (87%).

3. Antitermite and antifungal activities of *Vitex cofassus* heartwood [5]

Antitermite activity of *Vitex cofassus* heartwood against a subterranean termite, *Coptotermes formosanus* and its antifungal activity against a white-rot fungus (*Trametes versicolor*) and brown-rot fungus (*Fomitopsis palustris*) were investigated. The heartwood mill was extracted with acetone and MeOH to give their extracts, each of which were fractionated successively using *n*-hexane, EtOAc, and water to afford their soluble fractions (frs.). It was demonstrated that the MeOH extract itself, the EtOAc fr. and the *n*-hexane fr. from the MeOH extract, and the EtOAc fr. from the acetone extract had high antifeedant activity against *C. formosanus*. All the extracts and frs. were shown to have strong-moderate antifungal activity against *T. versicolor*, where the aqueous fr. of the acetone extract had the highest activity, while almost these extracts and frs. were found to have moderate-weak antifungal activity against *F. palustris*.

REFERENCES

- [1] T. Suzuki, K. Eto, Y. Kubota, T. Katayama, T. Pankasemsuk: Antioxidative catechol ligands/neolignans isolated from defatted kernel of *Jatropha curcas*. *J. Wood Sci.*, **62**, in press (2016).
- [2] T. Katayama, T. Suzuki: Effective utilization of biomass derived from *Jatropha curcas*, an oil plant for biodiesel fuel production: Investigation of bioactive components such as antioxidants, Proceedings of the 2014 (81st) Pulp and Paper Research Conference, Tokyo, pp. 61-66, June 2014.
- [3] D. Andrianto, T. Katayama, T. Suzuki: Screening of antioxidant and antihyperlipidemic potencies of Indonesian underutilized fruits, *Journal of the Forest Biomass Utilization Society*, **10**, 19-25 (2015).
- [4] F. Matsuno, T. Katayama, T. Suzuki, D. Andrianto: DPPH free radical scavenging and α -glucosidase inhibition activities of the extracts of five Indonesian underutilized fruits from Java island, Proceedings of the 6th Joint Symposium between Kagawa University and Chang Mai University, Kagawa, in press, August 2016.
- [5] Syahidah, T. Katayama, T. Suzuki, Yasuhiko Asada, Y. Ohtani, W. Ohmura: Antitermite and antifungal activities of *Vitex cofassus* heartwood *Journal of the Forest Biomass Utilization Society*, **10**, in press (2015).

The identification of chemical compounds from *Lagerstroemia speciosa* L. Pers.

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INTRODUCTION

Lagerstroemia speciosa L. Pers., which belongs to the Lythraceae family, is a tropical plant distributed in areas of Southeast Asia, including Thailand. It has been traditionally used for the treatment of diabetes and obesity [1]. Previous phytochemical investigations indicated that *L.speciosa* contained triterpenes, coumarins, lignans, phenolic compounds, including ellagic acids and ellagitannins and several flavonoids [1, 2]. It has been reported that the extraction of *L.speciosa* leaves possess potent hypoglycemic effects in vitro and in vivo [1]. In this study, phytochemical investigation of *L.speciosa* ethanolic leaves extract, diverse column chromatography methods were performed to isolate new lignan compound (A), along with five known ellagic acid derivatives (B-F). The structures of the isolated compounds were determined based on the basis of various spectroscopic methods (ultraviolet-visible mass spectrophotometer (UV-MS) and high-resolution mass spectroscopic (HR-MS), including hydroxy (¹H)- and carbon (¹³C)-nuclear magnetic resonance spectroscopy (NMR)).

RESULTS AND DISCUSSIONS

The leaves of *L.speciosa* L. Pers. were extracted with 80% ethanol. The crude extract (Fig.1) was partitioned successively with hexane, methanol, ethyl acetate and water. The ethyl acetate layer was subjected to separate by column chromatography using silica gel and purified by high-performance liquid chromatography (HPLC) with RP-18 to yield isolated compounds (A-F).

The structure elucidation of isolated compounds was accomplished by interpretation of the spectroscopic data, including 1D- and 2D-NMR. The five known compounds were determined to be 3,4-methylene-dioxy-3'-*O*-methyl ellagic acid (B) [2], 3,3',4'-tri-*O*-methyl ellagic acid (C) [1], 3,3'-di-*O*-methyl ellagic acid (D) [1], 3-*O*-methyl ellagic acid 4'-sulfate (E) [1], and 3-*O*-methyl ellagic acid (F) [1] (Fig.2). This study found that the lignan compound (A), 4,4'-dihydroxy-3,3'-dimethoxy-9,9'-epoxylignan were isolated for the first finding in *L.speciosa* from Thailand.

This result shows that *L.speciosa* ethanolic extract shares similar chemistry with the species of *Lagerstroemia*. Moreover, all isolated compounds will further be analysed the α -amylase inhibitory activity.

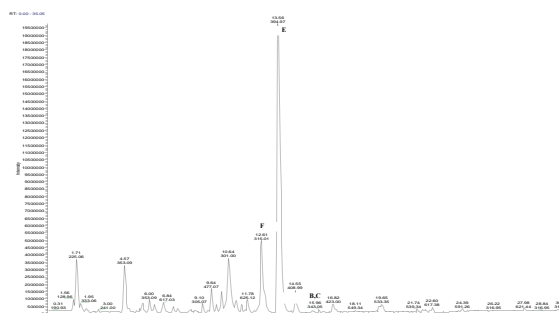


Fig.1 The chromatogram of *L.speciosa* leaves extract.

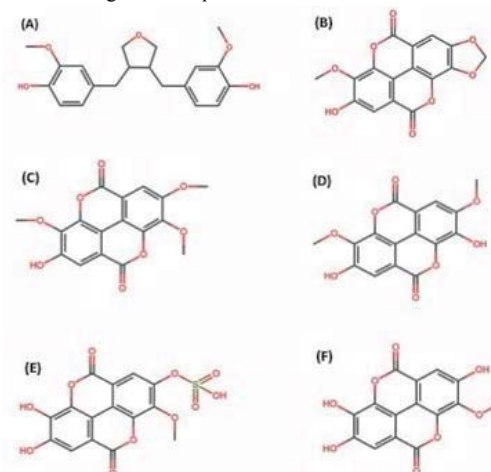


Fig.2 The structure of isolated compounds from *L.speciosa* leaves extract. A: 4,4'-dihydroxy-3,3'-dimethoxy-9,9'-epoxylignan, B: 3,4-methylene-dioxy-3'-*O*-methyl ellagic acid, C: 3,3',4'-tri-*O*-methyl ellagic acid, D: 3,3'-di-*O*-methyl ellagic acid E: 3-*O*-methyl ellagic acid 4'-sulfate, and F: 3-*O*-methyl ellagic acid.

ACKNOWLEDGMENT

The authors gratefully acknowledge the financial support of the Research and Researchers for Industries (RRI). We also thank Dr. Tetsuo Kokubun, Jodrell Laboratory, Royal Botanic Gardens, for conducting the NMR analysis.

REFERENCES

- [1] Bai N., He K., Roller M., Zheng B., Chen X., Shao Z., Peng T. and Zheng Q. 2008. Active compounds from *Lagerstroemia speciosa*, insulin-like glucose uptake-stimulatory/inhibitory and adipocyte differentiation-inhibitory activities in 3T3-L1 cells. J. Agric. Food Chem. 56: 11668–11674.
- [2] Huang G.H., Zhan Q., Li J.L., Chen C., Huang D.D., Chen W.S. and Sun L.N. 2013. Chemical constituents from leaves of *Lagerstroemia speciosa* L. Biochemical Systematics and Ecology, 51: 109-112.

An Increase of Ferritin Expression from Iron-Induced Nitric Oxide in Senescence *Lotus Japonicus* Nodule

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INTRODUCTION

Iron is an important micronutrient for plants especially for legumes which require iron to synthesize iron-containing proteins, such as leghemoglobin and in bacteroids for nitrogenase (Guerinot 1991; O'Hara 2001; Peters and Szilagyi 2006). Iron can be found highest concentration in nodules. However, it starts to decrease in senescent soybean nodules while ferritin which is another iron storage protein produced from leghemoglobin and nitrogenase breakdown is increased (Burton et al. 1998).

Up to current, ferritin physiological act in senescent nodules is rarely known so this study is aim to expose it.

RESULTS AND DISCUSSIONS

Iron concentration in different stages of nodules (2, 4, 8 weeks post infection, wpi) was determined by ICP-MS. At each stage, nodules were centrifuged and separated into cell sap and residues (Fig. 1). The data shows that free iron in nodule was nearly constant (Fig. 1a) while during nodule senescence, iron level in residue decreased (Fig 1b). This indicates that iron in nodules was delivered to shoot in senescence-stage.

To determine iron ability to induce NO accumulation in nodules, the cell-permeable NO-specific fluorescent probe (DAF-FM) has been used. Nodule from nitrogen fixation stage was soaked in water, iron citrate, FeSO₄ and DFOM (Desferoxamine mesylate, Fe scavenger) as results show in Fig. 2a. At 4 wpi, ferritin was induced by iron and ferritin is not express when treated with DFOM. This data indicates that ferritin is induced by ferrous and ferric. For NO production measurement, the nodule was soaked in fluorescent DAF-FM solution and measured the relative fluorescence unit (RFU) (Fig. 2b). At 7 wpi, the RFU value was induced compared to 4 wpi nodule which indicates that NO production was induced during senescence stage.

NO-responsive transcripts microarray analysis in *Arabidopsis* showed that ferritin was one of the NO-responsive genes (Parani et al. 2004). This study treated plants at 4 wpi with NO donor, sodium nitroprusside (SNP) to see the *Lifer1* expression regulated by NO signal. Fig. 3 shows that the *Lifer1* gene induction by SNP was obviously prevented by cPTIO addition. With cPTIO, iron-dependent *Lifer1* expression is abolished, this means that NO is a major element in the transduction pathway signal. All these data indicate that NO is able to bypass iron and place NO downstream of iron in the signaling cascade leading to ferritin accumulation.

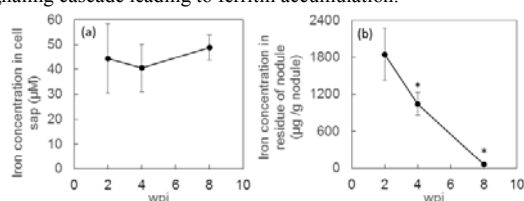


Fig. 1 Iron concentration of cell sap (a) and residue (b) from nodules at 2, 4, and 8 wpi using ICP-MS. The error bar indicates mean \pm SD. Statistically significant differences ($p < 0.01$) compared with *M. loti*-inoculated nodules at 2 wpi (asterisk symbols).

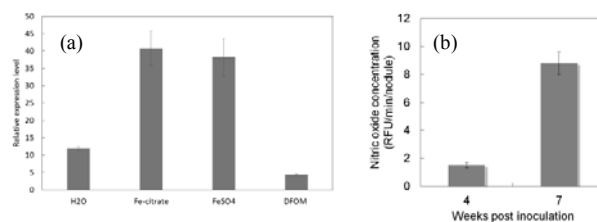


Fig. 2 (a) Expression of ferritin gene treated with 300 μ M DFOM, Fe scavenger. Plants at 4 wpi were treated with 300 μ M iron citrate or 5 mM DFOM for 3 hours. Total RNA was isolated from each nodule. The amount of transcripts were calculated by quantitative real time RT-PCR. The expression was normalized to ubiquitin. (b) Quantification of nodules NO production. Nodules were isolated from roots and soaked in 7 μ M DAF-FM solution. RFUs per nodule at 515 nm are shown. The error bar indicates mean \pm SD. Statistically significant differences compared to the control are defined by asterisks ($*p < 0.01$). Bar = 12.5 μ m.

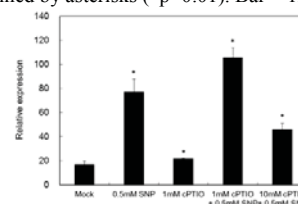


Fig. 3 Ferritin gene expression with various cPTIO and SNP concentrations. Mock is the control (distilled water). Transcript relative amounts were counted by means of quantitative real-time RT-PCR normalized to ubiquitin transcripts. The error bar indicates mean \pm SD. Statistically significant differences ($P < 0.01$) compared with the distilled water (asterisk symbols).

ACKNOWLEDGMENT

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REFERENCES

- [1] Burton JW, Harlow C, Theil EC (1998) Evidence for reutilization of nodule iron in soybean seed development. *J Plant Nutr* 21: 913–927
- [2] Guerinot ML (1991) Iron uptake and metabolism in the rhizobia/legume symbioses. *Plant Soil* 130: 199–209
- [3] Nagata M, Murakami E, Shimoda Y, Shimoda-Sasakura F, Kucho K, Suzuki A, Abe M, Higashi S, Uchiumi T (2008) Expression of a class 1 hemoglobin gene and production of nitric oxide in response to symbiotic and pathogenic bacteria in *Lotus japonicus*. *Mol Plant-Microbe Interact* 21: 1175–1183
- [4] Parani M, Rudrabhatla S, Myers R, Weirich H, Smith B, Leaman DW, Goldman SL (2004) Microarray analysis of nitric oxide responsive transcripts in *Arabidopsis*. *Plant Biotech J* 2: 359–366

Effects of NaCl Stress on Growth and Proline Content in *Helianthus annuus* L. Seedlings

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This study investigated growth and proline content in the seedlings of sunflower (*Helianthus annuus* L.). The Sunflower seeds were planted in the sand cultures which were watered with sodium chloride (NaCl) solution at the concentrations of 0, 5, 10 and 100 mM. After 5 days of cultivation, seedling growth (shoot height, root length, shoot fresh weight and root fresh weight) and proline contents in leaf, stem and root of the seedlings were determined. The results showed that the low concentration of 5 and 10 mM NaCl did not affect the seedling height and shoot fresh weight, but showed little increase in root fresh weight. The high concentration of 100 mM NaCl reduced shoot height, shoot fresh weight, root fresh weight and increased proline accumulation all of the three parts in this seedling. The results obtained from this study indicate that the low concentrations of NaCl may promote growth, while the high one resulted in growth reduction in this seedling.

INTRODUCTION

Sunflower sprouts or sunflower seedlings is an alternative for vegetables that have high nutritional value. Sunflower Medical Center indicate that sunflower sprouts have plenty of linoleic acid, which contributes to the maintenance of strong bones and a healthy brain. It is also rich in vitamin B, vitamin E and folate, which aid in digestion, boost immunity, and prevent heart disease and cancer. The International Sprout Growers Association reported that the amount of vitamins A, B2, E, D, and K in sunflower sprouts showed two times higher than lettuce, while the amount of vitamin A showed three times higher than corn and soy bean. These vitamins will prevent in cell aging of eyes and skin [7]. Also, this seedlings has high phenolic compound which qualify as an antioxidant. This phenolic compound can minimized some free radical which provide a protective effect on human health [6].

Sunflower sprouts are suitable for consumer health. Currently, they can be obtained from the local markets as well as in supermarkets. Varieties of sunflower seeds are also readily available and can be grown at home within a one-week period to produce sprouts that can be eaten. [3] It has been reported that the sunflower is a moderately salt-tolerant plant. It has also been reported that the low concentrations of sodium chloride could stimulate the growth of lettuce and cabbage seedlings which are commonly grown and consumed nowadays [5]. This experiment focuses on growth and proline changes in sunflower seedlings under sodium chloride stress. The results obtained from this study will establish basic knowledge on the salt tolerance of this plant. It may be used to add nutritional value to this seedlings, or seedling germination of other plants.

MATERIALS AND METHODS

Seeds of sunflower were purchased from Jia Tai Company. Sand culture was first washed three times with tap water and then dried at 100 °C for 24 hours. Two hundred fifty liter of the dried sand was contained in a glass with 10cm x12cm. 60 ml of NaCl solution at the concentration of 0, 5, 10 and 100 mM was watered to each glass. After immersing seed in distilled water for 8 hours following with 12 hours of seed incubation, 6 completed seeds (turgid and non-lean) were collected to plant in a glass of sand culture. 5 ml of the same concentration of NaCl solution were sprinkled every day for five days. The normal seedlings, shoot and root longer than 1 cm and appearance of 2 leaves, were selected to analyze growth (plant height, root length, shoot fresh weight

and root fresh weight) and proline content. The proline content was determined according to the modified method of [1] and [4].

RESULTS AND DISCUSSIONS

As shown in Table 1, the sunflower seedlings could grow in the sand culture which were watered with 5, 10 and 100 mM NaCl solution. Moreover, the low concentrations (5 and 10 mM) did not affect plant height, root length and shoot fresh weight parameters in the sunflower seedlings when compared to the non-NaCl treated seedling. The root growth evaluating by root fresh weight was little increase with the low concentrations of NaCl treatments. These results indicated that the 5 and 10 mM NaCl did not induce the sand culture to be the severe saline soil. Five days after watering the sand culture with the low concentration of NaCl, their electrical conductivities were shown as a non-saline soil (data not shown). Therefore, these concentration did not result in severe problem on growth of this seedling plants. In contrast, these concentrations may contribute the potent groundwork which will lead to growth well of the shoot part. Our results are similar to study in the radish which could enhance its seedling fresh weight at the low concentrations of 10 mM NaCl [10].

However, at the high concentration of 100 mM NaCl, the seedling height, shoot fresh weight and root fresh weight were decreased, while proline contents in the leaf, stem and root of the sunflower seedling were increased when compare to the other treatments (Table 1). The electrical conductivity of the sand culture after 5 days watered with 100 mM NaCl was evaluated as a moderate saline soil (data not shown). This indicates that this concentration is able to be the drastic impact on the growth of this seedling. When the plant subject to salinity stress, physiological change will be following step by step. At the initial stages of stress, the plant cell will lose cell turgidity resulting in the decrease of cell expansion. Subsequently, there may be a reduction of photosynthesis by the plant [9]. Furthermore, increase of proline accumulation in the sunflower seedling would be considered as a biochemical response to this NaCl stress. When the plant is subjected to salinity stress or water-deficit stress, proline is synthesized through glutamate pathway to perform as an osmoprotectant. This compound can reduce osmotic damage when the high water-potential difference between cells and outer environment occurs [2]. Finally, growth reduction of the sunflower seedling was revealed in this high NaCl stress. As in other studies reported that salt stress at high concentration of 100 -150 mM NaCl could also induce proline accumulation in mung bean and rice seedlings [8].

CONCLUSION

The low concentration of 5 and 10 mM NaCl did not have an effect on the seedling height, root length and shoot fresh weight, but showed little increase in root fresh weight. The high concentration of 100mM NaCl reduced seedling height, shoot fresh weight, root fresh weight and increased proline accumulation in the sunflower seedling.

ACKNOWLEDGMENTS

We are very grateful to Mr. Filnino Edmar So Ambos for editing this manuscript, and to Montfort College Chiang Mai for the financial support.

Table 1 Effects of sodium chloride (NaCl) on growth and proline content in 5 day old seedlings¹ of sunflower (*Helianthus annuus* L.)

NaCl Concentrations (mM)	Shoot height (cm)	Root length (cm)	Shoot fresh weight (g)	Root fresh weight (g)	Leaf proline content (μmol/g FW)	Stem proline content (μmol/g FW)	Root proline content (μmol/g FW)
0	6.18 ² ± 0.40a	7.79 ± 0.42a	1.09 ± 0.09a	1.19 ± 0.20b	0.30 ± 0.02ab	0.27 ± 0.04b	0.23 ± 0.04b
5	6.27 ± 0.36a	7.19 ± 0.55a	1.17 ± 0.09a	1.35 ± 0.15b	0.26 ± 0.05ab	0.19 ± 0.02b	0.20 ± 0.02b
10	6.34 ± 0.69a	7.44 ± 0.84a	1.24 ± 0.15a	1.54 ± 0.13a	0.22 ± 0.01b	0.18 ± 0.02b	0.18 ± 0.02b
100	3.93 ± 0.35b	7.96 ± 0.94a	0.76 ± 0.07b	1.21 ± 0.11b	0.41 ± 0.07a	0.54 ± 0.05a	0.35 ± 0.04a
F-test	*	*	*	*	*	*	*

¹ The seedling used, shoot and primary root consisting of longer than 1 cm and 2 leaves for at least.

² The data are the means of 4 replications ± standard deviation (SD). F-test, ns: no significant difference, *: significant difference $p < 0.05$. Mean sharing with different letters in a single column of the same parameter is considered significantly different by the least significance difference (LSD) test.

REFERENCES

- [1] Bates, L., Waldren, R.P., and Teare I.D. 1973. Rapid determination of free proline for water-stress studies. *Plant and Soil*, 39: 205-207
- [2] Delauney AJ, Verma DPS. 1993. Proline biosynthesis and osmoregulation in plants. *Plant J*. 4: 215-223.
- [3] Department of Land Development. 1997. Catalogue of Lower Mekong Basin GIS Dataset 1997. Land Use Planning Division.
- [4] Ghoulam, C., Fours, A. and Fares, K. 2002. Effect of salts on growth, inorganic ions and proline accumulation in relation to osmotic adjustment in fine sugar beet cultivars. *Environmental and Experimental Botany*, 47: 39-50.
- [5] Nathakarn Na Chiang Mai. 2556. Effects of sodium chloride stress on some physiological and biochemical changes in *Raphanus sativus* L. (Cruciferae) seedlings. Special Case: Bachelor Degree of Biology, Faculty of Biology. Chiang Mai University.
- [6] Pajak, P., Socha, R., Galkowska, D., Roznowski, J., Fortuna, T. 2014. Phenolic profile and antioxidant activity in selected seeds and sprouts. *Food Chem*, 143: 300–6.
- [7] Princessfangy, 2014. Department of Agricultural Extension Ministry of Agriculture. 2014.
- [8] Saha P, Chatterjee P, Biswas AK. 2010. NaCl pretreatment alleviates salt stress by enhancement of antioxidant defense system and osmolyte accumulation in mungbean (*Vigna radiata* L. Wilczek). *Indian J Exp Biol* 48:593–600.
- [9] Taiz L. and Zeiger E. 2006 (4th ed.). *Plant Physiology*. Sinauer Associates, Inc., Publishers, Massachusetts.
- [10] Yuan, G. Wang, X. Guo, R. and Wang, Q. 2010. Effect of salt stress on phenolic compounds, glucosinolates, myrosinase and antioxidant activity in radish sprouts. *Food Chemistry*, 121: 1014–1019.

Social Sciences and Humanities 3

- Social Science and Quality of Life -

Monday 29 August, 2016

15:20-17:20

Room C, North Block

Creation of A Sustainable Asia-America Exchange Program - Consideration of the Educational International Program

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In Kagawa University Intercultural Exchange Program, students and staff met a lot of great people and it was a very precious experience for us. We learned about the importance of cross-cultural understanding from interaction as a result of our joint activities. Students participating in this program had a many useful experience for student. There are a lot of international students who come from Colorado, Chiang-Mai and Eckerd to Japan. Recently, the number of students who go to learn about foreign culture and language from Japan is decreased than before. That is , the number of students who go to study abroad has been gradually decreasing. There are some problems of lack in communications skills, language competence and logical thinking. In Japan, almost all students are not interested in other cultures. Studying abroad is an enriching experience for students. We will describe our plans to ensure steady implementation of measures in securing of number of international students.

INTRODUCTION

As a part of the “global strategy” to open up Japan to the whole world and expand flows of people, goods, money and information between Japan and countries in Asia and other regions in the world, Japan will aim to accept up to 300,000 international students by the year 2020. Efforts should be made to strategically acquire excellent international students, as well as to accept highly capable students, while giving due consideration to the balance of countries, regions and fields of study. Japan will also continue to make intellectual contributions globally to other countries, including Asian countries. [1] It is important for the student body to be exposed to international students of different cultures. Kagawa University has a history of engaging actively in academic exchanges with overseas institutions.

RESULTS AND DISCUSSIONS

Japanese universities and graduate schools currently host around 100,000 international students, mostly from Asia. At the meeting, the council decided to increase this number to one million by 2025. The appealing features of universities should be enhanced globally, through international coordination and cooperation between universities, through such means as student exchange, credit transfer and double degree programs, promotion of interchange through short-

term exchange and summer schools, improvement of mobility of students, and guarantee of the quality of university curricula.

In accordance with the government’s Foreign Student Policy for the 21st Century Act, Kagawa University started to prepare to receive international students and in April 1985 a plan to receive international students at Kagawa University was enacted and a Committee for International Student Affairs was set up. To attain the goal, we are considering introducing a new international exchange committee in the Faculty of Education.

Student Exchange Support Program was started by Japan Student Services Organization Five years ago. This scholarship is available for student acceptance and student dispatch programs of less than three months by Japanese universities, junior colleges, colleges of technology or specialized training college. The acceptance and dispatch program for this scholarship must be conducted under each Japanese Universities’ control and responsibility. A student selection process and education system must be established for conducting a short-term stay program and/or a short-term visit program.

Here is a example of program between our university and Colorado State University(CSU). In August 2015 a group of three Japanese students from our university came to CSU for three weeks Intercultural Exchange Program using JASSO scholarship. We learned about the importance of cross-cultural understanding from interaction as a result of our joint activities. We began special course for Kagawa University student by CSU INTO. There are a lot of international students who come from USA to Japan. Nowadays, the number of students who go to study abroad has been gradually decreasing. There are some problems of lack in communications skills, language competence and logical thinking. in Japan, almost all students are not interested in other cultures. Studying abroad is an enriching experience for students. I will discuss the creation of a sustainable international exchange between CSU-KU looking toward our future mutual growth.

REFERENCES

- [1] Framework of the “300,000 International Students Plan” p. 5, July 29, 2008, Ministry of Education, Culture, Sports, Science and Technology.
- [2] Student Exchange Support Program (Scholarship For Short-Term Visit / Short-Term Stay Program), July 10, 20128, Japan Student Services Organization.

Challenges of Thai Alphabets on the Students with Learning Disabilities in Thailand

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Ratchaneekorn Tongsookdee*, Soisuda Vittayakorn*,
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Abstract

Thai Language is a compulsory subject in the national curriculum ranging from primary to higher education levels as it is the national and official language that Thai people use to communicate with one another in daily life. It is widely accepted that Thai language is rather complicated. It has 44 consonant letters, 15 vowel symbols that could combine into at least 28 vowels, and 5 tones. Consequently, Thai children especially those with learning disabilities have a lot of difficulties in reading and writing. These two language skills are a crucial means for the students to learn other content areas. In order to search for ways to support them, it is necessary that classroom teachers understand their problems precisely. This research project was aimed at investigating the types of difficulty encountered by the students with learning disabilities in reading and writing. The sample group comprised 36 students with learning disabilities taking the Thai subject in the 2015 academic year from 18 leading inclusive schools under Chiang Mai Primary Educational Service Area Office 1-6. The research tool was a student observation form for observing the learning disabilities in reading and writing. The data obtained were analyzed using frequency, percentage, and interpretative analysis. The findings revealed that most of the learning disability students had the reading difficulties in the alphabets; namely, consonant letters, vowels, and tones, and rhythm, whereas those on writing included the alphabets, ways of writing, and writing styles. Moreover, the result indicated that the target group had visual perception problem.

Keywords:

Learning Problems in Thai, Students with Learning Disabilities,
Special Education, Inclusive classroom, Screening

Introduction

Challenges of Thai Alphabets

Thai is Thailand's national language used for communication and used as a tool to acquire knowledge and experience from various information sources to develop knowledge, idea, analysis, criticism and creativity in order to keep up with social changes, science and technology advancement including developing careers leading to economic stability. As a result, Thai language has become a compulsory subject in Thailand's national curriculum until nowadays.

However, reading and writing Thai language is challenging as Thai alphabets consist of 44 consonants representing 21 sounds, 21 vowels representing 32 sounds and 4

tone marks representing 5 tones. Because of having different forms and sounds, it leads to reading and writing difficulties for learners, especially elementary school students. The reason is that Thai alphabets, especially the consonants and the vowels have special features and grammatical rules that learners must memorize and practice so that they can read and spell words correctly and fluently.

In terms of reading the sound system of Thai language having vowel sounds, consonant sounds and tone marks, Thai language is considered as the language that has various sounds, for example, 21 phonemes of sounds, 18 single vowel phonemes which are divided into 9 short vowels, 9 long vowel phonemes and 3 diphthongs. Moreover, there are consonant sounds or articulated sounds that are obstructed by some certain organs. These consist of 44 symbols producing 21 consonant sounds. Next, the tone sounds are called as musical sounds since the sounds are produced by high and low pitch while articulating each word. Thus, words have different meanings if their tones used are different, for example the words นาน นาน นาน (Naksakul, K. and et. al, 2011).

In terms of writing, Worachatudompong (2002) concluded that the features of Thai consonants have two groups. The first one consists of the consonant letters having the “heads” which are divided into the “outer head” on top such as ข ฃ ฉ ง ซ ท ฑ น บ ป ฟ พ ฝ ม ฆ ห ฟ, the consonants having the “inner head” on top such as ย ผ ฝ, the consonants having the “outer head” at the middle such as จ ฐ ฌ ด ต ฒ and the consonants having the “inner head” at the middle such as ก ศ ท อ ฮ. Due to these different forms of writing the consonants’ heads, many learners are confused, particularly when they read and write the consonants’ heads. For example, some students misunderstand between ก and ค.

From the above information, we can see that Thai alphabets having various forms and sounds can cause confusion to students with learning disabilities and slow down their reading and learning development.

For this study, the researchers emphasized on learners in elementary level since there were many students with learning disabilities in the northern region, especially in Chiang Mai Province. 817 students from 1,547 students were found to be the students with learning disabilities studying in normal classes (Ministry of Education, 2011). This kind of learners was found to have many problems, especially the problems of learning and academic difficulties. According to Salend (2005), this kind of learners had reading problems such as the problem of memorizing the symbols and the consonant sounds, memorizing words, speed of reading, difficulties of reading word by word, misunderstanding words and sentences so they had to spell words so that they could read them. Also, they skipped some words they did not know. They also had problems with pronunciation since they pronounced words unclearly. Moreover, they could not correctly read words according to the tones used. When they read a reading passage, they could not find main ideas or put sentences in chronological orders. In terms of writing difficulties, the difficulties of writing the consonants were found. They often made wrong alphabetical order mistakes, for example, ม-น or ค-ก. Furthermore, the difficulties in organizing a text system, sentence structure, word choice and spelling were also found. These are the main effects caused by brain injuries, genetics, and environmental factors. Thus, these difficulties regarding reading and writing may affect their learning efficiency in other subjects.

Research Objectives

This research was aimed at investigating the types of difficulty encountered by the students with learning disabilities in reading and writing.

Research Methodology

This study's population and samples were 36 students with learning disabilities having difficulties in learning Thai subject from 18 leading inclusive schools under Chiang Mai Primary Educational Service Area Office 1-6. They were chosen from 157 students who were in Prathom 2 to Prathom 5 studying in the academic year of 2014 by using the Test of Nonverbal Intelligence or TONI 3. From the test results, 71 students were found to have the Intelligence quotient scores higher than 80. Then they were tested by using the Developmental Test of Visual Perception-2nd Ed (DTVP-2) and the Dynamic Occupational Therapy Cognitive Assessment for Children (DOTCA-ch). According to the results, the LD students were more likely to have visual perception problems. Also, the teachers confirmed that 36 students had difficulties in learning Thai language.

The instrument used in this study was the learning behavior observation form for the LD students having difficulties in reading and writing. The data and the observation observing the students' learning behaviors were collected by the teachers. The researcher team coordinated and asked for cooperation from the teachers who were responsible for classes of the students with learning disabilities to observe and record their behaviors in the observation forms.

Research Findings

The findings can be concluded that most of the students with learning disabilities in the elementary level had reading problems; consonants, vowels and tones including rhythms and other related problems. In other words, the LD students were confused about the vowel sounds, especially the diphthongs and the inherent vowels. They also could not read the leading consonants and they were confused about the different tones. Therefore, they had to spell words while reading. Besides, they could not read the diphthongs so they skipped the word. Also, they mispronounced the word that they could not read, misunderstood the final consonants such as the word “หาค” as “หาง”. They replaced the word that they could not read by another word. In terms of the reading rhythm, the LD students read slowly, they incorrectly paused when reading and they did not read fluently. Their volume of voice was low. For other behaviors, the LD students were found to have a problem finding the main idea of the reading passage. They guessed the meaning from the pictures. Moreover, when they read, they looked nervous, frustrated or stressed out.

In terms of writing, most of the LD students in the elementary level were found to have the problem to distinguish the alphabets (consonants, vowels and tones), writing styles and ways and other related problems. They frequently misspelled easy words, could not write the leading consonants, frequently erased the words they wrote, spelled words while writing and often felt confused with the consonants that look similar such as ก-ก, พ-พ and ฅ-ฅ. They were also confused about the tone marks such the first tonal marker as the second tonal marker. For the writing styles, they could not correctly use the conjunctions. They wrote short sentences by using repetitive and easy words without giving details. In addition, they could write a paragraph and spaced when writing. Even they wrote sentences, the sentences were not understandable. For the writing ways, they wrote slowly,

they misplaced the vowels and tonal markers. Some wrote inconsistently, could not write on the lines and wrote slowly. For other aspects, they were found to miss some words when writing. They wrote and spelled words according to the sound they heard such as the word “เกษตร์” they wrote as “กะเสตร์”. They also looked nervous, frustrated or stressed out while writing.

Additionally, the result relating visual perception (tested by DTVP 2) showed that the target group had visual perception lower than the average criteria. When considered in details on movement visual perception (tested by DOTCA-ch), found that the target group had visual perception in term of non-movement lower than the average and they had the movement visual perception at the average.

Research Discussion

From the findings indicated that the LD students had reading and writing problems. The reflect of data in reading showed that it was very challenge for the students with learning disabilities such as they could read but could not pronounce the correct sounds, they had difficulties to distinguish vowels, also they had problem in oral reading, silent reading, and reading comprehension. Reading in general needs to use “See and Think” process which start from reception of what we see and send the message to our brains. Then the brain will translate the symbol information to meaningful data, however the brain process would work together with physical process (Mahakan, 1987 and Mankedwit, (2002). Moreover, the students cannot do reading comprehension because they don't understand the vocabularies.

Writing skills are high order skills which is rather complex than speaking skills, listening skills, and reading skills. Writing not only needs to practice but also need ideas to communicate with readers. Also the writers need to have good visual perception and eye-hand coordination skills. The target group in this study found having visual perception problem, which lead these students to have difficulties in learning. As Ayres (1979) stated that visual perception is the essential ability to perceive surrounding environment and in daily live we use 80% of visual perception. Also, Schneck (2001) pointed that when a person has visual perception problem, he/she will have difficulty in doing activities, including reading, spelling, writing, doing math, and visual motor integration.

From the research results suggested us to help these students with learning disabilities by accommodating and modifying lessons, medias, and classroom environment for these children.

Acknowledgement

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References

- Ayres, A. J. (1979). **Sensory Integration and the Child**. Los Angeles, CA: Western
Arayawinyu, P. (2002). **Learning Difficulty Children Instruction**. Bangkok:
Wankeow.
Fontana, J. L., Scruggs, T., and Mastropieri, M.A. (2007). Mnemonic strategy

instruction in inclusive social studies classroom. *Remedial and Special Education*, 28(6), 343-355.

- Jirawiboon, J. (2003). **Teachers and Parents Handbook for Children with Literacy Problems-Reading**. Bangkok: Business Organization of the Office of the Welfare Promotion Commission for Teachers and Educational Personnel.
- Ministry of Education. (2011). Educational Information Summary, Academic Year of 2009. Retrieved September 29, 2012 from http://www2.bopp-obec.info/info_52/index.php.
- Naksakul, K. and et.al. (2011). **Thai Language Norm Book 1**. (2nd ed.). Thai Language Institutes, Education Standard and Academic Office. Bangkok: Office of the Basic Education Commission. Ministry of Education.
- Salend, SJ (2005). **Creating inclusive classrooms: Effective and reflective practices for all students** (4th ed.). Columbus, OH: Merrill.
- Schneck, C. M. (2001). **Visual Perception**. In: J Case-Smith, ed. Occupational
- Traylor, D. (2010). Classroom modifications and accommodations for students with learning disabilities. Retrieved October 26, 2012 from <http://www.helium.com/knowledge/386766-classroom-modifications-and-accommodations-for-students-with-learning-disabilities>. Psychological Services.

A Bridge to International Education: The International Exchange and Educational Program for Food Safety Internship

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ABSTRACT

Kagawa University has been developing more educational opportunities for international students. The Faculty of Agriculture hosts a 31-day International Exchange and Educational Program for Food Safety, Short Stay Program (SS Program). This program has been a bridge for graduate studies at the Graduate School of Agriculture, particularly for the Career Development Program on Food Safety (CDPFS) conducted in the Japanese language (JL).

Generally speaking, JL is thought to be difficult to master and science majors are reluctant to undertake studies in JL, even though JL ability is a key factor for a career in Japan. To address this, a JL language component was incorporated in the SS Program in cooperation with the International Office. The JL language component exposes international students to elementary level JL, including the writing system. From this experience, interns gained confidence that they can master JL during the CDPFS.

RATIONALE FOR THE SHORT STAY PROGRAM

Providing globalized educational opportunities is an important objective and the Japanese government encourages Japanese universities to attract more international students. The Japan Students Services Organization (JASSO) supports short stay programs that offer international students educational experiences in Japan. Another benefit of short stay programs is that they can be a tool for recruiting international students to regular, degree-awarding programs. Through the Faculty of Agriculture SS Program, participants can fully experience Kagawa University itself: they can stay in Japan, meet faculty members and Japanese students, conduct laboratory experiments, learn topics from related fields, and experience a rigorous academic internship which prepares them for advanced studies in Japan.

CDPFS AND SS PROGRAM

Japan is a world leader in food safety, both in industry and academia. Internationalization of university studies, particularly in globalized fields, strongly benefits from the participation of international students from a variety of countries. More specifically, as Kagawa University continues to provide human resources in globalized fields, international students that have graduated from courses conducted in JL, will be in demand. Most Japanese companies require all employees to have JL ability. CDPFS attracts students who wish to develop career in Japan, since in addition to studies in food safety, CDPFS has JL and Japanese business culture components.

BUILDING BRIDGES TO THE FUTURE

While students are attracted to studies leading to careers in Japanese companies, a language barrier still exists: JL is thought to be difficult to master, especially among science major students. Even though careers at Japanese companies are highly desired and

regarded, they might be less attractive because of the perceived language barrier. International students may think enrolling in CDPFS carries some risk due to a Japanese language requirement for graduation. Lutes et al. (2012) found that by participating in the SS Program, student perceptions, about their ability to learn JL, improved. The high rate of matriculation from SS Program interns to graduate studies at Kagawa University supports these findings (Fig. 1 below).

Of the SS Program interns (2011 - 2015), 44.7% were eligible to apply for the CDPFS and 9.7% matriculated. Furthermore, two SS Program interns matriculated in other programs at the Graduate School of Agriculture.

	Participants	Eligible to apply	Matriculated
2011	14	8	4
2012	15	5	1
2013	22	10	0 (1*)
2014	24	14	3
2015	28	9	2

Fig. 1 Applications from SS Program Interns to graduate studies
* accepted but declined offer of admission

Shioi et al. (2016) focused on the qualitative aspects and reported that participants had positive experiences using the JL and could communicate successfully with Japanese people which also supports the positive effect of the SS Program in allaying concerns about learning Japanese among science majors.

CONCLUDING REMARKS

The SS Program, established in 2011, has grown annually, and in 2016, 30 interns from 14 countries will take part. This SS Program has been recognized as a model program by JASSO (Kawamura et al., 2015) and the success of this program is contingent on attracting high quality students to the program that undertake advanced degrees at Kagawa University, the cooperation of our international partners, and the cooperation of the Faculty of Agriculture and International Office of Kagawa University.

REFERENCES

- [1] Kawamura, O., Tamura, T., Ogawa, M., & Lutes, P. (2015). *On-site Training between the Universities of Southeast and East Asia about the Education of Food Safety and Functional Analysis Program: The Short-term Visiting Program which is Linked Up with the Foreign Students of the Short-term Stay Program*. Student Exchange Web Magazine. Japan Student Services Organization, 4-49, 33-40. Retrieved on June 1, 2015 from <http://www.jasso.go.jp/about/documents/201504kothomlp.pdf>
- [2] Lutes, P., Takamizu, T., & Shioi, M. (2012). Effects of a short visit on perceptions of learning Japanese language. *Journal of Kagawa University International Office*. 3, 19-31.
- [3] Shioi, M., Takamizu, T., & Lutes, P. (2016) Japanese Language Learning for Science Majors in a Short Stay Program Revisited: Moving beyond 'Survival Japanese'. *Journal of Kagawa University International Office*. 7, 1-16.

“Sanuki Program”: Introducing a Sustainable Japanese Language and Culture Program

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ABSTRACT

The International Student Center of Kagawa University (KU) launched the “Sanuki Program” in October 2014. The primary aim is to attract more students from our sister universities, especially from Chiang Mai University (CMU).

This is a one-semester program that targets beginner students of the Japanese language (JL). With the launch of the “Sanuki Program”, these students now have an opportunity to study at KU as exchange students.

The program consists of classes in JL, Japanese current affairs, and other classes conducted in English. In addition, students need to take a research based class called “Project Sanuki”, whereby the student selects a research topic related to Kagawa.

This program is grounded on a previously existing program that targets international students coming on the Japanese government scholarship. By broadening the target to include international exchange students, we are simultaneously improving the ‘efficiency’ of the program. More students mean that, more ‘variety’ is added into the program. This, in a way, brings about a certain element of sustainability into the program.

We look forward to receiving more students from CMU coming into this program.

THE AIM OF THE PROGRAM

The primary aim of this program is to provide an additional avenue other than those provided by the faculties, to host students from our sister universities. KU has 83 university and faculty level agreements, and each of these allows mutual student exchange flows. Not all of these agreements are actively utilized. Generally speaking, agreements with East Asian countries and some European countries are active in this regard. Apart from these countries we only have a few inbound students. Apart from having students from CMU, we would like to host more students from a variety of countries and universities as well.

THE CONTENT OF THE PROGRAM

The program consists of three categories of classes. The first category is on the JL. JL classes offers opportunities to learn and practice the basics of the language. After finishing these classes, students can expect to achieve at least N5 level of the Japanese Language Proficiency Test, which means that they can understand some basic Japanese.

The second category are Japanese current affairs classes. These classes focus on things Japanese. Japanese students may also join these classes. In addition, we have another class on management at the Faculty of Economics, which is conducted in English. Japanese students can also join this class.

The third category, “Project Sanuki” is a research based class whereby students probe on issues related to Kagawa. Past topics have touched on issues such as udon noodles, Aji stones, Muslims in Kagawa.

SUSTAINABILITY OF THE PROGRAM

This program builds and expands on a previously existing program that targeted international research students coming in on the Japanese government scholarship. Due to the size of KU, we normally have about one to two such students in an academic year. We decided to expand this program to include exchange students recruited from our sister universities. In doing so, the program became more robust and livelier as more students from different backgrounds and countries began to come in.

There is another potential positive aspect in the “Sanuki Program”. We are presently in the process of twitching the rules to allow Japanese students to take those classes conducted in English in the program. In Japanese national universities, most of the classes at the undergraduate level are conducted in Japanese. Even though the Japanese government has been encouraging universities to have more classes conducted in English, it is not an easy undertaking to do. If “Sanuki Program” can open up the classes conducted in English to Japanese students as well, all parties concerned will certainly enjoy the benefits.

RECORD OF PARTICIPANTS

So far (as of May 2016), we have accepted two students from CMU, and eight students from University of Brunei Darussalam.

Sanuki Program: Number of students enrolled

Period	CMU	UBD	MEXT	Total
2014/10-2015/02		1	2	3
2015/04-2015/08		3	2	5
2015/10-2016/02	1	2		3
2016/04-2016/08	1	2	1	4
Total	2	8	5	15

Note: CMU: Chiang Mai University; UBD: University of Brunei Darussalam; MEXT: Ministry of Education, Culture, Sports, Science and Technology, Japan

FUTURE OF THE PROGRAM

We are planning to coordinate with the various faculties to provide more classes using English as the medium of instruction. If we are successful, this will enlarge the choices of classes for the students. At the same time, we are hoping to target more students from more universities and countries.

Elderly Care: Lessons from the Special Nursing Homes in Sendai, Japan

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INTRODUCTION

With a rapid increase in the proportion of the elderly in Japan since the second half of the 20th century, Japan is now the country with the highest ageing proportion (26 per cent of the population aged 65 and over) in the world. Demographically, Thailand is about three decades behind Japan in terms of fertility transition. Currently, Thailand has 11 per cent of the population that aged 65 and over. Despite the rapid increase of the elderly proportion, Thailand has limited knowledge and experiences in dealing with institutional care and social support for the elderly. Currently, there are only 12 government-supported elderly homes, 7 government-supported elderly day care centers, and 7 elderly homes, supported by the local administrative offices, across the country. Japan, on the other hand, is well-known for its institutional elderly care and support. Therefore, this paper aims to examine how Japan has coped with care and support for its elderly by focusing on the institutions' roles in social care and support.

BACKGROUND OF THE STUDY AREA

Sendai is the capital city of Miyagi Prefecture, and the largest city in the Tohoku region, Northeast of Tokyo on Honshu Island (FIGURE 1). It has a population of around one million and a population density of 1,300 per square-kilometers. Most people are in their early 50s and their 20s - 30s due to the first and second baby booms in Japan, and the University students. Sendai has 5 wards which are Aoba-ku (the administrative center), Izumi-ku, Miyagino-ku, Taihaku-ku, and Wakabayashi-ku. The study site of this study is Aoba-ku which encompasses about 300 square-kilometers, with a population of about 297,000 and 148,000 households (as of 2012).

RESEARCH METHODOLOGY

Secondary data had been collected from books, journals, articles from various different institutes related to population/elderly plans and policies. This included: Japan Aging Research Center, Institute of Population Problems, Ministry of Health, Labour, and Welfare; and the National Institute of Population and Social Security Research. Primary data had been collected from the interviews with 6 directors and 1 manager from 7 Special Nursing Homes for the elderly in Sendai, Japan. Interviews with the experts in the field of population had also been done, including Professors from Komazawa, Kyoto Bunkyo, and Kobe Universities, and Director and senior researchers of the National Institute of Population and Social Security Research.



FIGURE 1 THE STUDY AREA

RESULTS

Results discussed here will start with a brief introduction of the changing population structure of Japan which has led to the increasing proportion of the elderly, followed by the long term care for its elderly, before discussing the institutions' roles in social care and support.

Population structure of Japan

In 1945, at the end of the World War II, the estimated number of Japanese population was 72 million, and the baby boom period took about 4 years until 1950. During the 1950s, Japan had low rates of births and deaths due to the maternal and child health care and the introduction of Eugenic Protection Act that legalize abortion. The birth rates declined sharply from 28 to 17 per 1,000 population by 1960. The rates had slightly increased during the 1960s, then continued to decline rapidly in 1970s and 1980s, to 10 births per 1,000 population in 1990, and have gradually declined to around 8 births per 1,000 population in 2012 (FIGURE 2). There are many important socio-economic factors that facilitated the decline of fertility such as the changing socio-economic structure (industrial development and urbanization). More women engaged in the labour force, and have fewer children, more women have become single, and rate of divorce has been increased.

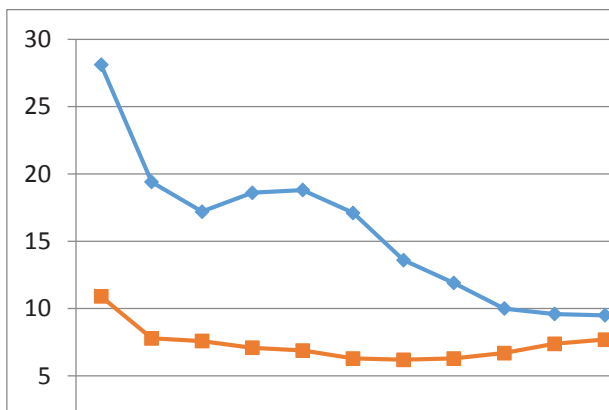


FIGURE 2. THE TREND OF BIRTH, DEATH, AND NATURAL INCREASE RATES OF JAPAN'S POPULATION

Japanese population reached 100 million in 1967 (FIGURE 3), and was declared as an aging society where the proportion of the elderly was 7 per cent, according to the 1970 census. The medical technological advance and increase in life expectancy/longevity have also facilitated to the increase of the elderly in Japan. The population aged 65 and over has increased rapidly from less than 5 per cent in 1950 to 9.1 per cent in 1980, to 17.4 per cent in 2000, and to 26 per cent in 2014. This proportion is expected to increase to almost 40 per cent by 2050 which means that 4 out of 10 people in Japan will be the elderly.

Long term care for the elderly in Japan

This study found that the system of institutional care and support for the elderly in Japan is very complex. However, the Japanese government has made the continuous effort to find solutions that suit the changing situation in terms of the

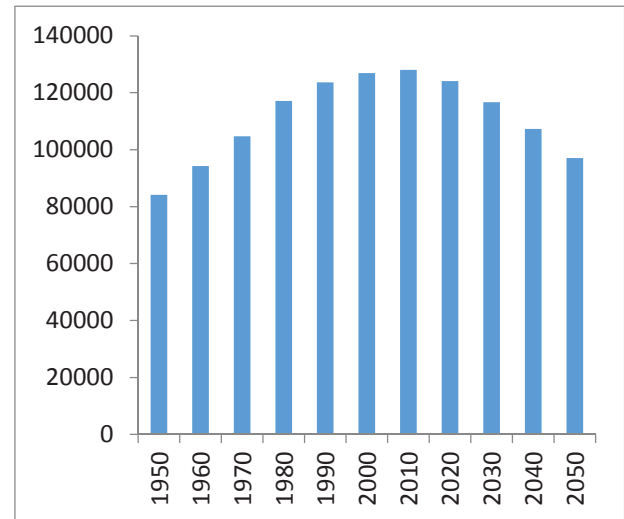


FIGURE 3. THE TREND OF JAPAN'S POPULATION, 1950-2050.

Source: Data from Statistics Bureau, Ministry of Internal Affairs and Communications; Ministry of Health, Labour and Welfare; Ministry of Land, Infrastructure, Transport and Tourism (2013).

changing population structure, the rapid increase of the elderly as well as the changing socio-economic. The Japanese government started to have the public pension insurance schemes since the first half of the twentieth century but has begun a proper action after the Second World War to cover all of its population. In 1941, the Employees' Pension Scheme was started, followed by the National Pension Scheme in 1961. These two schemes covered 90 per cent of the total workforce. Health Insurance Program was also provided with the three major plans that covered 87 per cent of the population. This program included the Association-managed Health Insurance Plan (AHIP) for people working in the large scale enterprise, the Government-managed Health Insurance Plan (GHIP) for people working in the small and medium size business, and the National Health Insurance Plan (NHIP), for people who were not covered by AHIP and GHIP, farmers, self-employed workers, and all employees, after retirement. In this plan, it included health and medical service program for the elderly. In 1963, there was the Welfare Law for the Aged which provided homes for the elderly, home care aid services and respite care (short stay program). In this law, it is believed that family members should take care of the elderly and Municipal governments would make decision on who would qualify for the benefits, depending on income and family members and family relationships. It has caused the increasing demand for long term care, and put pressure on the strict budgets restraints.

Due to the limitations of the Welfare Law for the Aged, the government had started the Health Service System for the Aged in 1982 which offered living space for elderly in need of care and even though it is originally with no co-payment, it later adopted a co-payment system in which the elderly paid 5 per cent of the total payment. Within this law, the local government welfare offices provided assistance and advice with social workers and volunteers, day service

centers, nursing homes, special nursing homes as well as group homes for elderly with dementia. As a consequence, many elderly chose to admit at hospitals instead of using the 'welfare system' which had complex procedure and investigate income and details of family's personal circumstances. However, since 1984, it appeared that other medical plans have to contribute to the National Health Insurance Plan because of the differences in the premium rates and the higher proportion of the aged that caused the weaknesses in financial foundation of the National Health Insurance Plan and the heavy subsidies of the government to cover the deficits. In 1985, the government approved for the establishment of institutions for long-term care for the elderly. In 1987, the White Paper on Health and Welfare had emphasized the responsibility of the elderly patients that should be shifted from hospitals to family caregivers and started the 10-year project called 'the Golden Plan' which was the social service programs for the elderly patients, and officially taken action from 1989 to 1999.

The Golden Plan involved municipal governments, to survey number of elderly in need and set specific plan for development of service infrastructure, and the local governments, to set the action plans based on municipalities within the district. It turned out that the target levels were not sufficient to meet the need of the population so the government revised this plan in 1994 and started a New Gold Plan which aimed to increase the number of home helpers, improve the capacity of short-stay facilities, provided day services at day centers as well as at-home services, with visits by doctors and nurses. However, there were still more demand than expected, and the supply of home care services and facility services had not kept up with the rapid need. In 1995, the average length of elderly stay in hospital was 33.7 days which was longer period than other developed countries. The Japanese government then had taken action in order to cover the growing long-term care expenses, and reimburse expenses for facility services and home care services to senior citizens who are in need of care by passing the Public Long-Term Care Insurance Law in 1997 which was effective in 2000. The Long-term Care Insurance System (LCIS) is caused from the need to ensure revenue source, the criticism raised against the conventional allocation system and the deterioration in the fiscal situation of medical care insurance caused by the long-term hospitalization of the elderly patients in need of care. The main contents of it are: 1) respect the choice made by consumers, regarding to their income level and family situation; 2) integrate the two systems (the Welfare System and the Health Service System for the Aged), based on both premiums and general tax and remove the overlap between the two systems; 3) encourage the entrance of diverse private-sector business into the market, due to the rapid increasing demand for long-term care services; and 4) introduce the concept of 'care management' that provide a variety of services in conjunction with one another to better meet the specific needs of the aged.

The roles of Special Nursing Homes

The government has updated regulations, channels, and procedures for the elderly to use the service for care and support, and, as the latest aim, to involve several scales of institutions from family to the community, local municipality,

prefecture, and national government. Therefore, there are many types of services for the elderly. After getting the care needs certification under the doctor's opinion and investigation, the elderly in need will get 2 types of support: care plan for care prevention and long-term care utilization plan. Under the care plan for care prevention, preventive benefits are long-term care prevention service and community-based service for preventive long-term care. Under the long-term care plan, care benefits are facility service, in-home service, and community-based service. The special nursing homes focused in this study is one of the facility service for long-term care plan. The 'special nursing home' can be defined as a facility with a capacity of 30 or more residents requiring long-term care (based on a facility service for long-term care plan), offering 24 hours service with no limits on residential period and provides assistance with activities of daily living such as care for bathing, toileting, eating, functional training, health controlling and recuperative caring.

There were 7 Special Nursing Homes in Aoba Ward which agreed to be interviewed. The oldest one was established in 1993. Four homes were established in the 1990s, 2 homes were established in the 2000s, and the recent one was established in 2011. The size of the home, number of staff and number of elderly resident are summarized in TABLE 1.

TABLE 1. THE SIZE, NUMBER OF STAFF AND RESIDENT IN THE STUDIED SPECIAL NURSING HOMES

Special Nursing Home	Size*	Number of staff		Number of resident (maximum)
		Full-time	Part-time	
1	Small	36	-	29
2	Small	21	8	50
3	Medium	55	-	55
4	Medium	50	-	70
5	Medium	90	-	70
6	Large	154	9	150
7	large	60	-	100

*Size of the Special Nursing Home is categorized here by using the number of resident where 50 residents or less is small size, 51-99 residents is medium size, 100 or more residents is large size.

The staffs working in the Special Nursing Homes include: directors, managing staffs/managers, nurses, care workers, general advisors, nutritionists, clerks, cleaners, and drivers. The number of resident shown in TABLE 1 is the number of Long-stay resident. In addition, in every studied Special Nursing Homes has services for Short-stay residents who are in need for temporary care (for a few weeks or a few months), and some Special Nursing Homes also have a day-care services. The number for the Short-stay resident is about one-third or up to half of the number of Long-stay resident.

About 90 per cent of the Special Nursing Homes has the maximum number of Long-stay resident with a very long waiting list of the elderly who want to stay in the Special Nursing Homes (TABLE 2). Unfortunately, those elderly have to wait until any of the Long-stay residents pass away which can take many years. It was found that about 10-20 per cent of the Long-stay residents passed away each year.

Around 80 per cent of the Long-term residents is female. The average age of the Long-stay resident is 85. A high proportion of the residents have dementia which is a chronic or persistent disorder of the mental processes caused by brain

disease or injury and marked by memory disorders, personality changes, and impaired reasoning. As most of the elderly in the Special Nursing Homes are the ‘very old’ elderly (aged 85 or more) with chronic disease, apart from the basic facilities such as nursing care, medical care, physical and other therapies, and assistance with daily life activities to meet with the elderly’s physical, social and psychological needs, special facilities also need to be provided for residents that could hardly help themselves such as bathing facilities (FIGURE 4).

TABLE 2. NUMBER OF THE ELDERLY ON WAITING LIST FOR EACH SPECIAL NURSING HOME

Special Nursing Home	Number of the elderly on waiting list
1	170
2	100-150
3	209
4	200
5	200
6	430
7	320

Most of the Special Nursing Homes provide extra activities for their residents. These include: co-activities with local community such as school, local residents (sing songs, play music, etc.), seasonal activities like going out to view cherry blossom, Christmas/New Year celebration, take the residents out for shopping, eating out in restaurants. They also have volunteers visiting the Special Nursing Homes occasionally to entertain the residents. Moreover, staffs from the Special Nursing Homes also give knowledge about elderly care support to students and staffs in local schools, teach how to cook for the elderly for families with elderly parents/grandparents, and train students from the local Universities.

Results on limitation of the management in Special Nursing Homes have shown that although they have been supported by the Social Welfare Organization, most of the Special Nursing Homes faces the problem of staff shortage. Apart from the changing population structure that led to the decrease number of working population, the rate of salary is quite low, the working environment, and the hard work do not attract the people/the new generation to work in Special Nursing Homes. Moreover, some Special Nursing Homes are located far from the city with no public transport. Moreover, some the staffs left the job each year which makes the situation even worst. Time spent on everyday hard work has to be combined with the training for the new workers (if any) every year. Another problem is the budget limitation, many Special Nursing Homes found that the insurance plan that keep changing occasionally makes it difficult for them to plan in a long-term. The salary for the workers cannot be increased due to the point system that relies only on the number of the patients. Some of them are in-debt because they invested in the buildings and expensive equipment. In addition, they are not allowed to change or modify the facility.



FIGURE 4. BATHING FACILITIES

DISCUSSIONS

Since the second half of the 20th century, Japan's population structure has changed rapidly which has led to the increase proportion of the elderly. Japan's population had reached 100 million in 1967, and has been declared as an ageing society in 1970. During those period, the welfare system and plans had been changed accordingly to suit with the increasing number of the elderly, the increase in longevity, the medical technological advance, and the socio-economic change. However, results from this study suggested that the changing population structure and composition has made the elderly care and support even more complex. The reduction of people in the working age has not just reduced the number of working population who pay taxes to support those facilities, but caused the shortage of labour in many sectors including caregivers. This has also been facilitated by the unattractiveness of the job, the low salary, and the working environment. Although the Japanese government has made an effort to import workers from Asian countries like Indonesia, Philippines, and Vietnam, the future that this imported workers would replace the Japanese workers in the field of caregivers is still uncertain concerning the Japanese language skills, the hard work and the working environment. Moreover, with the increasing rate of the 'very old' elderly, the difficulties in dealing with chronic diseases such as dementia has to be taken into consideration in every Special Nursing Homes.

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REFERENCES

- F. Coulmas, *Population Decline and Ageing in Japan – The Social Consequences*, Oxon: Routledge, 2007.
- Health, Labour and Welfare Statistics Association, *Handbook of Health and Welfare Statistics 2012*. Statistics and Information Department Minister's Secretariat, Ministry of Health, Labour and Welfare, Japan, 2013.
- Japan Aging Research Center, *Aging in Japan 1994*. Tokyo: Japan Aging Research Center (JARC), 1994.
- J. Kingston, *Contemporary Japan: History, Politics, and Social Change Since the 1980s*, Chichester: John Wiley & Sons, 2013.
- P. Olivares-Tirado and N. Tamiya, *Trends and Factors in Japan's Long-Term Care Insurance System: Japan's 10-year Experience*, The Netherlands: Springer, 2014.
- Y. Shigeyoshi (ed.), *Aging in Japan 1994*, Japan: Japan Aging Research Center, 1994.
- Statistics Bureaus, *Statistical Handbook of Japan 2013*. Ministry of Internal Affairs and Communications. Tokyo: Japan Statistical Association, 2013.
- N. Yagasaki (ed.), *Japan: Geographical Perspective on an Island Nation*. Third Edition. Tokyo: Teikoku-Shoin, 1997.
- Y. Wu, *The Care of the Elderly in Japan*, Oxon: Routledge 2014.

Climate change of Asian monsoon and its impact on society and humanity

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Climate change has large impact on people's life in Asian society. The author analyzed the global climate change such as El Nino / Southern Oscillation (ENSO), Indian Ocean dipole (IOD), tropical tropospheric warming (TTW) just after the El Nino events. The impact is different from region to region, but it can make serious damage. It has been shown that floods in Bangladesh and adjacent area including northeastern Indian subcontinent are strongly associated with the behavior of ENSO system. The author and co-investigators proposed a mechanism that connects the ENSO and rainfall of the monsoon system in the northeastern Indian subcontinent. This presentation will test the robustness of the mechanism with longer historical dataset, newly developed space borne radar system observation, and case study in the recent event. Further we will discuss about the impact of the monsoon system on the local society and humanity. One example is the epidemics of cholera and diarrhea in the Bengal Plain. It is well known that the epidemics of cholera have high relationship with ENSO behavior. The present study will try to detect the impacts of the marine environment in the northern Bay of Bengal and the monsoon rainfall in the northeastern Indian subcontinent.

INTRODUCTION

Cholera epidemics in Dhaka, Bangladesh have been well associated with the dynamics of El Nino / Southern Oscillation (ENSO)¹. The ENSO is one of the most prominent climate variabilities in the world, which is caused by the sea surface temperature variability over the tropical Pacific. This remote correlation between the climate system in the Pacific Ocean and the epidemics of cholera was explained by different two factors, local sea surface temperature variability over the Bay of Bengal² and the flood situation by heavy rainfall over the NE Indian subcontinent^{3,4}.

To address this problem, the author carried out the statistical analysis using both cholera and non-cholera diarrhea epidemics data from Dhaka ICDDR,B hospital. Special attention was focused on how the behavior of year-to-year variation of cholera and non-cholera diarrhea was explained by SST over the Bay of Bengal and rainfall variability.

RESULTS AND DISCUSSIONS

Firstly we described the behavior of climatological pattern of the cholera and non-cholera epidemics in Dhaka, Bangladesh. It is clearly seen that the seasonal patterns of cholera and non-cholera diarrhea epidemics are similar to each other. Two peaks are prominent in both the cholera and non-cholera epidemic patterns for early summer (dry season)

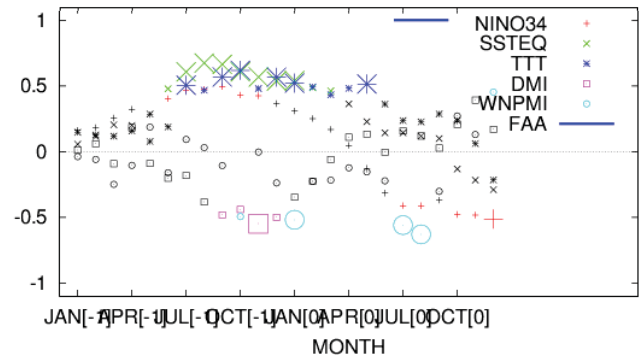


Fig. 1. Monthly correlation between five climatic indices with flood affected area data compiled by the Bangladesh Water Development Board (BWDB). June-to-September was indicated by the blue bar.

and late summer (wet season). However, the correlation between year-to-year variations in cholera and non-cholera epidemics is low in early summer peak and high in the late summer season peak. In the following, we concentrated on the late summer peak of the number of diarrhea patients.

The analysis of climate systems (Fig. 1) indicates that the flood affected area in Bangladesh was associated with the El Nino events maturing in the previous winter, and temperature increase in the tropical tropospheric temperature. Interestingly, the Indian Ocean Dipole also had significant correlation with flood in Bangladesh. Western North Pacific monsoon was significantly suppressed in summer especially in July and August. Thus, overall, the epidemics of diarrhea in Bangladesh were strongly affected by the variability of global climate system.

However, for the epidemics in late summer season, the SST variability over the northern Bay of Bengal has much more correlation for the cholera epidemics than the non-cholera epidemics. It indicates that the cholera mechanism has much more impact on the local SST anomaly in the northern Bay of Bengal.

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REFERENCES

- [1] S. G. Phillander, El Nino, La Nina, and the Southern Oscillation. Academic Press, 1989, pp.293.
- [2] M. Pascual, X. Rodo, S. P. Eliner, R. Colwell and M. J. Bouma. "Cholera dynamics and El Niño-Southern Oscillation." *Science*, vol. 289, pp. 1766-1769, 2000.
- [3] B. A. Cash, X. Rodo, and J. L. Kinter, "Links between Tropical Pacific SST and Cholera Incidence in Bangladesh: Role of the Eastern and Central Tropical Pacific," in *J. Climate*, vol.21, 2008, pp. 4647-4663.
- [4] T. Terao, F. Murata, A. Habib, M. S. H. Bhuiyan, S. A. Choudhury and T. Hayashi, "Impacts of Rapid Warm-To-Cold ENSO Transitions on Summer Monsoon Rainfall over the Northeastern Indian Subcontinent," in *J. Meteor. Soc. Japan*, Vol. 91, 2013, pp. 1-21.

Literature as a World's Healing Tool: Environmental Sustainability through Ecofeminist Perspectives in Louise Erdrich's Selected Novels

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Abstract – This paper aims to analyze ecofeminist perspectives in Chippewa Indian society, a tribe of Native Americans living in the midwestern region of the United States and in Ontario, Canada through the selected novels of Louise Erdrich: *The Birchbark House* (1999) and *The Porcupine Year* (2008), to examine the dominance of patriarchy that is the menace to women and nature, and to prove that ecofeminist perspectives can help support environmental sustainability. Erdrich's works reflect ecological awareness through Chippewa Indians' viewpoints in regard to respecting nature. Chippewa Indians truly believe that all things in nature – living things or non-living things – are sacred as they possess spiritual essence and also believe in the special power of women that can connect to the spirit in nature and heal people as medicine women. These viewpoints are clearly portrayed through the protagonist of two selected series novels, Omakayas – a young girl adopted to the family and Nokomis, her grandmother. Omakayas learns how to pay respect to nature from Nokomis. Though she is a child, she is able to help her family to survive the disease by using her special power to heal and take care of them. Also, she can help her family to survive starvation in a long winter by connecting to Great Spirit and having premonition for meat. Traditionally, there is a belief that women in Chippewa Indians had a very important role in tribal life. Still, woman abuse has occurred in the tribe. Erdrich portrays women oppression through some tribal female characters who suffer from domestic violence and are aggressively abused by a white man. As women are closely related to nature, being oppressed by men power can also affect nature as it is feminized. Nature possesses the same qualities of women and also faces the same oppression in the patriarchal society. All environmental problems people are facing nowadays have resulted from the progress of the Industrial Revolution in the late 1700s and early 1800s. The Industrial Revolution is marked as the major turning point to the world's ecology and human – nature relation. People have destroyed and exploited all natural resources in order to gain economic benefit which is valued best. The emergence of the Industrial Revolution has anthropocentrism as its basis. Anthropocentrism is a belief in the patriarchal society that human beings are the central entities of all species in the world and have the proper right to possess all things in the world as well. That is the reason why people hold this belief to use natural resources wastefully. This demonstrates that patriarchal ideology is the main problem for the world's ecology and equality. Thus, to eradicate inequalities, the oppression against women and nature and to revolute an ecological system, ecofeminism is raised here through literature to solve the problems and bring about environmental sustainability to the world as literature can be easily accessible and can be upheld to indoctrinate people to have ecological awareness and environmental concerns.

INTRODUCTION

Industrial Revolution in the late 1700s and early 1800s is the main cause that affects the world's ecological system. A large quantity of natural resources and environment have been destroyed and exploited consistently until the present, especially in the industrial fields. James Lovelock states that there is a persistent belief that the earth is human beings' property. This erroneous belief has led people to exploit nature wastefully for the benefit of mankind and for continuing their business without concerning for the following disaster [1]. Many people have agreed with the view that human beings are more superior to nature. Consequently, they believe they have the proper right to use and consume natural resources in every way with no cogitation. This viewpoint is related to anthropocentrism which views human beings as the central entities of the universe and the most superior of all species. Besides, among human species, men are considered the superior. Thus, this shows that anthropocentrism is rooted in the patriarchal ideology. David R. Keller and Frank B. Golley state that anthropocentrism is related to the patriarchal ideology because they are both "validated by the same conceptual logic" in supporting the male dominance over women and nature without regarding its negative effects [2].

Anthropocentrism: a main problem for women and nature

Anthropocentrism had derived from androcentrism, a male-centered perspective, which has been spread to many societies since ancient times. This perspective is entitled as "the oldest of oppression" by Vandana Shiva, an Indian scholar, environmental activist and anti-globalization author. Also, Ynestra King, an American ecofeminist author and activist, and Sharon Doubiago, an American author, both assert that, historically, women's oppression by the male dominance has manifested in the society prior to the oppression of nature by male power or by mankind. Karen J. Warren indicates that the conceptual view of patriarchy has dominated both women and nature as it has feminized nature and has validated women and nature to be lower than men and men's culture [3]. Being in the same inferior state of women and nature, Val Plumwood, an Australian ecofeminist philosopher and activist, explains that, in patriarchal society, women are recognized to be similar to nature because of their reproductive biology, emotion,

wildness, and being animal-like. These similarities only describe women and nature in a negative way [4]. Men had constructed this gender discrimination in order to brand women as “the Other” while men possess contrary traits which are positive and have the right to control women and nature. This contrasting views of men and women result in the creation of binary oppositions which derive from dualism of some ancient Greek and Roman philosophers, such as Plato, Aristotle, and Pythagorus. This dichotomy refers to a pair of relatively opposite terms, for instance, brightness – darkness, straight line – curve, odd number – even number, man – woman, reason – emotion, master – slave, culture – nature, and so on. Plumwood criticizes that dualism has the significant role in shaping Western people’s thoughts toward nature and taking root of Western civilization and patriarchy. Moreover, dualism is the important tool that rulers or masters use as a method in applying the logic of hierarchy by distinctly constructing identities of different terms. One contains positive characteristics – being in order, articulate, and important, whereas the other one is composed of negative traits such as being inferior, disordered, and ambiguous. Absolutely, women are put to possess the latter traits. So, men who are superior in the patriarchal society hold the concept of binary oppositions as the authority to oppress and subordinate women as well as exploit nature. This concept helps men to advocate women’s oppression and exploitation in natural resources [5].

In addition, anthropocentrism is clearly found in Christian Genesis creation story and Judeo - Christian Tradition. That is, there is a belief that God creates a man (Adam) and assigns him to take care and rule over nature (the Garden of Eden). When man has an authority from God to rule over nature which is set to provide benefits for humans’ living, man then exploits nature and uses it without restraint [6]. Therefore, it can be said that anthropocentrism gives the Westerners the proper right to exploit natural resources as much as they can. This can be seen in following excerpt from the Holy Bible [7]:

Then God said, “Let us make man in Our image, after Our likeness. And let them have dominion over the fish of the sea and over the birds of the heavens and over the livestock and over all the earth and over every creeping thing that creeps on the earth.

So God created man in His own image, in the image of God He created him; male and female He created them.

And God blessed them. And God said to them, “Be fruitful and multiply and fill the earth and subdue it, and have dominion over the fish of the sea and over the birds of the heavens and over every living thing that moves on the earth.”

And God said, “Behold, I have given you every plant yielding seed that is on the face of all the earth, and every tree with seed in its fruit. You shall have them for food.

(Genesis 1: 26-29)

The above excerpt demonstrates that Christianity has supported and condoned man’s dominance over nature. Early philosophers and scientists had claimed this belief was right and reasonable to support their attempt to explain and conquer nature in every way. For example, René Descartes – a French philosopher – had stated that animals were inferior to human beings in every aspect. Though some animals act like human, they did not have spiritual essence and consciousness as human have. Human beings are the only species in the world that possesses spiritual essence, consciousness, rationality, and wisdom [7].

Thus, nature and women are inevitably trapped in men’s power in the patriarchal society, though they both are in the role of mothers who give birth and nurture mankind. Sherry Ortner, an American anthropologist, has suggested that “female to male as nature is to culture.” This statement indicates that women are unavoidably viewed as inferior to men and nature is perceived as subordinated to culture. According to this reproduction of patriarchal discourse, in other words, Ortner considers that human beings inherently regard themselves as superior to nature (or being closer to culture) as well as men regard themselves as superior to women. By the way, comparing female to nature is to signify that women are physically and mentally closer to nature than men and to reinforce women’s association with nature. If this metaphor is true, so the only hope for women’s freedom is to return to nature [8]. This is the role and significance of ecofeminism to retrieve freedom to nature and environment as well as freedom of women from being under male domination.

Ecofeminism

Ecofeminism is a branch of feminist approaches that has a bonding of feminism and ecology. This perspective examines the unity and connections between women and nature. Ecofeminist philosophers and activists believe that the patriarchal ideology, a social system in which men have power over women, leads to dominance and oppression of nature and environment. The word “ecofeminism” firstly appeared in the book *Féminisme ou la Mort* written by Françoise d’Eaubonne, a French feminist author. D’Eaubonne has suggested that the oppression against women in the patriarchal world is directly related to environmental degradation. Then, in the 1980s, Karen J. Warren concluded d’Eaubonne’s concept regarding ecofeminism that people should have understanding about women’s oppression and environmental degradation in order to recognize the connection of these problematic aspects. The theory and practice of feminism should have ecological views included. Similarly, the feminist theory and practice, ecological problem solving should be related to feminist perspectives [9]. Therefore, it is clear that nature and women are inseparably connected to each other. Women are often in harmony with nature and are more sensitive to fertility and deterioration of nature than men. Under the patriarchal ideology, women and nature are facing the same problems. That is, they both are potential victims of men. Chairat Charoensin-o-larn has stated that if women can free

themselves from male dominance, nature can also be free because women and nature are recognized as the oneness [10]. Ecofeminist approach, moreover, provides a controversy regarding the existence of sex oppression, environmental degradation, and inequalities of all forms, especially gender and race. This approach has emerged to heal the earth and revolute an ecological system which will demonstrate a new form of gender relation of men – women and of humans – nature. The main purpose of ecofeminism is to eradicate the oppression against women and nature.

Connection between Women and Nature

The state of being in harmony with nature of women is obviously portrayed in the book series, *The Birchbark House* (1999) and *The Porcupine Year* (2008) of Louise Erdrich, who addresses herself as a Chippewa Indian - American author. Chippewa Indians (or Ojibwe or Anishinaabe) is a tribe of Native Americans living in the midwestern region of the United States – North Dakota, Michigan, Wisconsin, and Minnesota and in Ontario, Canada. Erdrich used to live in Wahpeton, North Dakota when she was young because her German - American father and her French - Chippewa Indian - American mother had taught at a boarding school set up by the Bureau of Indian Affairs there. Her parents had always told her about the relationship between Native Americans and the white men. Also, they both had supported and encouraged her to read and tell stories according to the verbal tradition of Native Americans. These had led her to start the journey on Lake of the Wood which is located on the Canada – United States border when she was older in order to find out and learn about her descents' history and roots. Erdrich states in her biological book, *Book and Islands in Ojibwe Country*, that she had grown up on the Great Plains which is far away from those islands for many hundred miles. As Erdrich realizes that she has descended from people over there, those islands have haunted her all the time. That is a reason that she decided to visit Lake of the Wood. Then, she has enrolled to The Turtle Mountain Band of Chippewa Indians and has become a well-known tribal author until now [11]. In the late 1960s and early 1970s, there was the Red Power or American Indian Movements (A.I.M.), one of the movements occurred in the United States during the Civil Rights Era. The tribal works had an important role at that time and was marked as “Native Renaissance” or “Indian Renaissance” in literature. Erdrich's works have become widely remarkable at that time [12].

The tribal stories throughout Erdrich's novels are told from insiders and based on true stories of her descent on Lake of the Woods. Her works reflect ecological awareness through Chippewa Indians' viewpoints in regard to respecting nature. Chippewa Indians truly believe that all things in nature – living things or non-living things – are sacred as they possess spiritual essence. Thus, the Chippewa Indians seek to live in harmony with nature respectfully. This tribal characteristic is clearly portrayed through Nokomis who is a grandmother of Omakayas, the protagonist of these novels. Nokomis is a role model for Omakayas in

respecting all things in nature because nature is the great giver. In *The Birchbark House*, there is a scene in which Nokomis goes to find some birchbark to build a house in the springtime. Having treated the birchbark tree as a respectful person, Nokomis politely begs the tree for its barks and made an offering to the spirits with tobacco, as seen in the following:

“Old sister,” she said to the birchbark tree, “we need your skin for our shelter.”
At the base of the tree, Nokomis left her offering, sweet and fragrant. Then she peered closely, deciding just where to make the first cut. (7-8)

Also, in the scene in which the family has to move for a new location to prepare for the coming winter, Nokomis respectfully prayed for the spirits to protect her family during the winter as in following:

“Anishaa,” she breathed quietly, standing again, holding in her palm a tiny mound of tobacco. She looked down at the tobacco, touched it lovingly, and asked the spirits for protection against the cold. She spoke to the creator. “We're very small,” she said, “just human. Help us to live this winter through. Come to us, especially, during the harshest moon, the Crust On Snow Moon, when so often meat is scarce, when the ice is too thick to catch many fish, when disease breaks us and the windigo spirit, the Hungry One, comes stalking from house to Anishinabe house. Oh, daga, wedookaow Anishinabeg. Wedookaow Anishinabeg,” she asked. (101-102)

The above excerpts reveal how grateful and respectful of Chippewa Indian women toward nature. Nature is regarded as their relatives according to the word “old sister” that Nokomis says to the tree and this word also signifies seniority of nature that early exists and should gain respect of human beings who came on earth later. Also, Chippewa Indian women believe that nature has spirit that can protect and take care of them whenever they face hard times.

Moreover, Chippewa Indians specially believe in the special power of women that can connect to the spirit in nature. This special power is essential for healing people as medicine women. Though there are medicine men in the tribe, Chippewa Indians still believe that women have more healing power than men. Chippewa Indian women traditionally had a very important role in tribal life. They could be builders, farmers, craftswomen, warriors and medicine women. Having the special power to connect to the spirit in nature for the sake of healing and freeing people from many difficulties, Chippewa Indian women were accepted as respectful and mother-like persons. In other words, they are the representation of the Great Mother who nurtures and protects humankind.

Besides, in *The Birchbark House*, Nokomis instinctively has the special power to connect to nature. She can find some medicines or herbs in the woods by listening to plants' whispering. This special trait of her enables her to

become a medicine woman in her community. When some family members suffer from smallpox, Nokomis is able to heal and take care of them by using her medicinal plants and her intrinsic instinct of healing until they finally get better. Similar to her grandmother, Omakayas –a seven- year-old girl – also has this special power. She helps Nokomis in healing her family from a severe disease. Additionally, when her grandmother is extremely tired from a lack of sleep, Omakayas is the one who is responsible for taking care of the whole family. In the scene in which her father's feet are mortally wounded, Omakayas is able to follow her instinct to find some special herbs to heal her father until the wound is completely cured which extremely surprise her grandmother who had taught her this skill.

Moreover, Nokomis has a special intuition enabling her to communicate with the Great Spirit. In the novel *The Birchbark House*, Nokomis respectfully pleads for the Great Spirit's protection of her family during the hard winter. When the winter lasts long and the provision they have preserved is not enough for everyone in the family, all family members have suffered from starvation. Then, Nokomis dreams of the Great Spirit coming to tell her about an exact location of a deer lying in the woods. Nokomis tells this dream to Deydey, Omakayas' father. After having been told, Deydey difficultly walks through snow into the woods, he eventually finds a deer. He then hunts it and brings it home to feed the family. So everyone finally survives the hard winter.

In *The Porcupine Year*, Omakayas also has the same special trait of her grandmother. When she reaches her nine years old, she has a premonition that Old Tallow would pass away after fighting with a huge bear, in exchange of having bear meat as food for all starving people in a long winter. Omakayas could hear the Great Spirit's voice whispering to her:

“My relatives, nindinawemaganidok,” Omakayas heard her beloved protector say, “it is time for Old Tallow to hunt the bear!” (116)

All these selected scenes help to manifest the special power of Chippewa Indian women in connecting nature or the spirits in nature for the sake of healing others. Erdrich has clearly demonstrated in her novels that women who have paid respect to nature are endowed with special intuition or ability to communicate with the Great Spirit or supernatural beings. Therefore, women are often seen in harmony with nature because they mutually depend on and respect each other.

Male Dominance of Women

Even if women play significant roles in Chippewa Indian society, woman abuse has still occurred in the tribe. Erdrich's works reveal the oppression and maltreatment of men against women in the past and the present. The aspect of male dominance of women particularly appears in *The Porcupine Year* in which the protagonist, Omakayas, has

grown older enough to perceive some harsh realities of the world. The male oppression against women is firstly told to her by Nokomis, her grandmother. For instance, Nokomis tells her a traditional story-telling about The Bear Girl named Makoons who was born a bear to a human family. Because Makoons has the ability to bring the sun to a village which has been in darkness for a long time by a bad medicine woman's curse, the chief of the village forces his son to marry her in exchange. However, due to the unpleasant appearance of Makoons, she is badly treated by the chief's son. The chief's son makes her sleep on the floor while he sleeps in bed. Makoons cannot endure his maltreatment, she then asks him to get rid of her by throwing her into fire. As soon as the fire destroys her bear figure, Makoons becomes a beautiful woman. Even though the chief's son repeatedly begs her to be his wife again, she abruptly denies him and decides to return to her home. This traditional story-telling demonstrates that not only women's oppression but also women's resistance has existed in the tribal society for a long time. Even though Chippewa Indians value the significant role of women, the patriarchal system is still powerful.

Another story-telling of Nokomis is a story of Old Tallow, the best friend of her, who was known as Light Moving in the Leaves when she was young. At the age of ten, Light Moving in the Leaves was only the girl in the family who survived the sickness. Unfortunately, she was sold to a cruel voyageur named Charette by some unscrupulous persons. Charette, a white man, has maltreated her severely. He abuses her by making her do a great deal of work which is over the power of a ten-year-old girl. He lets her sleep and eat some bones with dogs. He treats her as though she was an animal. Also, he adds the weight upon her back to carry everyday so that she feels like her bones were going to break. Living among a pack of dogs everyday finally makes Light Moving in the Leaves know dogs' language and can communicate with them. Light Moving in the Leaves, then is called by him Tallow, is able to understand dogs' grief as they have to face the same maltreatment. As times go by, Tallow has grown stronger whereas Charette becomes old, weak, and get sick. She realizes that she is not an animal and should set herself free from Charette's dominance. At first, she hesitates how to deal with Charette – to take care of him due to his sickness or to leave him alone. With their fury toward him for a long time, a pack of Charette's dogs finally help her out by devouring Charette alive and serves Tallow as their master from then on. This story not only reveals an aggressive abuse of men against woman and animals, but also shows that a white man cruelly maltreats a tribal woman. This problem is widely spread when the white men have interfered in the tribes' land and extended their power over the tribal society.

Being loyal to the white men of some Native American men can affect tribesmen's attitudes and behaviors as well. Many tribesmen have taken alcohol-drinking culture from the white men and become alcoholic. Alcohol use of tribesmen can cause domestic violence against women and children. Domestic violence is also found in *The Porcupine Year* through the character Muskrat who has a husband named Robert LaPautre. He wholeheartedly takes side with

the white men. Becoming an alcoholic, he maltreats his wife and children and deserts his family. Moreover, he conspires with other men and steals other people's provision including his family's and relatives'. These following excerpts obviously show LaPautre's abuse against women:

Albert opened his mouth in an oily grin and stepped closer. Omakayas noticed that he'd lost several teeth. All of a sudden, he lunged, caught Old Tallow around the middle, and knocked her to the ground. (95)

After Albert LaPautre leaves his tribal family to serve the white men, he then conspires with some betrayal tribal men to plunder other tribal family despite his relatives. Even though Old Tallow is an old woman, he still violently attacks her. LaPautre is a male tribal character who reveals his wickedness and betrayal to his own tribes as his wife, Muskrat, mentions to in this following scene:

Muskkrat : I am sorry, my mother. What have I become? This winter has been very hard for us, too, without you, our family. And my old husband, ninaabemish . . . ah, how I loved the old scoundrel. I am sorry I insulted you, Mikwam. I believed that my Albert-ish would stay with us. Even though he was drinking, I allowed him back into our lodge. Again, he stole from us and deserted us. He has hurt Two Strike's heart, for she adored him and was certain that he would stay by her. How alone I am, nindinawemaganidok, please don't despise me. Never again shall I trust that devil. Ingiiwebinidi-in. I have thrown him away!" (154)

The above dialogue shows how evil LaPautre is. Not only abandon his family in the hard time (winter), he also steals some provision and stuffs that are stored for the whole family to eat and use during the wintertime and maltreats his daughter who adores him best and sets him as her idol. This clearly shows the domestic violence of Chippewa Indian society while the traditionally significant roles of women in the tribes no longer matter.

Anyway, there is a redundant mention about alcohol that being used by LaPautre and it can entirely change his behavior.

He'd neglected his family and believed himself a famous medicine man, he'd been known to steal a dried fish or two, but he had never been cruel. "Perhaps the ishkodewaaboo has destroyed his heart," Yellow Kettle said. (101)

The word "ishkodewaaboo" means alcohol or liquor in Chippewa language. Alcohol is regarded as a white men's culture that has destroyed the tribal men's lives for a long time. Erdrich has told a story about a young tribal man with alcohol in her *Books and Islands in Ojibwe Country*. This young nice man who is a good hunter trades his things with the first white trader in the islands. Firstly, he trades for

things he needs and then also for liquor. The white trader uses liquor as a tool to defraud him. As times go by, he becomes alcoholic and his family leaves him. As an alcoholic, he cannot go hunting as usual and finally becomes a vagrant who waits for the Death Spirit to sing him the old song before taking his life. The old song of the tribes named "nagamonan" has the words as following repeatedly:

Kiiwashkwe biishki indigo anishaa dash indigo
(I am drunk. I am nothing.)

This song was initially sung by a drunken man in the past who suffered from the intervention of the white trader coming to Chippewa land during the eighteenth century, "when the fur trade began the first alterations that would forever shift the economic, social, and spiritual balance of Ojibwe life in Lake of the Wood" [13]. So, these reveal that alcohol is the white's evil culture that has affected and destroyed Native American's lives for a long time. Its power can totally ruin good people and can probably cause wickedness as a male character in the story.

However, from three stories above, though women are maltreated by male dominance, the resistance is still found in all female characters' reaction. Makoon, the Bear Girl, no longer let herself to be in male control again even though her husband wholeheartedly begs for her love. She insists to live her life at her home rather than to be risky in male power. Light Moving in the Leaves or Tallow finally decides to free herself from Charette's brutal power and lives her life in the tribal community with her sturdy body and stronger mind and a pack of dogs that become her loyal friends. Muskrat throws away her alcoholic husband, LaPautre and no longer hopes for the coming of him. She can be a mother who deals all works in the family during the hard wintertime and takes good care of her children. All of these reveal that all female characters are strong and are not submissive under male dominance. The noticeable observation about these female characters is that they do not use force against male characters in return at all, though they had been badly treated or even they will have a chance to revenge those men. This shows that women preferably aim to live peacefully and equally to men in the society without any dominance over one another. The intention of ecofeminist perspective is to eradicate only the male oppression against women and nature, not eradicate each other.

The aforementioned novels reveal that in a patriarchal society, men are superior to women and that white people are superior to the Native Americans. In other words, both women and the Native Americans are maltreated under the patriarchal ideology. Both are alike in that they are closely connected to nature. As supported by Ortner's statement, "female to male as nature is to culture", Native Americans were often seen as inferior to the white men because the tribal people are regarded that they do not have culture whereas the white are civilized enough to rule over the tribes and seize their land in order to intentionally exploit natural resources. So, Native Americans can be feminized here whereas the white men are masculinized.

Besides, this following excerpt reveals the tribesman's attitude toward the white's investment in tribal land regarding this aspect:

Deydey did not trust the white people, the chimookomanag. He did not trust the chiefs. He did not trust the one they called "great father" off in Washington. *He is not my great father*, Deydey would say. *I have seen him starve our people. I have seen him take our land. No father kills his children and leaves them homeless!* So Deydey did not trust the idea of one big homeland for all of the Anishinabeg. (45)

According to this above excerpt, it obviously demonstrates distress and anger of Native American people toward their colonizers, American people. The word "chimookomanag" that Chippewa Indian people use to call the white men means "big knives" which symbolize dangerous and harmful things that have hurt and destroyed Native American people until the present, especially to their Great Mother, nature.

Nature is as Great Mother or Mother Earth for Native American people. So when the white men have seized their land and have ruined the land by doing investments or industries such as mining, it is similar to ruin their mother as well. Carolyn Merchant, an American ecofeminist philosopher, has said that "for most traditional cultures, minerals and metals ripened in the uterus of the Earth Mother, mines were compared to her vagina, and metallurgy was the human hastening of the birth of the living metal in the artificial womb of the furnace – an abortion of the metal's natural growth cycle before its time" [14]. This demonstrates how people who respect nature like Native American people will feel whenever their mother or their land is devastated. Also, this clearly shows how disgusting the white men are in rapidly exploit natural resources.

Not only Chippewa Indian people, other tribes of Native American people have suffered from the interference of the white men for a long time as the white men have come to occupy their land and wastefully exploit natural resources that they respect and value best. There is a great speech of a Smohalla (a tribe of Native Americans) prophet in rejecting the U.S. government's demand to move to the reservation and to take up farming and mining stated in Kinsley's *Ecology and Religion* [15]:

"You ask me to plow the ground! Shall I take a knife and tear my mother's bosom? Then when I die she will not take me to her bosom to rest. You ask me to dig for stone! Shall I dig under her skin for her bones? Then when I die I cannot enter her body to be born again. You ask me to cut grass and make hay and sell it, and be rich like white men! But how dare I cut off my mother's hair?"

The above speech vividly reveals the great respect and great gratitude toward their Great Mother and also the determined insistence of Native American people to protect their own land.

As shown above, it is obviously demonstrated that male dominance, both in literal and allegorical meaning, is menacing and problematic. Not only harm women, this patriarchal perspective have also ruined nature which is the source of all living things' lives.

Literature as an Influential Tool on Society

Literature has a great impact on society because it can reflect society and reveal issues or aspects in the society that need to be improved and changed. As a mass art, literature can be easily accessible to various types of people and can arouse people to concentrate and concern in which problematic aspects occurring in the societal trend in order to find solution and create improvement toward that aspects.

These two novels, *The Birchbark House* (1999) and *The Porcupine Year* (2008) are selected for this research to demonstrate ecological awareness and ecofeminist perspectives through the viewpoints of Chippewa Indian peoples. As a children book series, the researcher believes that these books can convince and indoctrinate children to be eco-minded and pay attention to environmental essence together with taking care of them. Because of children are in the stage of thinking and social development, especially in the year of seven - nine like the protagonist, there is a tendency that ecological awareness will be settled down to their intuition. Not only ecological awareness that they will have, it is also the gender equality that they will help create to extend the sustainable society and the peaceful world.

Louise Erdrich loves literature and writing as she had been trained to read and tell story according to the oral tradition of Native Americans. So, this tradition influences her to express her thoughts and opinion, especially distress and resistance toward American people, by writing novels. As Erdrich states in her *Book and Islands in Ojibwe Country* that she prefers the tribal name Ojibwe best as it derives from the verb Ozhibii'ige, which means "to write". She indicates that Ojibwe (or Chippewa Indian) people are great writers, that is because they are also great storytellers [16]. Storytelling and writing are the ways that Chippewa Indian people use to express their resistance and distress toward the white men and also to express their respecting for nature and ecological concerns.

Thus, this shows that Native American community has ecological awareness and respect nature as the great giver or the Great Mother according to ecofeminist point of view. Respecting nature and believe in the natural spirit let people cause no harm to nature. This perspective can effectively bring about the sustainability to the society.

Conclusion

The two novels, *The Birchbark House* (1999) and *The Porcupine Year* (2008), have demonstrated that the patriarchal ideology is the main problem for women and

nature. Especially, the patriarchal system in the white men's society which will certainly attempt to push the capitalism and industrial development forward for their business as they value best without recognizing environmental degradation or pollution as well as women's values and potentiality. Because of the increase of environment and women's problems, ecofeminism has emerged to heal the earth, revolute an ecological system and eradicate the oppression against women and nature. Thus, having ecofeminist perspectives as the significant viewpoint to live our lives with nature and environment like Chippewa Indian women can definitely solve gender inequality, environmental problems and extend environmental existence and sustainability to our world as well.

ACKNOWLEDGMENTS

I would like to express my heartfelt gratitude to my generous adviser, Dr. Chalathip Wasuwat, for her assistance, guidance, inspiration and understanding which help me through the difficulties during the working process of this research. Without her assistance, this research would not be completed. Also, I would like to express my thanks to Assoc. Prof. Naruemol Teerawat for her useful guidance and suggestions.

REFERENCES

- [1] Lovelock, J. (2007). *The Revenge of Gaia*. London: Penguin Books, 173.
- [2] Dalile, B. (2000). *Environmental ethics: Between anthropocentrism and ecocentrism*. Retrieved May 13, 2014, from [http://www.academia.edu/1476524/ Environmental_Ethics_Between_Anthropocentrism_and_Ecocentrism](http://www.academia.edu/1476524/Environmental_Ethics_Between_Anthropocentrism_and_Ecocentrism)
- [3] Slicer, D. (1994). Wrongs of passage: Three challenges to the maturing of ecofeminism. In K. J. Warren (Ed.), *Ecological Feminism*. London: Routledge, pp. 30-31.
- [4] Plumwood, V. (1993). *Feminism and the Mastery of Nature*. London: Routledge, 21.
- [5] Ganjanapan, S. (2011). *Green Thinking, Discourse, and Movement*. Chiang Mai: Social Research Institute and faculty of Social Sciences, pp. 175 - 176.
- [6] Sangkhaphanthanon, T. (2009). *Ecocriticism: Discourse of Nature and Environments in Thai Literature*. Doctoral dissertation, Naresuan University, Thailand.
- [7] Kinsley, D. (2008). *Ecology and Religion* (L. Suphmantra, Trans.). Bangkok: Plan Printing. (Original work published 1995), pp. 226, 244.
- [8] Merchant, C. (1990). Ecofeminism and feminist theory. In I. Diamond & G. F. Orenstein (Eds.), *Reweaving the World: The Emergence of ecofeminism*. San Francisco: Sierra Club Books, 102.
- [9] Sukhumvada, S. (2009). *Earth-based Spirituality in Selected Contemporary American Women Authors*. Chiang Mai: Chiang Mai University, 16.
- [10] Charoensin-o-larn, C. (2011). *Development Discourse: Power, Knowledge, Truth, Identity and Otherness*. Bangkok: Wipasa, 295.
- [11] Erdrich, L. (2003). *Books and Islands in Ojibwe Country*. Washington, DC: National Geographic Society, 4.
- [12] Lee, A.R. (2010). Gerald Vizenor: Postindian gamester. In D. Seed (Ed.), *A Companion to twentieth-century United States fiction*. West Sussex: Blackwell, 508.
- [13] Erdrich, L. (2003). *Books and Islands in Ojibwe Country*. Washington, DC: National Geographic Society, pp. 38 - 41.
- [14] Merchant, C. (1980). *The Death of Nature: Women, Ecology and the Scientific Revolution*. New York: HarperCollins, pp. 3 -4.
- [15] Kinsley, D. (2008). *Ecology and Religion* (L. Suphmantra, Trans.). Bangkok: Plan Printing. (Original work published 1995), 128.
- [16] Erdrich, L. (2003). *Books and Islands in Ojibwe Country*. Washington, DC: National Geographic Society, 10.
- [17] *Development of Thai Organic*. Retrieved February 25, 2016, from <http://www.green.net.or.th/en/article/1367>
- [18] *AgriBioMediterraneo*. Retrieved February 25, 2016, from http://www.ifoam.bio/sites/default/files/page/files/abm_flyer.pdf

Poster Presentation

POSTER PRESENTATIONS

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P- 3	Sustainability in Chiang Mai's Maize Production Management: A Holistic Approach (<i>refer to page 58</i>)	Supalin Saranwong	CMU
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P- 12	Design and implementation of an WEB system for error correction code learning	Akira Nakayama	KU
P- 13	Development of Flexion Lock Function for Passive Transfemoral Prosthetic Knee during Stair Ascending	Tatsuya Sugimoto	KU
P- 14	Effects of Upper Limb Balance Training on Standing Postural Control	Masahiro Takebayashi	KU

P- 15	Design of Rotation Center Position of Transfemoral Prosthetic Knee Joint Unit Based on Gait Analysis of Intact Subjects	TomohiroTanaka	KU
P- 16	Evaluation of enzymatic epimerization for all deoxy-ketohexoses by D-Tagatose 3-epimerase from <i>Pseudomonas cichorii</i> ST24	Takuya Kumagai	KU
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P- 22	Carbendazim-resistant isolates of <i>Pestalotiopsis</i> sp. Causing Strawberry Leaf Blight	Jitparpat Kummanid	KU
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P- 36	Effects of Recombinant <i>Saccharomyces cerevisiae</i> on Ruminal Degradability of Napier and Ruzi in Thai Native Cattle (<i>refer to page 48</i>)	Soparak Khemarach	CMU

Determination of Physicochemical Properties of Various Magnetic Ionic Liquids

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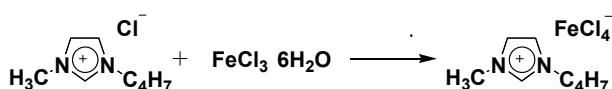
When 1-butyl-3-methyl imidazolium chloride crystal and the crystal of iron chloride (III) hexahydrate were mixed equimolar amount, endothermic solid-phase reaction occurs and the liquid of dark brown tetrakis chloro iron (III) -1- butyl-3-methyl-imidazolium and the water was produced. Using the same method we synthesize a variety of magnetic ionic liquids. In addition, the synthesized magnetic ionic liquid, to examine the physical-chemical properties such as spectroscopic properties and thermal properties, and describes findings conducted compared..

INTRODUCTION

A Ionic liquids (ILs) have unique physicochemical properties, such as low vapour pressure, high thermal stability, a wide electrochemical window, broad liquid range, and excellent solvation ability to dissolve many organic and inorganic compounds.[1] Ionic liquids have also received growing interest in the field of materials sciences. Hamaguchi[2] and Saito[3] independently reported the magnetic properties of [C4mim][FeCl4]. Interestingly, no attention had been paid to this property of the salt until then; Angell and co-workers meanwhile investigated physical properties of [C4mim][FeCl4].[4] Application of the magnetic ionic liquids are receiving growing interest nowadays, [5] and iron-containing MCILs have been used for extraction of aromatic cluster materials from coal direct liquefaction residues. [6] We were fascinated by the interesting physical phenomena of MCILs from the standpoint of teaching science in high school and decided to develop convenient and practical means for preparing them.

RESULTS AND DISCUSSIONS

I have found that the magnetic ionic liquid can be synthesized from the ionic liquid from previous studies in our laboratory. I was synthesized magnetic ionic liquid corresponding to the ionic liquid of each and stirred at a rate of equimolar FeCl₃·6H₂O and the ionic liquid. Ionic liquid. I knew that magnetic ionic liquid can also be synthesized with a cobalt salt than previous studies and I was prepared similarly. The ionic liquid was prepared by direct mixing of anhydrous FeCl₃ and [bmim][Cl] in an Ar-atmosphere. In our laboratory, we focused it is considered a ferromagnetic material and can be synthesized, for the synthesis of magnetic ionic liquid containing iron salts. Synthesis Representative examples are given below(Scheme 1).



Scheme 1

The differential scanning calorimeter (hereinafter DSC), while giving a certain amount of heat, by measuring the temperature of the sample and reference material, is regarded

as the temperature difference between the thermal properties of the sample, measuring the exothermic reaction or endothermic reaction by the state change of the sample is a device for. In many of their physical properties research, in order to confirm the thermal stability, thermal analysis using such as differential scanning calorimetry and thermal gravity analysis – differential thermal analysis (TG-DTA) and so on have been made on ionic liquids and their crystals. Make it possible to figure out not only the reaction of the state change caused by simple heat such as melting, phase transition of the structure, such as crystallization, polymer materials, organic materials, metals, thermal properties measured by the DSC, such as ceramic and are widely used in evaluation of physical properties(Figure 1).

We succeeded in preparing novel magnetic ionic liquids by a very simple method. The hybrid anion type magnetic imidazolium salt ionic liquid, prepared. It has enough lifetime to use it as a teaching material of magnetic ionic liquid in a high school class. These magnetic ionic liquids are expected to become a new class of magnetic/electrical fluids with potential further applications. We succeeded in preparing novel magnetic ionic liquids by a very simple method. The hybrid anion type magnetic imidazolium salt ionic liquid, prepared. It has enough lifetime to use it as a teaching material of magnetic ionic liquid in a high school class. These magnetic ionic liquids are expected to become a new class of magnetic/electrical fluids with potential further applications.

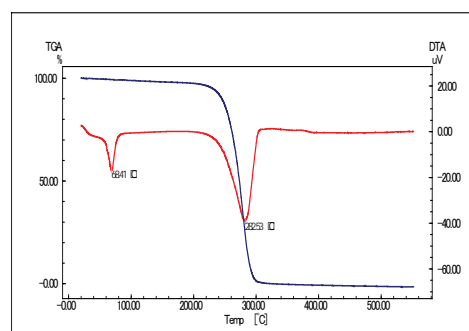


Figure 1. The example of TG-DTA Ionic liquid Data.

REFERENCES

- [1] Reviews for ILs see: (a) S. Chowdhury, R. S. Mohan, J. L. Scott, *Tetrahedron*, **2007**, 63, 2363. (b) N. V. Plechkova, K. R. Seddon, *Chem. Soc. Rev.* **2008**, 37, 123. (c) J. P. Hallett, T. Welton, *Chem. Rev.* **2011**, 11, 3508.
- [2] S. Hayashi, H. Hamaguchi, *Chem. Lett.* **2004**, 33, 1590.
- [3] Yoshida, Y.; Otsuka, A.; Saito, G. Natsume, S.; Nishibori, E.; Takata, M.; Sakata, M.; Takahashi, M. Yoko, T. *Bull. Chem. Soc. Jpn.*, **2005**, 78, 1921.
- [4] (a) W. Xu, E. I. Cooper, C. A. Angell, *J. Phys. Chem. B.* **2003**, 107, 6170. (b) W. Xu, C. A. Angell, *Science*, **2003**, 302, 422.
- [5] Review. C. Biao, L. Quan, Z. Baozhong, *Progress in Chemistry*, **2012**, 24, 225.
- [6] J. Wang, H. Yao, Y. Nie, L. Bai, X. Zhang, J. Li, *Ind. Eng. Chem. Res.* **2012**, 51, 3776.

Spiritual care needs of elderly people with dementia: a literature review

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Background

Epidemiological data shows an increasing number of elderly people affected by dementia. It is mentioned that people with dementia have spiritual care needs.

Aim

This paper presents a literature review focusing research on the spiritual care needs of elderly people with dementia. The purpose of this literature review is to examine the existing body and knowledge about spiritual care needs of elderly people and apply a spiritual framework of coping in organizing the literature to identify themes and gaps in knowledge.

Methods

A systematic review of the MEDLINE and PubMed databases performed up to May 2016 was further conducting internet searches. 49 literature in the fields of nursing, dementia and spiritual were selected. We found 8 literature review, 2 case studies, 5 withdraw a paper and 34 research studies. A literature was conducted to find research published from 1992 to 2015 aimed at spiritual care needs of elderly people and considering all possible items relating to selected expediential.

Conclusions

8 research studies were reviewed. Findings suggest that elderly people with dementia draw from their spirituality and faith to find meaning and courage in facing the challenges of cognitive losses. Limited empirical knowledge compels the need for more research to explore how spiritual care is coping with dementia.

Key words: spiritual care, dementia, elderly people

REFERENCES

- [1] F. F. Ayhan, E. Ceceli, M. Usta, D. Kurultak, and P. Borman, "The importance of cognitive component of comprehensive geriatric assessment in home-living elderly patients," *Turk Geriatr. Derg.*, vol. 13, no. 3, pp. 150–159, 2010.
- [2] E. L. Sampson, L. Jones, I. C. V Thuné-Boyle, R. Kukkastenevemas, M. King, B. Leurent, A. Tookman, and M. R. Blanchard, "Palliative assessment and advance care planning in severe dementia: an exploratory randomized controlled trial of a complex intervention.," *Palliat. Med.*, vol. 25, no. 3, pp. 197–209, Apr. 2011.
- [3] C. J. Farran, B. H. Miller, J. E. Kaufman, E. Donner, and L. Fogg, "Finding meaning through caregiving: development of an instrument for family caregivers of persons with Alzheimer's disease.," *J. Clin. Psychol.*, vol. 55, no. 9, pp. 1107–25, Sep. 1999.
- [4] M.-J. H. E. Gijsberts, J. T. van der Steen, M. T. Muller, C. M. P. M. Hertogh, and L. Deliëns, "Spiritual end-of-life care in Dutch nursing homes: an ethnographic study.," *J. Am. Med. Dir. Assoc.*, vol. 14, no. 9, pp. 679–84, Sep. 2013.
- [5] J. van der Steen, L. Radbruch, C. Hertogh, M. de Boer, J. Hughes, P. Larkin, A. Francke, S. Jünger, D. Gove, P. Firth, R. Koopmans, and L. Volicer, "White paper defining optimal palliative care in older people with dementia: a Delphi study and recommendations from the European Association for Palliative Care.," *Palliat. Med.*, vol. 28, no. 3, pp. 197–209, 2014.
- [6] L. Odbehr, K. Kvigne, S. Hauge, and L. J. Danbolt, "Nurses' and care workers' experiences of spiritual needs in residents with dementia in nursing homes: a qualitative study.," *BMC Nurs.*, vol. 13, no. 1, p. 12, Jan. 2014.
- [7] L. S. Odbehr, K. Kvigne, S. Hauge, and L. J. Danbolt, "Spiritual care to persons with dementia in nursing homes; a qualitative study of nurses and care workers experiences.," *BMC Nurs.*, vol. 14, no. 1, p. 70, Jan. 2015.
- [8] A. Brinkman-Stoppelenburg, B. D. Onwuteaka-Philipsen, and A. van der Heide, "Involvement of supportive care professionals in patient care in the last month of life.," *Support. Care Cancer*, vol. 23, no. 10, pp. 2899–906, Oct. 2015.
- [9] B. Johnston, S. Lawton, C. McCaw, E. Law, J. Murray, J. Gibb, J. Pringle, G. Munro, and C. Rodriguez, "Living well with dementia: enhancing dignity and quality of life, using a novel intervention, Dignity Therapy.," *Int. J. Older People Nurs.*, vol. 11, no. 2, pp. 107–20, Jun. 2016.
- [10] L. Høgsnes, E. Danielson, K.-G. Norbergh, and C. Melin-Johansson, "Healthcare professionals' documentation in nursing homes when caring for patients with dementia in end of life - a retrospective records review.," *J. Clin. Nurs.*, vol. 25, no. 11–12, pp. 1663–73, Jun. 2016.

Study of trial supplies of warm care (Calm-Refresh-Thermal-Sheet) - Comparison of the effects due to different quantities of heat source-

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INTRODUCTION

For patients who cannot bathe or take a shower, nurses give a bed bath to provide a refreshing feeling and maintain cleanliness. In addition, nurses provide a hot compress or foot bath to warm the body and alleviate pain and insomnia. There have already been some studies of the effects (Iwasaki, 2005). There are a variety of supplies for bed baths, such as damp towels and steamed towels. Shimizu et al. considered steam cloth as bed bath supplies that can be applied also for frail patients (Shimizu, 2014). A steam cloth is one that applies warm steam to the skin using a towel and a little hot water. It is simple and easy. And it has already been found that it is useful for its practical, physical effect and positive psychological effects such as relaxation and exhilaration (Shimizu, 2015; Toge, 2014). We have developed the “Calm-Refresh-Thermal-Sheet” (hereinafter “CRT-Sheet”). It is more convenient, disposable, and can also be used in disasters. The CRT-Sheet, like a steam cloth, warms the body by providing humidity and heat to the skin. Our purpose this time is to compare the feeling and impressions due to the difference in the quantity of heat source of the CRT-Sheet in order to determine the optimum quantity of the heat source.

PURPOSE

The purpose is to compare the feeling and impressions due to the difference in the quantity of heat source of trial supplies CRT-Sheet (Calm-Refresh-Thermal-Sheet) to warm the body by providing humidity and heat to the skin.

METHOD

CRT-Sheets are made by wrapping a heating element in gel-smear nonwoven cloth, and the gel's moisture evaporates in response to heat dissipation from the heating element. The quantity of heat source of the CRT-Sheet is 37.5 g and 45.0 g (made by Hosho Co. Ltd., 2015), releasing heat at 45.8/47.3°C 1 minute after application, 41.4 / 43.1°C after 5 minutes, 45.6 / 44.6°C after 10 minutes, 51.7 / 50.7°C after 15 minutes respectively. The amount of water evaporation from the 37.5 g / 45.0 g heating element was 3.27 / 2.96 g, and per minute transpiration rate was 0.2180 / 0.1973g/min. Data collected was a self-administered questionnaire, including two free description questions and 20 pairs of adjectives on a 10-scale by SD method. Data were responses to questionnaires after the respondent used the CRT-Sheet. Free description was about perceived differences between the two heat sources, and the feeling of using the CRT-Sheet. Respondents were 13 participants (1 man and 12 women) using the 37.5 g CRT-Sheet, out of whom 4 subjects (all women) also used the 45.0 g CRT-Sheet. The average age was 28.8 years, and 36.3 years respectively. CRT-Sheets were applied to the right and left front upper arms, back, and abdomen. The analysis methods were descriptive statistics

and content analysis. This survey was positioned as a pilot study by the development team members. Ethical procedure involved explaining the purpose of the investigation verbally, and responses were obtained after consent.

RESULTS AND DISCUSSION

Evaluation results by the SD method were similar, and the difference between the average values was 0.1 to 2.3. Items with average divergence values of 1.0 or more: refined-simple, sticky-refreshing, restless-relaxed, leisurely-strained, soggy-tight (stiff), vulgar-refined, suppressed-open (in descending order). The 37.5 g heat source quantity was more refined (polished), sticky, relaxed, soggy and leisurely, and 45.0 g was more refined (grace), open. Items with average value difference of 0.1 or less: conservative-radical, warm-cool, dry-wet, favorable-unfavorable (in ascending order); in both cases they felt warm, wet and favorable. Items with no difference: conservative-radical; it was the intermediate value. In the free description about the feeling and impressions due to the difference in the quantity of heat source, respondents answered as follows: 45.0 g was hotter, cannot be applied for long, and it is difficult if they try to provide care as well as a bed bath; 37.5 g was an appropriate amount of heat. Concerning the feeling of using the CRT-Sheet: they felt refreshed after using it, it was easy to use, the retention side was hot. They felt 45.0 g was too hot, falling gel was uncomfortable when their body was wiped.

The above results suggest that the 37.5 g heat source was more suitable as bed bath supplies that was not too hot, provides warmth, and has the effect of easing tension in a relaxed and leisurely way.

In the future, we will need to examine improvement of the retention side of the CRT-Sheet, effects on the skin tissue, and differences by age and sex ratio also.

CONCLUSION

Comparison of effects due to different quantities of heat source in the CRT-Sheet indicated the 37.5 g heat source was more suitable than 45.0 g as bed bath supplies in terms of safety and comfort.

REFERENCES

- [1] Iwazaki Mayumi, Nomura Shihoko, “Examination of the Relaxing Effects of Local Warm Pack Application - Comparison of the Influences of Two Treatments: Warm Pack Application to the Back and Warm Foot Soaks”, Japan Society of Nursing Research Journal Vol. 28 No. 1 2005, p 33-43
- [2] Hiroko Shimizu, Tetsuo Toge, Tomoko Sakakibara, Akito Hotta, “Change of skin temperature, humidity and emotional feelings by steamed cloth sponge bath”, CME 2015, p 2-3.
- [3] Tetsuo Toge, Kunihiko Tsutsui, Tomoko Sakakibara, Hiroko Shimizu, Akito Hotta, “The effect of sponge bath to the hand on resting brain function: a novel feature of power spectrum analysis in EEG”, CME 2014.

Oxidative Stress Inhibits the Protein Phosphatase 5 Activation by S100 Proteins

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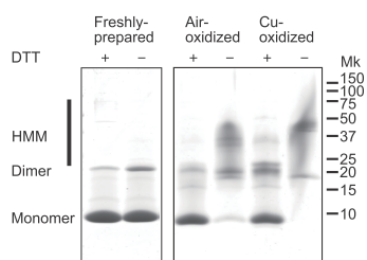
INTRODUCTION

Oxidative stress is a result of imbalance between the reactive oxygen production and antioxidant system in our body and is mediated by intracellular signaling pathways. Protein phosphatase 5 (PP5) is a serine/threonine phosphatase that is important for the oxidative stress responses. We have reported that S100 proteins significantly activate PP5 in a calcium dependent manner. Therefore, we investigated the effect of oxidative stress on the S100 proteins and PP5 interaction and PP5 enzyme activity.

RESULTS AND DISCUSSIONS

Recombinant S100A2 was easily oxidized in air or with Cu treatment and formed cross-linked dimers and higher molecular weight complex structures. The binding of S100A2 to PP5 was reduced by oxidation, resulting in decreased PP5 activation in vitro (Fig.1). PP5 activation was also inhibited by oxidation of other S100 proteins including S100A1, S100A6, S100B, and S100P. In living cells, hydrogen peroxide (H₂O₂) induced endogenous S100A2 oxidation in human keratinocytes (HaCaT) and human hepatocellular carcinoma (Huh-7) cells (Fig.2). Furthermore, H₂O₂ treatment reduced the binding of S100A2 to PP5 and resulted in the decrease of PP5 activation in Huh-7 cells. These results suggest that oxidative stress inhibits S100 proteins to bind and activate PP5 and could modulate the signaling cascades of oxidative stress responses.

A



B

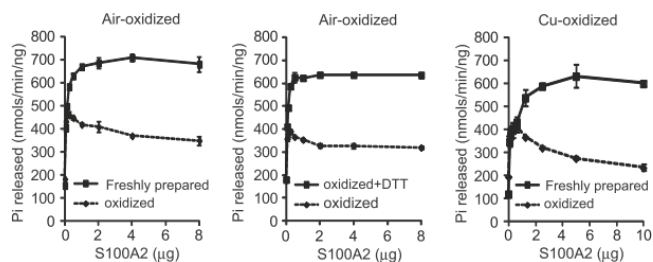


Fig. 1. Oxidation of S100A2 and PP5 activation (A) S100A2 was oxidized and separated by Tricine SDS-PAGE. (B) PP5 activation was measured

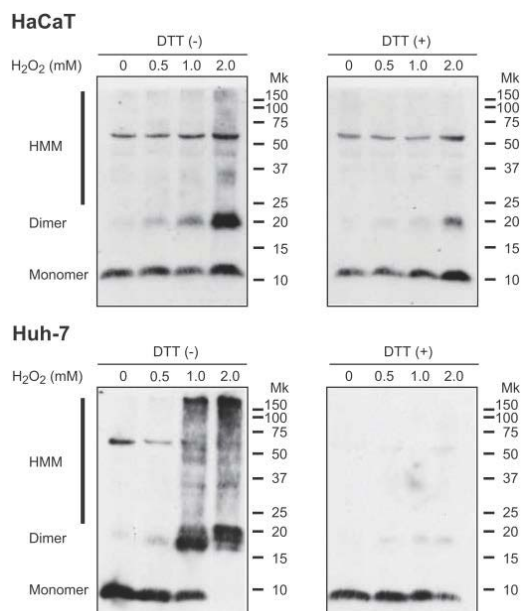


Fig.2. Oxidation of S100A2 by H₂O₂ in HaCaT and Huh-7 cells. Cells were treated with 0-2 mM H₂O₂ for 90 min and proteins were purified. Samples were separated on Tricine SDS-PAGE with or without 50 mM DTT treatment.

ACKNOWLEDGMENT

This research was supported by the Kagawa University Characteristic Prior Research Fund 2011. We thank Keiko Tsurumi (Kagawa University) for excellent technical assistance.

REFERENCES

- [1] Donato, R., Cannon, B.R., Sorci, G., Riuzzi, F., Hsu, K., Weber, D.J. & Geczy, C.L. (2013) Functions of S100 proteins. *Curr. Mol. Med.*, 13, 24-57.
- [2] Heizmann, C.W. (2002) The multifunctional S100 protein family. *Methods in molecular biology*, 172, 69-80.
- [3] Hinds, T.D., Jr. & Sanchez, E.R. (2008) Protein phosphatase 5. *Int. J. Biochem. Cell Biol.*, 40, 2358-2362.
- [4] Lim, S.Y., Raftery, M.J., Goyette, J., Hsu, K. & Geczy, C.L. (2009) Oxidative modifications of S100 proteins: functional regulation by redox. *J. Leukoc. Biol.*, 86, 577-587.
- [5] Ray, P.D., Huang, B.W. & Tsuji, Y. (2012) Reactive oxygen species (ROS) homeostasis and redox regulation in cellular signaling. *Cell. Signal.*, 24, 981-990.
- [6] Tsuchiya, M., Yamaguchi, F., Shimamoto, S., Fujimoto, T., Tokumitsu, H., Tokuda, M. & Kobayashi, R. (2014) Oxidized S100A4 inhibits the activation of protein phosphatase 5 through S100A1 in MKN45 gastric carcinoma cells. *Int. J. Mol. Med.*, 34, 1713-1719.
- [7] Yamaguchi, F., Umeda, Y., Shimamoto, S., Tsuchiya, M., Tokumitsu, H., Tokuda, M. & Kobayashi, R. (2012) S100 proteins modulate protein phosphatase 5 function: a link between CA²⁺ signal transduction and protein dephosphorylation. *J. Biol. Chem.*, 287, 13787-13798.

Role of hepatocyte nuclear factor-5 in high glucose-induced augmentation of proximal tubular angiotensinogen

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INTRODUCTION

Pathogenesis of diabetic nephropathy is associated to uncontrolled chronic hyperglycemia, moreover, the renin-angiotensin system (RAS) is considered to be involved in most of the pathological processes that lead to diabetic nephropathy [1]. Previous studies demonstrated that angiotensinogen (AGT) production in renal proximal tubular cells (RPTCs) regulates intrarenal RAS activity and an increase in AGT expression contributes to renal accumulation of Ang II in the kidney [2].

High glucose is known to stimulate AGT synthesis in RPTCs, and intrarenal AGT levels are increased in diabetic rats [3, 4], and contributes to the regulation of intrarenal angiotensin level [5]. Promoter elements have been demonstrated essential in regulation of human AGT expression [6]. Therefore, this study aimed to investigate whether high glucose activates AGT synthesis in human RTPCs and identify glucose-responsive transcriptional factors that bind to human AGT promoter DNA sequences.

RESULTS AND DISCUSSIONS

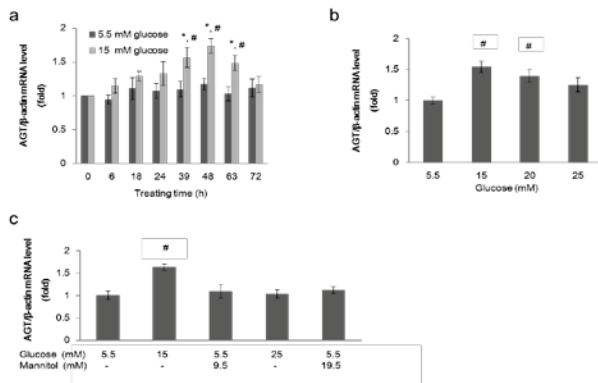


Fig. 1 High glucose augmented AGT mRNA level of HK-2 cells in a time and dose-dependent manner.

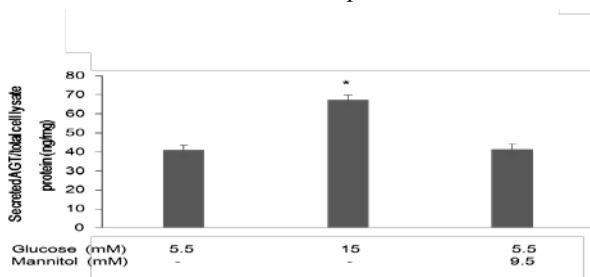


Fig. 2 High glucose augmented the secreted AGT level in the culture medium of HK-2 cells.

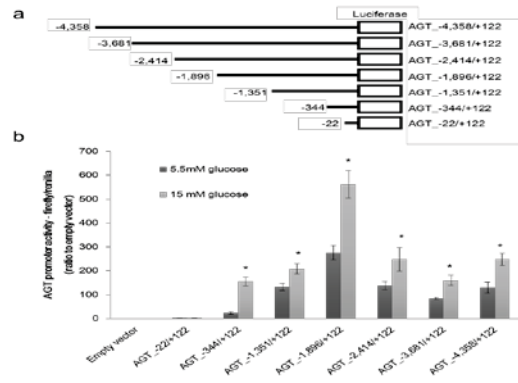


Fig. 3 High glucose augmented AGT promoter activity of HK-2 cells transfected with seven deletion mutant constructs of human AGT promoter sequence.

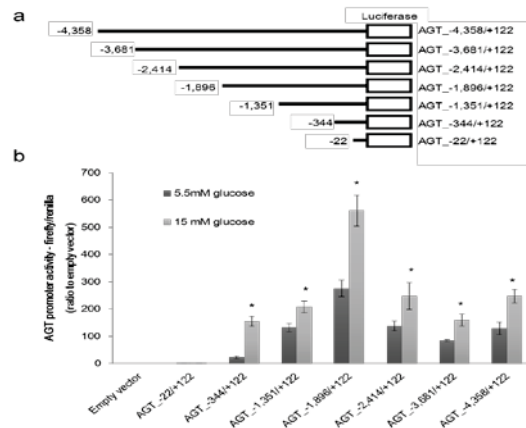


Fig. 4. Mutation in HNF-5 binding sites reduced the response of AGT promoter activity under the treatment with high glucose.

REFERENCES

- [1] Chawla T, Sharma D, Singh A: Role of the renin angiotensin system in diabetic nephropathy. *World journal of diabetes* 2010, 1(5):141-145.
- [2] Kobori H, Harrison-Bernard LM, Navar LG: Expression of angiotensinogen mRNA and protein in angiotensin II-dependent hypertension. *Journal of the American Society of Nephrology* : JASN 2001, 12(3):431-439.
- [3] Bagby SP: Diabetic nephropathy and proximal tubule ROS: challenging our glomerulocentricity. *Kidney international* 2007, 71(12):1199-1202.
- [4] Casarini DE: Upregulation of intrarenal angiotensinogen in diabetes. *Hypertension research* 2010, 33(11):1106-1107.
- [5] Anderson S, Jung FF, Ingelfinger JR: Renal renin-angiotensin system in diabetes: functional, immunohistochemical, and molecular biological correlations. *The American journal of physiology* 1993, 265(4 Pt 2):F477-486.
- [6] Acres OW, Satou R, Navar LG, Kobori H: Contribution of a nuclear factor-kappaB binding site to human angiotensinogen promoter activity in renal proximal tubular cells. *Hypertension* 2011, 57(3):608-613. interface," *IEEE Transl. J. Magn. Japan*, vol. 2, pp. 740-741, August 1987 [*Digests 9th Annual Conf. Magnetics Japan*, p. 301, 1982.

Effect of Support on Ir-Catalyzed Synthesis of Nitrogen-containing Organic Compounds

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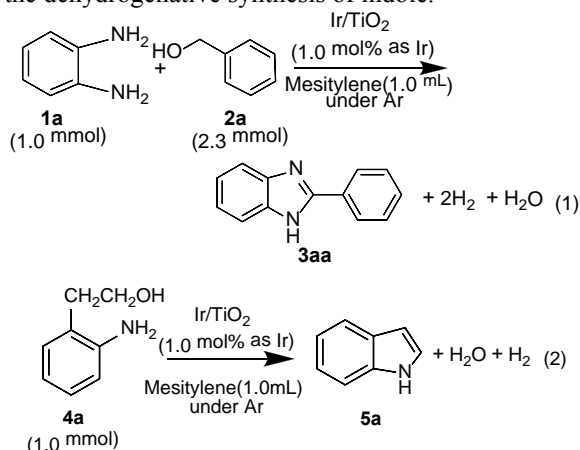
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INTRODUCTION

From the viewpoint of view of green sustainable chemistry, heterogeneous catalysts for organic syntheses have attracted attention because of their advantages in the easy separation from the products and reuses. Benzimidazoles and indole are important chemical feedstocks, particularly in pharmaceutical and agrochemical industries [1]. Therefore, the development of effective synthetic method is highly required. Dehydrogenative synthesis of them is the most efficient route, and we have reported heterogeneous Ir/TiO₂ catalyst that realizes the synthesis of them from phenylenediamines and primary alcohols even at 120 °C [2].

In the present study, we investigated effects of TiO₂ supports of iridium catalysts to further improve the activities. Furthermore, these catalysts were also successfully applied for the dehydrogenative synthesis of indole.



RESULTS AND DISCUSSIONS

Supported iridium catalysts were prepared by impregnation method using Ir(acac)₃ (acac=acetylacetonate) solution, followed by calcination at usually 400 °C for 30 min and the reduction in a flow of H₂ at 500 °C for 30 min. The reactions were performed under an Ar atmosphere using a hot stirrer equipped with a cooling block for refluxing. The products were analyzed by GC and GC-MS.

Effects of titania supports of iridium catalysts on the synthesis of benzimidazole (3aa) from 1,2-phenylenediamine (1a) and benzyl alcohol (2a) were examined at 100 °C for 18 h as shown in Table 1. Activities towards the synthesis of indole (5a) from 2-(2-aminophenyl) ethanol (4a) are also shown in Table 1. Note that XRF analysis revealed partial loss of iridium species from several catalysts during the calcination (Table 1, entries 3, 4), while the yield of products were compared using 2.0 wt% Ir catalysts. Among the catalysts examined, those supported on such as TIO-6 and F-1R showed higher activities than anatase type TiO₂

supported catalysts: The desired product (3aa) was obtained in 59 to 61% yield. The story is also true for indole synthesis, where TIO-6 and F-1R-supported catalysts gave 5a in the yield of 45% and 52%, respectively.

Effect of calcination temperature was significant, as shown Fig. 1. Among examined, the JRC-TIO-6-supported catalyst calcined at 240 °C showed the highest activity: Oxidative decomposition of Ir(acac)₃ was found to occur at 240 °C on JRC-TIO-6.

The characterization of the catalysts by TEM revealed the formation of uniformly-dispersed nanoclusters of iridium species (less than 2 nm in diameter) on rutile, which would be responsible for the excellent activity.

Table 1. Activities of Ir/TiO₂ catalysts for synthesis of benzimidazole and indole

Entry	TiO ₂ support	Ir loading (wt %)	Yield of 3aa at 100 °C, 18 h (%)	Yield of 5a at 100 °C, 18 h (%)
1	TIO-4(A)	2.0	23	29
2	TIO-6(R)	2.0	59	45
3	F-1R(R)	1.0	61	52
4	F-2(A)	1.2	23	33
5	F-6(A)	2.0	43	27

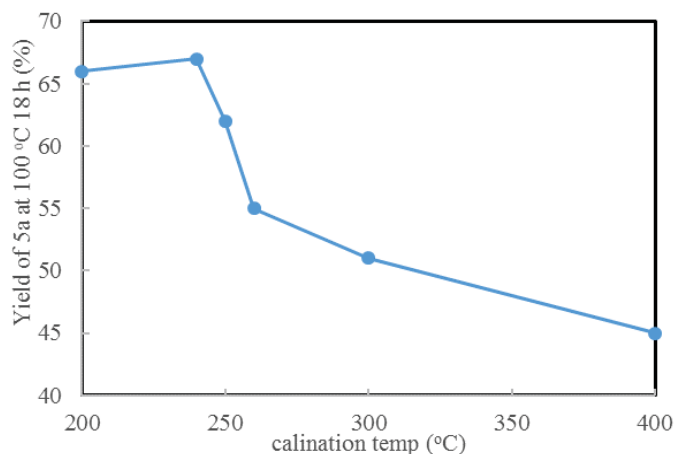


Fig. 1. Effect of calcination temperature on activity of Ir/TIO-6 catalyst (2.0 wt% Ir loading) for indole synthesis

REFERENCES

- [1] D. A. Horton, G. T. Bourne and M.L. Smythe, Chem. Rev., vol 103, pp. 893-930, and references therein.
- [2] K. Tateyama, K. Wada, H. Miura, S. Hosokawa, R. Abe, and M. Inoue, Catal. Sci. Technol., vol. 6, pp.1677-1684, 2015

Design and implementation of a WEB system for error correction code learning

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We have designed and implemented an e-Learning system based on Web application for students to learn error correcting code by themselves. Our system was written in JavaScript language which can execute as Web application and work on the major Web browsers from PCs to smart phones.

The system requests its users to input original information (binary expression), calculates the necessary “additional information (binary expression) and shows error-checking matrix for the hint of error-code learning. And it facilitates users to understand how they constructs single-error-correcting code efficiently and effectively. Now we are willing to apply our system into practical education of our university and evaluate it in the real classroom lecture.

INTRODUCTION

Single error correction (including Double errors detection) is the very topical theme of code theory in Information Science. So we have developed a Web-based e-Learning system in JavaScript for beginners for Information Science. Our system can treat with more than 50-bit length for complicated cases for error correction code construction. We hardly used to manipulate such a long and time-consuming calculation for code construction and error correction in a usual lecture. With our system, however, the above fundamental calculation in code theory would be able to include practical and complicated examples for beginners to learn code theory and understand its essential capability in an effective and efficient ways.

SCHEME OF ERROR CORRECTION CODE AND OUR SYSTEM

As you know, Hamming inequality expressed by Eq. (1) can provide minimal integer 'k' to construct error correction code for a given information of 'm'-length binaries (totally 'm+k'-length binaries).

$$2^k \geq m + k + 1. \quad (1)$$

With the below logical expression, we can determine which value for each k_i . Binary operations {AND, OR} must be replaced with logical AND operation and logical Exclusive-OR operation respectively.

$$\begin{pmatrix} 0 & 0 & 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 \end{pmatrix} \begin{pmatrix} k_1 \\ k_2 \\ m_1 \\ k_3 \\ m_2 \\ m_3 \\ m_4 \end{pmatrix} = \begin{pmatrix} k_3 + m_2 + m_3 + m_4 \\ k_2 + m_1 + m_3 + m_4 \\ k_1 + m_1 + m_2 + m_4 \end{pmatrix}$$

For example, if m=4 then minimal integer k=3 from Eq.(1). Each ' k_i ' can be calculated by exclusive-OR operation with m_j ($j = 1,2,3,4$) from Eq.(2).

$$\begin{cases} k_1 = m_1 \oplus m_2 \oplus m_4 \\ k_2 = m_1 \oplus m_3 \oplus m_4 \\ k_3 = m_2 \oplus m_3 \oplus m_4 \end{cases} \quad (2)$$

Based on the above scheme and mechanism of single error correction we have developed a Web-based e-Learning system for beginners to understand how to construct single error correction of 'm+k'-length binaries for a given 'm'-length binary information and how to detect and correct where single error occurs on 'm+k'-length binaries. Fig. 1 shows our system written in JavaScript for Japanese users.

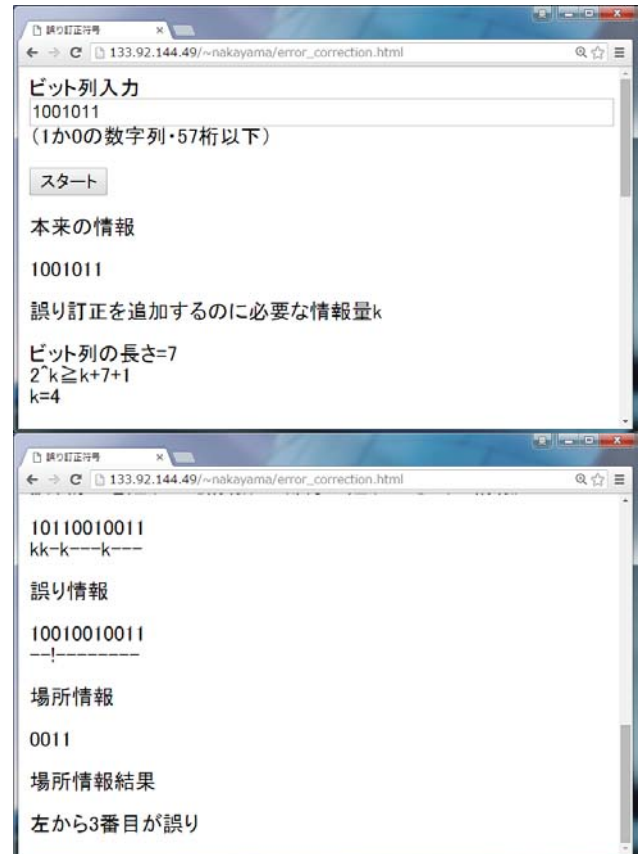


Fig. 1. Our Web-based e-Learning system for Single-Error-Correction code written in JavaScript (for Japanese users). The Upper is for users to input initial binary data for error correction code construction and the lower is the result to indicate where single error occurs within initial data and additional code for error correction.

RESULTS AND DISCUSSIONS

Applicable 'm'-length is less than or equal to 57, so users of our system can have a practical experience to learn error correction code without restriction from time-consuming task. We will improve and reproduce our system with interactive facilities and graphical demonstration for more effective understanding in near future.

Development of Flexion Lock Function for Passive Transfemoral Prosthetic Knee during Stair Ascending

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INTRODUCTION

We previously developed a passive knee joint mechanism that enabled level walk and stair ascent with a transfemoral prosthesis [1]. Stability of transfemoral prosthesis has been established in the level walk mechanism, such as four bar link mechanism [1]. However, stability for stair ascent has not been established in any passive mechanism for a prosthetic knee. Unintended knee flexion should be avoided not to fall during stair ascending, as well as level walking. Therefore, in the present study, we added knee flexion lock function to the passive knee joint mechanism without disturbing the existing functions.

DEVELOPMENT OF FLEXION LOCK FUNCTION

A) Basic structure of the prosthetic knee

The proposed knee is based on a four bar link mechanism that is composed of Link L_1 , L_2 , L_3 , and L_4 (Fig. 1). Joint J_1 , J_2 , J_3 , and J_4 connect these links. Link L_3 can rotate about Joint J_3 relative to L_4 . The Stopper St_1 and St_2 limit the rotation of L_3 . When the stair ascent mechanism functions, Stopper St_2 limits the rotation of L_3 , so the position of J_1 is stable (Fig. 2). Because Link L_1 that the thigh socket is attached to rotates about J_1 during knee extension in stair ascent stance phase, we fixed ratchet on L_1 around J_1 (see Fig. 1 and 2).

B) Statics of the mechanism

Suppose that the mechanism shown in Fig. 2 is in equilibrium, that hip joint moment is not generated, and that the prosthetic knee is fixed to the ground. Following equations are obtained.

$$\mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3 = 0 \quad (1)$$

$$\mathbf{r}_1 \times \mathbf{F}_1 + \mathbf{r}_3 \times \mathbf{F}_3 = 0 \quad (2)$$

where \mathbf{F}_1 , \mathbf{F}_2 , and \mathbf{F}_3 are the force vectors acting on Link L_1 from the thigh socket, Link L_3 or Joint J_1 , and the pawl, respectively. Joint J_2 can move freely in the slit of Link L_2 that also can rotate freely, so no force acts on L_1 from L_2 or J_2 . \mathbf{r}_1 and \mathbf{r}_3 are displacement vectors from the rotation center of L_1 to the application points of each vector. From Equation (1) and (2), the functions of the prosthetic knee depending on the direction of \mathbf{F}_1 is depicted in Fig. 2.

EVALUATION EXPERIMENT AND DISCUSSIONS

We conducted the evaluation experiment to check the design for the flexion lock function to work appropriately and the existing functions not to be disturbed. In the experiment, the prototype of the prosthetic knee was fixed on a device to measure the direction of the load \mathbf{F}_1 on the knee joint θ , the knee joint angle θ_k , and the motion of the

prosthetic knee joint (flexed/stable/extended). As the result, the flexion lock mechanism functioned as we designed (Fig.3 left graph). According to the analysis of the equations, then, we also found that the location of the pawl widen the area of the flexion lock function in Fig. 3 (right graph). In the future work, the motion of the proposed knee users is needed to evaluate.

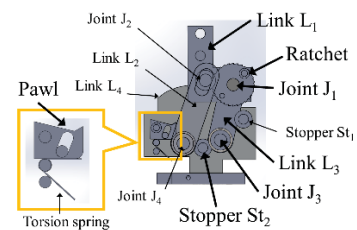


Fig.1 Illustration of the proposed mechanism for passive prosthetic knee. The left side of this illustration is the front side. The thigh socket is attached to the top of Link L_1 .

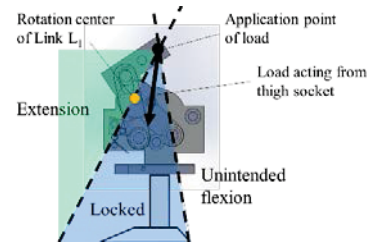


Fig.2 Relationship between the direction of the load acting from the thigh socket and the prosthetic knee functions. Which function works depends on the position of the end of the arrow indicating the load on the prosthetic knee.

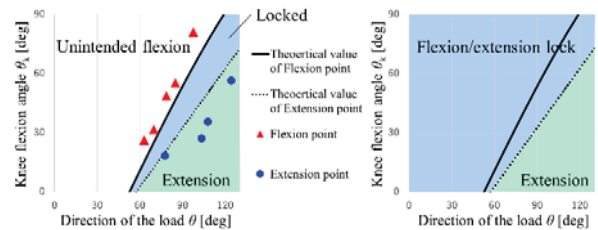


Fig.4 Relationship among the direction of the load θ , knee joint flexion angle θ_k , and the prosthetic knee motion. The left graph depicts the theoretical values and measured values. The right graph shows the change of the area of the flexion lock function due to the location of the pawl in the knee joint mechanism.

REFERENCE

- [1] T. Tanaka et al. "Passive knee joint mechanism that enabled level walk and stair ascent with a transfemoral prosthesis," *Proceedings of the JSME Conference on Robotics and Mechatronics (Japanese)*, No.15-2, pp. 189-192, 2015.
- [2] R. Harada et al. "Analysis of passive Knee Joint Mechanism of Transfemoral Prosthesis for Stair Ascent," *Proceedings of the SICE System Integration Division Annual Conference (Japanese)*, pp. 2687-2692, 2012.

- [3] POWER KNEE, OSSUR,
<http://www.ossur.com/prosthetic-solutions/products/dynamic-solutions/power-knee> (accessed 11-03-2016).

Effects of Upper Limb Balance Training on Standing Postural Control

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Abstract—A few studies have reported that training in sitting posture using the upper limbs improved standing postural control. Although these studies suggested that the balance training on the arms effected standing postural control, free motion of the trunk and head were included. Therefore, the mechanism of the improvement remains unclear. The purpose of the present study was to investigate the effects of arm balance training on standing postural control. Ten subjects were assigned into two groups randomly and asked to perform balance exercise on the arm with and without restraint of trunk and neck motion. The position of the center of pressure (COP) on the force platform was measured during standing before and after the four week training. As the result, anterior-posterior range of COP trajectory was decreased in the both groups. The improvements in the both groups would have been derived from internal models constructed by the training. However, frequency analysis of COP position showed an interaction effect between the groups and pre-post sessions. Therefore, these results suggest that the arm trainings with and without trunk motion construct different internal models.

INTRODUCTION

Generally, lower limb muscle activities are important for standing postural control [1]. Exercise and training on the legs, therefore, are conducted to improve standing postural control in the literature [2]. However, a few studies have reported that training in sitting posture in which the upper limbs were exercised improved standing postural control [3][4]. Although these studies suggested that balance exercise on the arms effected standing postural control, free motion of the trunk and head were included. Therefore, the mechanism of the improvements remains unclear. The purpose of the present study was to investigate effects of trunk and neck restraint during the arm balance training on standing postural control.

METHODS

Ten subjects were asked to perform upper limb balance exercise [4] as a four-week training. They were randomly assigned into two groups with and without restraint of trunk and neck motion during the exercise. Before and after the four-week training, the position of the center of pressure (COP) on the force platform was measured (100 Hz) during double-leg standing (30 s) and single-leg standing (20 s). Two-way (groups \times test sessions) repeated measures ANOVA was used to examine the range and mean power frequency of the COP trajectory. The COP trajectory was normalized with participants' foot length and width. Significant findings were subsequently examined with a Bonferroni post-hoc

multiple comparison test. Statistical significance was set at $p < 0.05$.

RESULTS AND DISCUSSIONS

A significant effect of the interaction was not found in the range of the COP trajectory during double-leg standing. The anterior-posterior range of the COP trajectory was decreased in the both groups during single-leg standing with eyes open after the four-week training ($F=8.13$, $p < 0.05$) (Fig. 1). This result suggests that the decrease in the range of the COP trajectory was derived from an internal model constructed by the upper limb balance training in the both groups. However, mean power frequency of the anterior-posterior component of the COP trajectory during single-leg standing with eyes closed showed a significant interaction ($F=11.03$, $p < 0.05$) (Fig. 2). This change of the mean frequency would indicate that the two groups had different models because of the trunk and neck restraint.

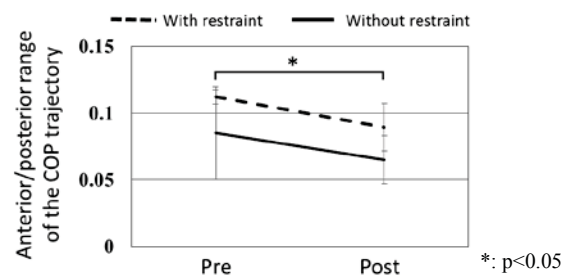


Fig. 1. Anterior-posterior range of the COP trajectory during single-leg standing with eyes open.

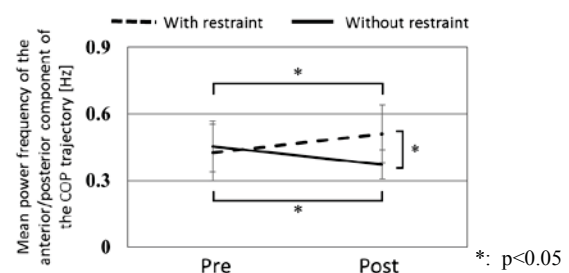


Fig. 2. Mean power frequency of the anterior-posterior component of the COP trajectory during single-leg standing with eyes closed.

REFERENCES

- [1] V.S. Stel et al., "A classification tree for predicting recurrent falling in community-dwelling older persons," *J Am Geriatr Soc*, vol. 51(10), pp. 1356–1364, 2003.
- [2] K. McConcille et al., "Evaluation of an electronic video game for improvement of balance," *Virtual Reality*, vol. 16, pp. 315–323, 2012.
- [3] U. Granacher et al., "Effects of Core Instability Strength Training on Trunk Muscle Strength, Spinal Mobility, Dynamic Balance and Functional Mobility in Older Adults," *Gerontology*, vol. 59, pp. 105–113, 2013.

- [4] K. Yokoi, "The effects of the 'short stick exercise' on fall prevention among community-dwelling elderly people," *The Journal of Japanese Association of Occupational Therapists* (Japanese), pp. 189-202, 2012.

Design of the Rotation Center Position of Transfemoral Prosthetic Knee Joint Unit Based on Gait Analysis of Intact Subjects

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Abstract—One of the most commercially available components for transfemoral prosthetic knee utilizes four bar link mechanism, which is able to allow a prosthetic knee to be highly stabilized during prosthetic stance phase and prosthesis users to walk safely without unintended knee flexion. This stability of the prosthetic knee joint is derived from the position of rotation center (RC) of its mechanism. However, the RC position differs from one product to another, and information on how to decide the position has been unclear. According to mechanical analysis of the mechanism, the RC position and load on the prosthetic knee determine the state of the prosthetic knee function (flexion lock or flexion). In the present study, we designed the RC position so that prosthesis users are able to control the state of the prosthetic knee with the thigh motion that is similar to that of intact subjects during gait. To do this, we analyzed a gait database of intact subjects.

INTRODUCTION

Four bar link mechanism is able to allow a prosthetic knee to be highly stabilized during prosthetic stance phase and enable prosthesis users to walk safely without unintended knee flexion. This stability of the prosthetic knee joint is derived from the position of rotation center (RC) of its mechanism. However, the RC position differs from one product to another, and information on how to decide the position has been unclear [1]. According to mechanical analysis of the mechanism, the RC position and the direction of load on the prosthetic knee determine the state of the prosthetic knee (flexion lock or flexion). In the present study, we designed the RC position so that prosthesis users are able to control the state of the prosthetic knee with the thigh motion that is similar to that of intact subjects during gait.

METHODS

For prosthesis users, the magnitude and direction of load on a prosthetic knee can be control. Especially, the direction of the load (see θ_{Fs} below) determines the prosthetic knee motion (flexion/extension) depending on the position (direction) of the RC of the mechanism. Therefore, we designed the prosthetic knee to be controllable with the thigh motion that is similar to that of intact subject during walking. To do so, we used “AIST gait database 2015” [2] and inverse dynamics analysis for the gait. One hundred and eighty seven intact subjects’ data were analyzed. The knee joint angle θ_k , shank angle θ_s , directions of the force acting on the shank from the thigh relative to the global coordinate system θ_F

and the shank local coordinate system θ_{Fs} were calculated at the beginning of knee flexion in the late stance phase.

RESULTS AND DISCUSSIONS

According to the gait analysis, the RC direction can be set as θ_{Fs} to prevent unintended knee flexion and to provide knee flexion at the end of the stance phase. The angle of the RC direction must be large to provide safe walk, but it makes the prosthetic knee harder to be flexed by the user. Analyzing the gait database provided us the value of the upper limit of the RC direction in two ways.

a) Distribution of the population

The angle of the RC direction should be set at θ_{Fs} of the Equation (1) to enable ninety five percent of the population (one side of the normal distribution) to walk safely with the prosthetic knee.

$$\theta_{Fs} = \text{mean} + 1.65 \times \text{standard deviation} \\ = 21.75 \quad [\text{deg}] \quad (1)$$

b) Regression analysis

Table 1 shows the coefficients of correlation between the variables focusing on θ_{Fs} and θ_s . Statistically significant correlation was found between θ_{Fs} and θ_s , and between θ_{Fs} and θ_k ($p < 0.05$). However, θ_{Fs} and θ_s did not correlate to the general gait parameters, such as shown in Table 1. Hence, the equation for the angle of the RC direction should be set with the following equation.

$$\theta_{Fs} = -0.2687 \times \theta_k + 62.38 \quad [\text{deg}] \quad (2)$$

Transfemoral prosthesis users generally do not flex the prosthetic knee during stance phase. Therefore, the knee joint angle must be 180° . Then, we obtained the angle.

$$\theta_{Fs} = 17.00 \quad [\text{deg}] \quad (3)$$

Thus, the RC direction was designed in the two ways. In the future work, the results of the present study are needed to be evaluated in comparison among the existing.

Table1. Coefficient of correlation

	θ_s	Shank length	Gait Speed	Step length	Body weight	Body height	Cadence	Gait cycle	θ_{Fs}	θ_k
θ_F	-0.81	-0.03	0.06	0.01	0.03	-0.03	0.01	0.01	-0.15	-0.76
θ_s		0.04	-0.14	-0.18	-0.03	0.04	-0.03	-0.18		

REFERENCES

- [1] J. de Vries, “Conventional 4-bar linkage knee mechanisms : A strength weakness analysis,” *Journal of Rehabilitation Research and Development*, Vol . 32 No . 1, pp. 36-42, February 1995.
- [2] Kobayashi Y, H. Hobar, T.A. Heldoorn, M. Kouchi, M. Mochimaru, “Age-independent and age-dependent sex differences in gait pattern determined by principal component analysis,” *Gait and Posture*, Vol. 46, pp. 11-17, May 2016.

Evaluation of enzymatic epimerization for all deoxy-ketohexoses by D-Tagatose 3-epimerase from *Pseudomonas cichorii* ST24

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One of the key enzymes required for rare sugar production is ketose 3-epimerase which can catalyze the C-3 position epimerization of ketoses. D-Tagatose 3-epimerase (D-TE) from *Pseudomonas cichorii* ST24 has wide substrate specificity, and catalyzes reversible epimerization between D-tagatose and D-sorbose at the C-3 position. And D-TE could epimerize ketohexoses and ketopentoses. So D-TE is most important for production of various rare sugars. In this research, I focused on deoxy-ketohexoses for efficient production of deoxy-ketohexoses, and evaluated reactivity toward deoxy-ketohexoses by D-TE. Recombinant D-TE from *P. cichorii* ST24 was purified completely by HiTrap Q HP, HiTrap Phenyl HP, Resource Q column chromatography. The purified D-TE had a molecular weight of about 32 kDa and the specific activity of 67.0 U/mg with D-tagatose as a substrate. Using purified D-TE, the reactivity toward 6-deoxy-ketohexoses and 1-deoxy-ketohexoses were evaluated by HPLC analysis of the reaction mixture. The result showed D-TE could catalyze reversible epimerization of 1-deoxy-ketohexoses and 6-deoxy-ketohexoses. D-TE catalyzed epimerization of all 6-deoxy-hexoses and exhibited the highest enzymatic activity of 45.0 U/mg for 6-deoxy-L-sorbose (67.1% of D-tagatose). Whereas, D-TE showed low activity toward all 1-deoxy-ketohexoses.

INTRODUCTION

Rare sugars were defined as rare monosaccharides and their derivatives. Recently, development of production methods of rare sugars by microbial and enzymatic biotransformation enable the production of large amounts of various rare sugars [1, 2]. D-Tagatose 3-epimerase (D-TE) from *Pseudomonas cichorii* ST24 catalyzes reversible epimerization reaction between D-tagatose and D-sorbose. Furthermore D-TE epimerizes the configuration at the C-3 position of all ketohexoses and ketopentoses. Thus D-TE is one of the most important enzyme for production of various rare sugars [3]. Recently, it has been reported that D-TE catalyzes epimerization of 6-deoxy-ketohexoses and 1-deoxy-ketohexoses [4]. In this report, we evaluated reactivity toward all deoxy-ketohexoses by D-TE for efficient production of 6-deoxy-ketohexoses and 1-deoxy-ketohexoses.

RESULTS AND DISCUSSIONS

The recombinant D-TE from *P. cichorii* ST24 was purified by HiTrap Q HP, HiTrap Phenyl HP, Resource Q column chromatography. The purified D-TE had a molecular weight of about 32 kDa and the specific activity of 67.0 U/mg with D-tagatose as a substrate. The substrate specificity of D-TE toward all ketohexoses, 6-deoxy-ketohexoses, and 1-deoxy-ketohexoses was measured the amount of product by HPLC. Fig. 1 shows the substrate specificity of D-TE toward ketohexoses. D-TE could epimerize the configuration at the C-3 position of all ketohexoses. D-TE showed the highest activity toward D-tagatose (100%) followed by D-allulose

(63.2%), L-allulose (35.5%), D-fructose (24.1%), D-sorbose (11.6%), L-tagatose (7.63%), L-fructose (5.69%), and L-sorbose (2.63%). Fig. 2 shows the substrate specificity of D-TE toward 6-deoxy-ketohexoses. D-TE was also active on all 6-deoxy-ketohexoses. DTE showed the highest activity toward 6-deoxy-L-sorbose (67.2%) followed by 6-deoxy-L-tagatose (64.4%) and 6-deoxy-D-tagatose (36.4%), 6-deoxy-D-allulose (14.1%), 6-deoxy-L-allulose (13.5%), 6-deoxy-D-fructose (6.61%), 6-deoxy-L-fructose (3.92%), 6-deoxy-D-sorbose (2.87%). Furthermore, D-TE showed little activity toward all 1-deoxy-ketohexoses.

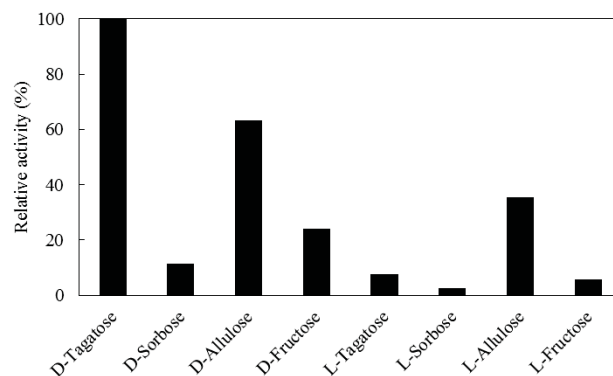


Fig. 1 Substrate specificity of D-TE (ketohexoses)

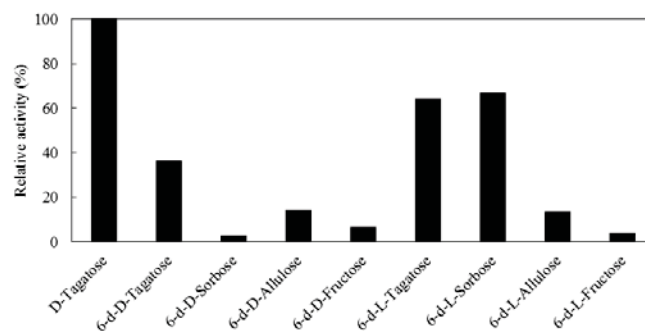


Fig. 2 Substrate specificity of D-TE (6-deoxy-ketohexoses)

REFERENCES

- [1] K. Takeshita, A. Suga, G. Takata, K. Izumori, *J. Biosci. Bioeng.*, 2000, 90, 453.
- [2] K. Morimoto, C. Park, M. Ozaki, K. Takeshita, T. Shimonishi, T. Birger Granstrom, G. Takata, M. Tokuda, K. Izumori, *ENZYME AND MICROBIAL TECHNOLOGY*, 2006, 38, 855.
- [3] K. Izumori, *J. Biotechnol.* 2006, 124, 717–722
- [4] P. Gullapalli, A. Yoshihara, K. Morimoto, D. Rao, K. Akimitsu, S. F. Jenkinson, G. W. J. Fleet*, K. Izumori, *Tetrahedron Letters*, 2010, 51, 895

Trial Big Data Analysis of Electric power demand with Weather information

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Nowadays, data mining and so-called "Big Data Analysis" becomes more and more popular and useful in our social lives. We have already tried to apply techniques of data mining into some fields in order to visualize normally unknown or veiled relation. This time, we have focused on electric power demand, which is one of the indices or barometers of social lives. And we want to know and visualize how such electric power demand has been affected by the effect of environmental condition. With consideration of some districts such as Hokkaido, Tokyo and Shikoku, our focused demand above has been visualized through relations between weather information as environmental conditions.

INTRODUCTION

This study will try to analyze open accessible information about electric power demand(s) of some districts in Japan and demonstrate visualization of relation among environmental conditions which we can usually obtain information just as weather reports. And we would like to apply our Big Data Analysis-based approach to realize data mining for normally unknown or hidden relation in order to retrieve effective and/or dominant conditional elements from uncertain situation.

OUR BIG DATA ANALYSIS APPROACH

We have focused electric power demand in East-north part, Middle one and West-south one of Japan so that we select the three major electric power companies given in TABLE I, determine average temperature, amount of precipitation and hours of sunshine as environmental conditions, and perform data mining analysis for visualization of relation between electric power demands and environmental conditions.

In order to set up for big data analysis, we have acquired data for electric power demand from each electric power company and retrieved data from weather information database by means of our Perl application. These are very tough jobs because we don't know normally where we can obtain suitably and efficiently

TABLE I OUR TARGET FOR BIG DATA ANALYSIS APPROACH

	Target Areas		
	Hokkaido (East North part)	Tokyo (Middle of Japan)	Shikoku (West South part)
Power Supply	Hokkaido Electric Power Co. Inc.	Tokyo Electric Power Co. Inc.	Shikoku Electric Power Co. Inc.
Focused City	Sapporo city	Tokyo (our Capital)	Matsuyama city
Environmental Conditions	Average Temperature, Amount of Precipitation, Hours of Sunshine		

RESULTS AND DISCUSSIONS

After our Big Data Analysis, we have found that there have been special or probably similar relations between electric power demands and environmental conditions in the

three focused areas of Japan. Fig. 1 and Fig. 2 and Fig.3 show relations between electric power demands and average temperatures in Sapporo (in Hokkaido), Tokyo (our capital, middle in Japan) and Matsuyama (in Shikoku) respectively.

We recognize that our Big Data Analysis-based approach can demonstrate visualization of normally unknown relation effectively.

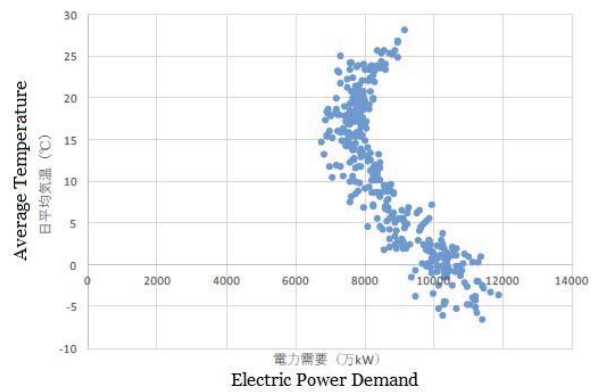


Fig. 1. Relation between Average Temperature and Electric Power Demand in the domain Area of Hokkaido Electric Power Co. Inc.

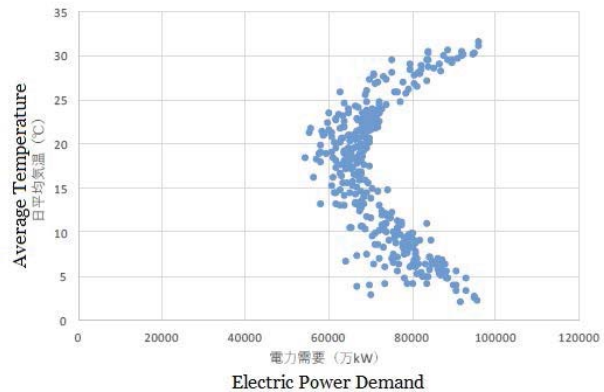


Fig. 2. Relation between Average Temperature and Electric Power Demand in the domain Area of Tokyo Electric Power Co. Inc.

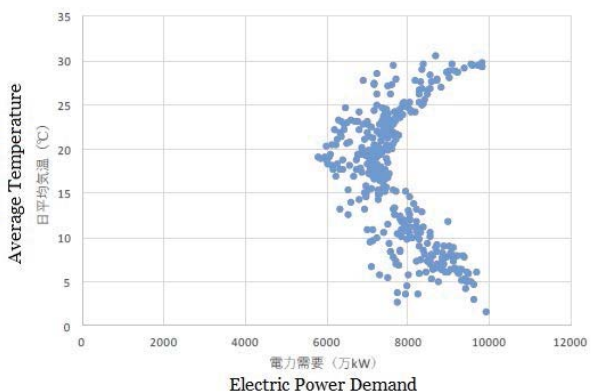


Fig. 3. Relation between Average Temperature and Electric Power Demand in the domain Area of Shikoku Electric Power Co. Inc.

Sentimental analyzed relationship between Twitter and published documents

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In this research, we have performed the following manipulations to realize the above targets; deciding to select and choose suitable Twitter accounts who tweet interesting messages and acquire a possible amount of their relevant message, specifying and defining value for word of messages for sentimental dictionary, categorizing and listing such a calculated value for each word or expression as item of the dictionary[1], using these values as "Sentimental Values" for calculation of tweeting messages, calculating Sentimental Values for tweeting message from students of selected universities, checking statistical relation between the above "Sentimental Values" and published data.

INTRODUCTION

This study is to perform some kind of data mining as an example of visualization of sentimental words extracted from messages of Twitter and to analyze hidden or unknown relation between sentimental value and the relevant behavior/phenomena. We have defined translation scheme from words in Twitter's message into sentimental values, applied the scheme into data mining with calculation of sentimental values for tweeting messages acquired from Twitter, and demonstrated relation between sentimental values and categorized human behavior.

DATA MINING FLOW OF OUR SYSTEM

Our system is configured with three major parts, namely acquisition of data from Web (Social Media), information processing scheme (data mining for acquired message from Web), and generation of documents by our system. Fig. 1 shows schematic block diagram for our system and its data mining flow. After connecting Twitter as Web-based Social Media, we have acquired an amount of data to be analyzed

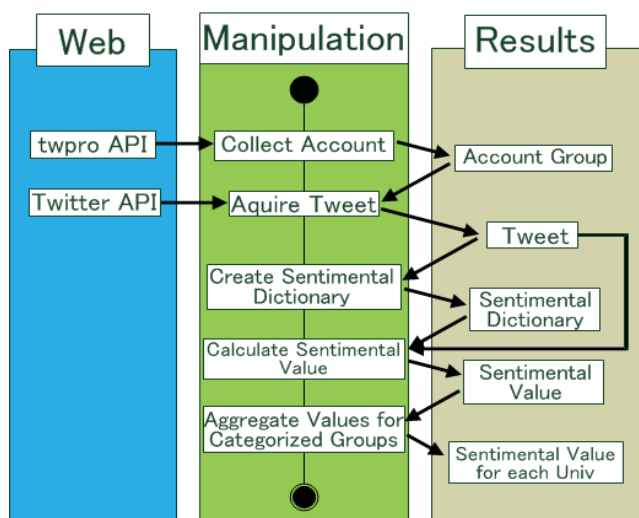


Fig. 1. Schematic Diagram for System Configuration (in the paper: "A Study of Visualization for Hidden Relation between Published Documents and Message from Twitter by means of Sentimental Analysis Approach," Masakazu Kyokane, et.al.: The International Journal of E-Learning and Educational Technologies in the Digital Media (IJEETDM) Vol.2, No.1, pp.217 - 224 (January 2016))

with "twpro API" and "Twitter API".

We could have focused on specific data based on speakers' attributes as target users. With these data, the middle part is to present a series of manipulations for information processing from data into generated results which include some temporary files.

From top to bottom, The 'Manipulation' part will be able to perform processing sequentially sometimes by automatically and otherwise by manually. This part is the main body of our system, showing "System Configuration and Processing Flow" and can accomplish some kind of sentiment analysis and generate our interesting results. We have obtained related relation between the above files based on messages from Twitter.

RESULTS AND DISCUSSIONS

We have tried to demonstrate and visualize normally hidden or unknown relations between messages from Twitter and information of published documents according to sentimental analysis. For example, we have been analyzing relationship between sentimental analyzed results and several information from the above documents, such as population of district, number of universities' students, number of Starbucks coffee shops, attraction index of district, and so on.

We have to discuss consistency about our approach with sentimental analysis. About two year 2014 and 2015, we had applied our approach based on Twitter messages so that it had been assumed that sentimental analysis must generate similar sentimental values between Twitter message in 2014 and 2015. Fig.2 shows relation between sentimental values from analysis for 2014 and 2015 Twitter messages. We can recognize that there is a certain relationship between sentimental values from 2014 and 2015 in Fig. 2.

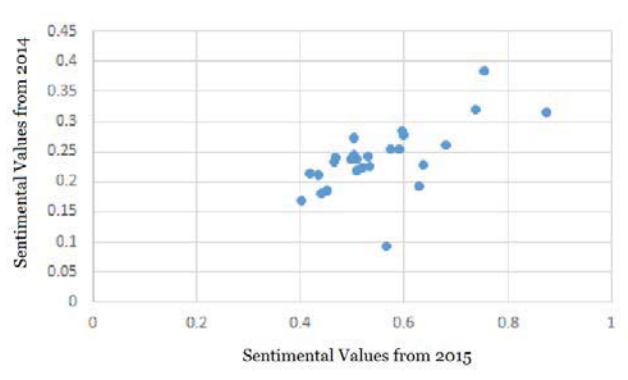


Fig. 2. Comparison between Sentimental Values analyzed from Twitter messages in 2014 and 2015

REFERENCES

[1] T. Kumamoto, et.al. "Proposal of Impression Mining from News Articles", Lecture Notes in Computer Science Vol13681, pp 901-910, 2005

Lifetime Improvement by Extended LEACH with Energy Harvest in Wireless Sensor Network

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Wireless Sensor Network (WSN) is applied to various fields such as agriculture and disaster prevention. In disaster prevention, sensor nodes can locate in extensive area. In this case, sensor nodes are usually driven by battery energy. Thus, depletion of battery energy is a serious problem.

Many methods are proposed such as Low Energy Adaptive Clustering Hierarchy (LEACH) and Energy Harvesting (EH) to avoid the running out of battery energy.

In this paper, we proposed LEACH with Partial Energy Harvest (LPEH) and Extend LEACH with Energy Harvest (ELEH). Computer simulation results show the effectiveness of our proposed method.

INTRODUCTION

WSN becomes the generic technology for realizing a ubiquitous network society. In WSN, sensor nodes are usually driven by battery energy. In addition, a lot of nodes are placed in extensive area. Thus, it is difficult to change the batteries of all nodes. For this reason, extending the lifetime of WSN is important. EH technology was proposed to improve the lifetime of WSN [4]. However, there is a problem that applying EH devices causes rising costs. LEACH was also proposed to extend lifetime [2]. In LEACH, Cluster Head (CH) is changed on regular basis to distribute energy consumption. However, LEACH does not take into account residual energy in CH selection.

To solve the above mentioned problems, we propose LPEH and ELEH to extend lifetime and save on expenses.

PROPOSED METHOD

To equip all nodes with EH devices causes rising costs. In LPEH, the number of EH nodes is limited to avoid rising costs. Selection of CH operation is same as LEACH. Thus, it is expected that the batteries of non-energy harvest nodes die earlier than EH nodes. For this reason, LPEH does not extend lifetime sufficiently. To solve this problem, we propose ELEH. In ELEH, CH are chosen from only EH nodes to extend lifetime effectively. To do so, the energy consumption of non-EH nodes become small. As a result, ELEH can realize longer lifetime compared to LPEH.

PERFORMANCE EVALUATION

Fig. 1 shows the relationship between the lifetime and the number of active nodes when the number of EH nodes is 50. Here, conventional method uses simple LEACH. Lifetime is defined as the number of rounds until the half of nodes are still active. In conventional method, the lifetime is 37 rounds. On the other hand, the lifetime of LPEH and ELEH are 91 rounds and 127 rounds, respectively. ELEH improves the lifetime by 210 % as compared with the conventional method and by 40 % as compared with the LPEH, respectively.

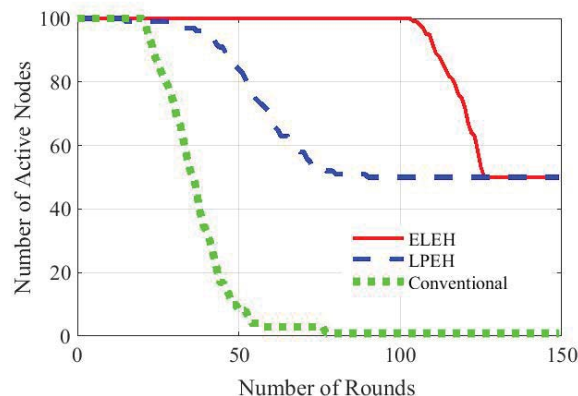


Fig. 1. Relationship between the number of rounds and the number of active nodes (Number of EH nodes: 50)

Table 1. Relationship between lifetime improvement ratio and rising costs ratio

Number of EH Nodes	Lifetime Improvement Ratio		Rising Costs Ratio
	LPEH	ELEH	
50	117%	210%	20.0%
80	90 %	207%	33.8%

Table 1 shows the lifetime improvement ratio and rising costs ratio in comparison with the conventional method. In the calculation, the price of sensor nodes and energy harvest devices are referred by [3]. In both cases of the number of EH nodes is 50 and 80, the lifetime improvement ratio in ELEH is better than LPEH. Rising costs ratio of ELEH is same as LPEH. Thus, we have better performance in ELEH than LPEH.

CONCLUSION

This paper proposes LPEH and ELEH to extend the lifetime of WSN without rising costs.

Computer simulation is conducted to show the effectiveness of the proposed method. Effective energy harvest node selection in accordance with the loaded traffic is future work.

REFERENCES

- [1] S. Sudevalayam, et al., "Energy Harvesting Sensor Nodes: Survey and Implications," *IEEE Commun. Surveys & Tutorials.*, vol. 13, no. 3, pp. 443-461, July 2010.
- [2] W. B. Heinzelman, et al., "An application-specific protocol architecture for wireless microsensor networks," *IEEE Trans. Wireless Commun.*, vol. 1, no. 4, pp. 660-670, Oct. 2002.
- [3] <http://akizukidenshi.com/> (accessed April 14, 2016)

Role of *ACTT1* gene encoding acetyl-CoA synthetase for biosynthesis of ACT-toxin in *Alternaria alternata* tangerine pathotype

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Alternaria brown spot, caused by the tangerine pathotype of *Alternaria alternata*, is a serious disease of commercially important citrus cultivars. The fungal pathogen produces host-selective ACT-toxin that possesses highly specific host selectivity. ACT-toxin causes necrosis on leaves and induces electrolyte leakage from tissues of only host citrus cultivars. The structure of ACT-toxin consists of 9, 10-epoxy-8-hydroxy-9-methyl decatrienoic acid, valine, and polyketide moieties (Fig. 1). Ten genes were estimated to be involved in biosynthesis of ACT-toxin, and we had analyzed 9 genes [1-6], except the *ACTT1*, as essential genes for ACT-toxin production and pathogenicity. In this study, the role of *ACTT1* (ACT-toxin *Tox* gene 1) was analyzed by targeted gene disruption for one copy knock-out and RNA-silencing for knock-down. The results indicate that *ACTT1* is essential for ACT-toxin biosynthesis and full virulence of the tangerine pathotype of *A. alternata*.

INTRODUCTION

Alternaria alternata is a filamentous fungus which distributes extensively as a saprophyte in nature, however seven strains of *A. alternata* are known as a phytopathogen producing host-selective toxin. The tangerine pathotype of *A. alternata* produces host-selective ACT-toxin (Fig.1) and causes *Alternaria* brown spot disease only on tangerines and mandarins. ACT-toxin biosynthesis gene cluster locates in 1.9 Mb-conditionally dispensable chromosome in genome of the tangerine pathotype. ACT-toxin biosynthesis genes consist of biosynthesis genes for the decatrienoic acid moiety (*ACTT1*, 2, 3, R, 5 and 6) sharing with AK- and AF-toxins produced by Japanese pear and strawberry pathotypes, and other sets of genes responsible for the biosynthesis of ACT-toxin-specific structural moieties (*ACTT5*, 2, 3 and 4).

In this study, we present the distribution and role in ACT-toxin production and the pathogenicity of *ACTT1* encoding a putative acetyl-CoA synthetase.

RESULTS AND DISCUSSIONS

Identification and Distribution of *ACTT1*

ACTT1 encoding a putative acetyl-CoA synthetase, was identified from the tangerine pathotype. Pulsed-field gel electrophoresis (PFGE) and southern blotting demonstrated that *ACTT1* located to the small chromosome (1.9Mb) among several isolates of the tangerine pathotype of *A. alternata* obtained from citrus groves in Florida. *ACTT1* homologues were detected in the genomes of ACT-toxin producers, but not in ACT-toxin non-producers. The *ACTT1* probe detected 4 fragments when genomic DNA was digested with restriction enzyme of *Xho*I, which had no predicted restriction site within the probe sequence, indicating that there are multiple copies of *ACTT1* in the genome.

Analysis of *ACTT1* Using Homologous Recombination-mediated Gene Disruption or RNA Silencing

Targeted gene disruption of single copy of *ACTT1* significantly reduced *ACTT1* expression and ACT-toxin production. However the transcription and ACT-toxin production were not completely missing due to the presence of remaining functional copies. Furthermore, RNA-silenced mutant of *ACTT1* led to complete loss of ACT-toxin production and pathogenicity. These results suggested that *ACTT1* plays an essential role in ACT-toxin production as well as pathogenicity in the tangerine pathotype of *A. alternata*.

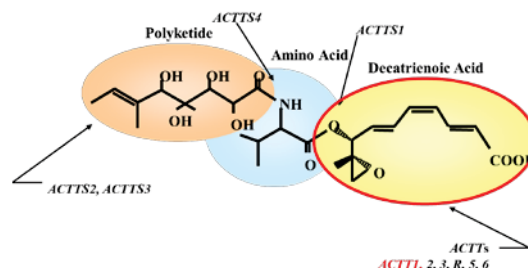


Fig. 1. Chemical Structure and Biosynthesis Genes of ACT-toxin Produced by the Tangerine Pathotype of *A. alternata*

REFERENCES

- [1] Ajiro, N., Miyamoto, Y., Masunaka, A., Tsuge, T., Yamamoto, M., Ohtani, K., Fukumoto, T., Gomi, K., Peever, T.L., Izumi, Y., Tada, Y., and Akimitsu, K. (2010) Role of the host-selective ACT-toxin synthesis gene *ACTT2* encoding an enoyl-reductase in pathogenicity of the tangerine pathotype of *Alternaria alternata*. *Phytopathology* 100: 120-126.
- [2] Masunaka, A., Tanaka, A., Tsuge, T., Peever, T.L., Timmer, L.W., Yamamoto, M., Yamamoto, H., and Akimitsu, K. (2000) Distribution and characterization of *AKT* homologs in the tangerine pathotype of *Alternaria alternata*. *Phytopathology* 90: 762-768.
- [3] Masunaka, A., Ohtani, K., Peever, T.L., Timmer, L.W., Tsuge, T., Yamamoto, M., Yamamoto, H., and Akimitsu, K. (2005) An isolate of *Alternaria alternata* that is pathogenic to both tangerines and rough lemon and produces two host-selective toxins, ACT- and ACR-toxins. *Phytopathology* 95: 241-247.
- [4] Miyamoto, Y., Masunaka, A., Tsuge, T., Yamamoto, M., Ohtani, K., Fukumoto, T., Gomi, K., Peever, T.L., and Akimitsu, K. (2008) Functional analysis of a multicopy host-selective ACT-toxin biosynthesis gene in the tangerine pathotype of *Alternaria alternata* using RNA silencing. *Mol. Plant-Microbe Interact* 21: 1591-1599.
- [5] Miyamoto, Y., Ishii, Y., Honda, A., Masunaka, A., Tsuge, T., Yamamoto, M., Ohtani, K., Fukumoto, T., Gomi, K., Peever, T.L., and Akimitsu, K. (2009) Function of genes encoding acyl-CoA synthetase and enoyl-CoA hydratase for host-selective ACT-toxin biosynthesis in the tangerine pathotype of *Alternaria alternata*. *Phytopathology* 99: 369-377.
- [6] Miyamoto, Y., Masunaka, A., Tsuge, T., Yamamoto, M., Ohtani, K., Fukumoto, T., Gomi, K., Peever, T.L., Tada, Y., Ichimura, K., and Akimitsu, K. (2010) *ACTT3* encoding a polyketide synthase is essential for the biosynthesis of ACT-toxin and pathogenicity in the tangerine pathotype of *Alternaria alternata*. *Mol. Plant-Microbe Interact* 23: 406-414.

Carbendazim-resistant isolates of *Pestalotiopsis* sp. Causing Strawberry Leaf Blight

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Strawberry Leaf Blight in Thailand is caused by phytopathogenic fungus *Pestalotiopsis* sp., which results in reduced strawberry production. Carbendazim is often used to control this disease, and appearance of a resistant isolate against the fungicide has been concerned due to multiple uses of this fungicide. Screening of field isolates from strawberry leaf blight symptoms in northern Thailand identified 56 carbendazim-resistant isolates. Phenotypic detection of these isolates showed 39 highly resistant (HR) isolates grew well on PDA amended with carbendazim at ≥ 500 mg/l and 17 sensitive (S) isolates grew on PDA with carbendazim at ≤ 1 mg/l. Polymerase chain reaction (PCR) amplifying a partial region of gene encoding β -tubulin from this pathogen, which has been known to be the target site of carbendazim, was performed, and the PCR products were cloned and sequenced to detect mutation at particular site(s) of this gene correlating with the carbendazim-resistant phenotype.

INTRODUCTION

Strawberry (*Fragaria x ananassa* Duch.) was introduced to Thailand in the 1970s and cultivated in the cooler northern area [1]. *Pestalotiopsis* leaf blight of strawberries, is caused by *Pestalotiopsis* sp. [2]. The most common control method of *Pestalotiopsis* sp. is use of fungicides that contain carbendazim, a broad spectrum benzimidazole [3]. The molecular mechanism of benzimidazole fungicides have been correlated with a point mutation in the β -tubulin gene, which results in altered amino acid sequences at the benzimidazole-binding site [4]. The aim of this study was to isolate the fungicide-resistant *Pestalotiopsis* sp. and compare their β -tubulin gene to the sequence of carbendazim-resistance and carbendazim-sensitive isolates to determine whether a mutation in this gene is resistant.

RESULTS AND DISCUSSIONS

Survey and isolate collection of *Pestalotiopsis* sp.

Occurrence of *Pestalotiopsis* leaf blight disease in strawberry was surveyed in Sa Moeng, Mae Taeng, Mae Rim and Mae Wang, Chiang Mai province, Thailand. The leaf blight samples were collected from cultivated fields primarily used for strawberry cultivation. Pathogens were isolated from leaf blight symptomatic strawberries in which 56 isolates were morphologically identified as *Pestalotiopsis* sp. including Sa Moeng (PSM) 29 isolates, Mae Taeng (PMT) 17 isolates, Mae Rim (PMR) 6 isolates and Mae Wang (PMW) 4 isolates, respectively.

Screening of *Pestalotiopsis* sp. for carbendazim resistance

Among the isolates of *Pestalotiopsis* sp., 56 isolates were randomly selected and tested for carbendazim re-

sistance by growth assays on PDA amended with carbendazim at concentrations of 0.01-1,000 mg/l. The isolates consisted of 39 isolates (69.6%) with the highly resistant (HR) phenotype containing 29 isolates (51.8%) obtained from Sa Moeng, 6 isolates (10.7%) from Mae Rim and 4 isolates (7.1%) from Mae Wang, respectively. There were 17 isolates (30.4%) of the sensitive (S) phenotype from Mae Taeng. None of the isolates showed weakly resistant (WR) or moderately resistant (MR) phenotype (Fig. 1).

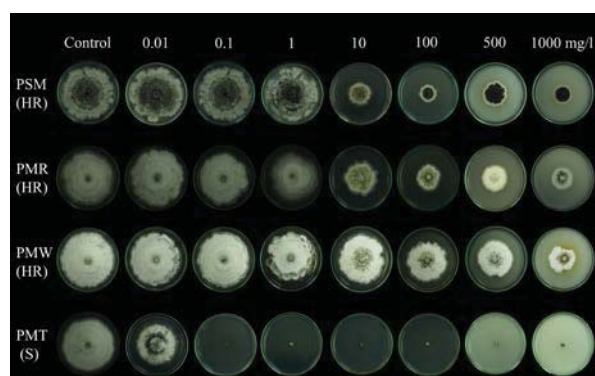


Fig. 1. Carbendazim-resistant assays of *Pestalotiopsis* sp. causing leaf blight strawberry on potato dextrose agar (PDA) supplemented with carbendazim at the control (0), 0.01, 0.1, 1, 10, 100, 500, and 1,000 mg/l; (HR) - highly resistant phenotype, (S) - sensitive phenotype

Analysis of β -tubulin gene from carbendazim resistance isolates of *Pestalotiopsis* sp.

A partial region of β -tubulin (*TUB2*) gene from 39 isolates of highly resistant (HR) phenotype and 17 isolates of sensitive (S) phenotype was amplified by PCR, and the sequences were compared with that of wild-type *P. clavispora* (accession no. EF152585.1).

ACKNOWLEDGMENT

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REFERENCES

- [1] P. Sampet, "Strawberry production in Thailand," *Thai J. Agri. Sci.*, 1980, vol 13(4), pp. 359-366.
- [2] L.N. Bhardwaj, Ved-Ram, G.K. Sharma, "Management of foliar diseases of strawberry," *Plant Disease Res.*, 1998, vol 13, pp. 169-171.
- [3] C.L. Davidse, 1986. Benzimidazole fungicides: mechanism of action and biological. *Impact Annual Review Phyto.* vol. 24, pp. 43-65.
- [4] Z. Ma, T. J. Michilides, "Advances in understanding molecular mechanisms of fungicide resistance and molecular detection of resistant genotypes in phytopathogenic fungi," *Crop Protection*, 2005, vol. 24, pp. 853-863.

Functional Evaluation of ACR-toxin Biosynthesis Genes

Matsuoka, S., Nikaido, S., Izumi, Y., Kamei, E., Katsumoto, M., Masunaka, A., Miyamoto, Y., Ohtani, K., Mochizuki, S., Peever, T. L., Ichimura, K., Gomi, K., and Akimitsu, K.
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Alternaria alternata rough lemon pathotype produces host selective ACR-toxin and causes *Alternaria* leaf spot disease in rough lemon. ACR-toxin biosynthesis gene cluster *ACRT* locates in 1.5 Mb-conditionally dispensable chromosome (CDC) in the genome of *A. alternata* rough lemon pathotype. Draft sequence of this CDC identified three open reading frames named *ACRTS1*, 2, 3, and these genes were found to exist only in the genome of ACR-toxin producers. *ACRTS1* encoding hydroxylase and *ACRTS2* encoding polyketide synthase were essential for ACR-toxin biosynthesis. Targeted gene disruption of one copy of multiple *ACRTS3* homologs encoding cyclase also reduced ACR-toxin production and virulence. RNA-silenced mutant of *ACRTS3* led complete loss of ACR-toxin production and pathogenicity. Considering of a putative biosynthetic pathway of ACR-toxin, enzymes encoding by *ACRTS1*, 2, 3 are likely sufficient enough to complete production of ACR-toxin. Three genomic fragments from the CDC containing respectable *ACRTS* genes were transformed to non-pathogenic strain of *A. alternata*, which does not produce ACR-toxin and has no CDC. Examinations of ACR-toxin production in the transformants are currently progressing.

INTRODUCTION

Alternaria alternata (Fr.) Keissl. is generally known to distribute in the nature as a saprophytic fungus. Some of phytopathogenic *A. alternata* produces host-selective toxin (HST). HSTs of *A. alternata* are low-molecular-weight, secondary metabolites that induce disease symptoms and have the same specificity as infection by the toxin-producing *A. alternata*.

Host-selective ACR-toxin consists of a dihydro-pyrone ring with a polyalcohol side chain produced by *A. alternata* rough lemon pathotype (Fig. 1) [1]. Draft sequence of 1.5 Mb-CDC identified three open reading frames (ORFs) which exist specifically in the genome of ACR-toxin producers. By gene disruption and RNA silencing of *ACRTS1* encoding hydroxylase, *ACRTS1*-disruptants reduced ACR-toxin production and virulence and *ACRTS1*-silenced mutant completely lost the ACR-toxin production and pathogenicity. This result suggested that *ACRTS1* was essential for ACR-toxin biosynthesis and virulence [2]. *ACRTS2* encoding polyketide synthase (PKS) was also isolated and analyzed its function by gene disruption and RNA silencing. As the result, *ACRTS2* was also identified to be essential for ACR-toxin biosynthesis and pathogenicity [3]. Furthermore, *ACRTS3* encoding cyclase was also analyzed by targeted gene disruption of one copy of multiple *ACRTS3* homologs and reduction of ACR-toxin production and virulence was identified. These results revealed involvement of *ACRTS3* for ACR-toxin biosynthesis and additional confirmation using RNA-silencing and the following experiments were achieved.

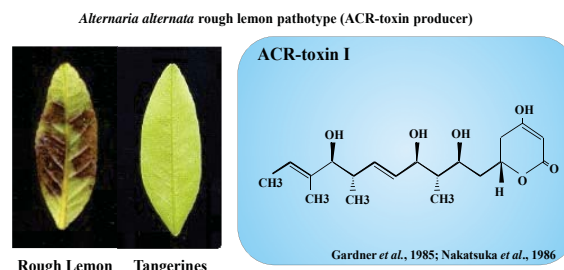


Fig. 1. Chemical structure of host-selective ACR-toxin I produced by *A. alternata* rough lemon pathotype. ACR-toxin is pathogenic to rough lemon and rangpur lime, but not pathogenic to tangerines.

Considering of a putative biosynthetic pathway of ACR-toxin, enzymes encoding by *ACRTS1*, 2, 3 are likely sufficient enough to complete production of ACR-toxin. Three genomic fragments with sizes of 14.8 kb, 16.5 kb, and 7.9 kb from the CDC containing respectable *ACRTS* genes were transformed to non-pathogenic strain of *A. alternata* O-94, which does not produce ACR-toxin and has no CDC.

RESULTS AND DISCUSSIONS

RNA-silenced mutant of *ACRTS3* led complete loss of ACR-toxin production and pathogenicity. These results indicate that *ACRTS3* is required for ACR-toxin biosynthesis and is essential for pathogenicity of the rough lemon pathotype of *A. alternata*.

To produce *ACRTS1*, 2, 3 transformants, genomic fragments with size of 14.8 kb, 16.5 kb, and 7.9 kb from the CDC containing respectable *ACRTS* genes were amplified by Long PCR. PEG-mediated transformation generated a transformant with three fragments containing *ACRTS1*, 2, 3 respectively (3G-6B). Mycelium suspension of this transformant was treated with rough lemon leaves. As a result, 3G-6B caused little necrotic lesion. Further analyses of this transformant 3G-6B is currently progressing.

REFERENCES

- [1] Akimitsu, K., Peever, T.L. and Timmer, L.W. (2003) Molecular, ecological and evolutionary approaches to understanding *Alternaria* diseases of citrus. *Mol. Plant Pathol.* 4: 435-446.
- [2] Izumi, Y., Kamei, E., Miyamoto, Y., Ohtani, K., Masunaka, A., Fukumoto, T., Gomi, K., Tada, Y., Ichimura, K., Peever, T. L., and Akimitsu, K. 2012. Role of pathotype-specific *ACRTS1* gene encoding a hydroxylase involved in the biosynthesis of host-selective ACR-toxin in the rough lemon pathotype of *Alternaria alternata*. *Phytopathology* 102:741-748.
- [3] Izumi, Y., Ohtani, K., Miyamoto, Y., Masunaka, A., Fukumoto, T., Gomi, K., Tada, Y., Ichimura, K., Peever, T. L., and Akimitsu, K. (2012). A polyketide synthase gene, *ACRTS2*, is responsible for biosynthesis of host-selective ACR-toxin in the rough lemon pathotype of *Alternaria alternata*. *MPMI* 25:1419-1429.

Isolation of growth inhibitory substances

in *Cyathea lepifera* leaves

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Introduction

Cyathea lepifera Copel. is one of the dominant forest species distributed in the subtropical and tropical areas on East and Southeast Asia. An allelopathic interaction of this fern with other plant species may be involved in the domination. Allelopathic substances, which accumulated in the soil by the leaching from the leaves and/or decomposing of the leaves, may inhibit the growth of other plant species. However, there has been no published studies of allelopathic activities of *C. lepifera*. Thus, the objectives of this study were the determination of allelopathic activities of *C. lepifera* leaves extracts and isolation of allelopathic substances.

Material and Method

C. lepifera leaves were extracted with 70% (v/v) aqueous methanol and methanol for two days, respectively. After filtration, those extracts were combined and evaporated at 40°C. Then, the biological activity of the extracts was determined on the shoot and root growth of cress (*Lepidium sativum* L.), lettuce (*Lactuca sativa* L.), alfalfa (*Medicago sativa* L.), Italian ryegrass (*Lolium multiflorum* Lam.), timothy (*Phleum pratense* L.) and barnyard grass (*Echinochloa crus-galli* (L.) Beauv.) at the six concentrations. The extracts were partitioned with an equal volume of ethyl acetate. The ethyl acetate fraction was then separated by silica gel column and Sephadex LH-20 columns, and C₁₈ cartridges while monitoring inhibitory activity with cress bioassay. The active substances were finally purified by high performance liquid chromatography.

Result and Discussion

Aqueous methanol extracts of *C. lepifera* leaves inhibited the shoot and root growth of all test plants and the increasing extract concentration increased the inhibition (Fig. 1). At the concentrations greater than 100 mg dry weight equivalent

extract/mL, the shoot and root growth of all test plants were inhibited by 30% and 1% that of control, respectively.

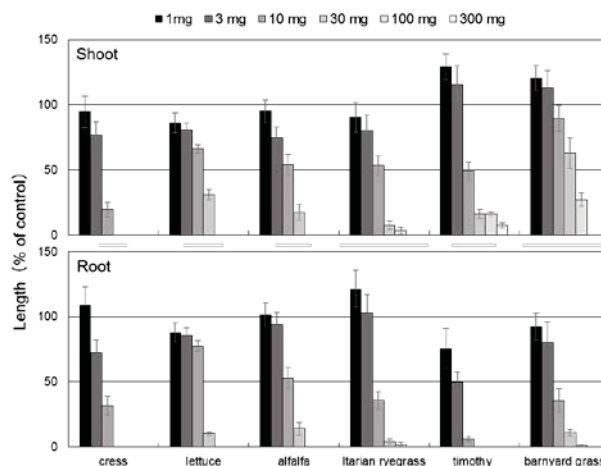


Fig. 1. Effects of aqueous methanol extracts of *C. lepifera* leaves on shoot and root growth of six test plants at the concentrations of 1, 3, 10, 30, 100, 300 mg dry weight equivalent extract/mL. Means \pm SE from two independent experiments with 10 plants for each determination are shown (n=20).

Two inhibitory substances were finally isolated by high performance liquid chromatography at the retention time of 134-140 min and 158-164 min, respectively (Fig. 2). Both substances exhibited the growth inhibitory activity on the shoot and root growth of cress seedlings (Fig. 3).

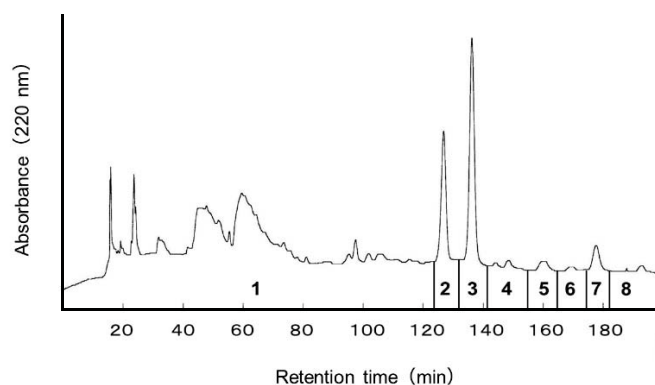


Fig. 2. HPLC chromatogram of active fraction.

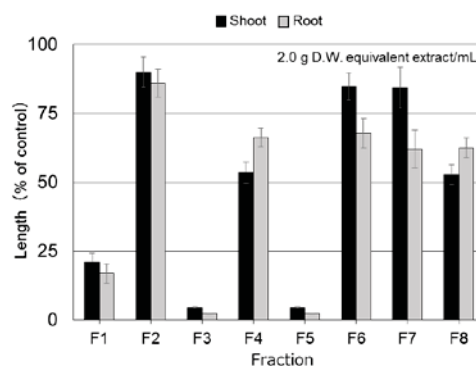


Fig. 3. Effects of fractions separated by HPLC on shoot and root growth of cress seedlings. Means \pm SE from two independent experiments with 10 plants for each determination are shown (n=20).

The present results suggest *C. lepifera* leaves may have allelopathic activities and contain at least two growth inhibitory substances. These growth inhibitory substances

may play an important role in allelopathic activities of *C. lepifera*.

D-Allulose and D-allose production by D-allulose 3-epimerase and L-rhamnose isomerase from *Shinella* sp. NN-6 and characterization of D-allulose 3-epimerase

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Shinella sp. NN-6 has D-allulose 3-epimerase (D-AE) and L-rhamnose isomerase (L-RhI). These enzymes were simultaneously produced with yeast extract medium containing 1.0% L-rhamnose. A partially purified D-AE and L-RhI complex (AERIC) was prepared from crude enzyme. The immobilized AERIC (iAERIC) showed the both activity in wide pH range, (pH7.0-9.0) at 45°C, providing D-allulose and D-allose from D-fructose. However, D-glucose was also produced as a by-product. The equilibrium of D-glucose, D-fructose, D-allulose, and D-allose was in a ratio of 7:64:9:7. The purified D-AE was found to be homogenous 37 kDa on SDS-PAGE and 148 kDa by gel filtration, suggesting that this D-AE was four identical subunits. The enzyme was the most specific for D-allulose. This enzyme was the most active at pH 5.5 and 80 °C in the presence of Co^{2+} . The kinetics parameter, K_m , turnover number (k_{cat}), and catalytic efficiency (k_{cat}/K_m) toward D-allulose was 108 mM, 21765 min^{-1} , and 201 $\text{min}^{-1} \text{mM}^{-1}$, respectively.

INTRODUCTION

D-Allulose and D-allose are rare sugars which exist in nature in extremely small amounts. Recently rare sugar has attracted attention because they have superior functionality. For example, D-allulose has effects of Insulin secretagogue, inhibition of arteriosclerosis and anti obesity, D-allose has effect of ischemia protective, inhibition of cancer cell growth and antioxidant. We had developed to produce D-allulose and D-allose individually by D-AE and L-RhI, respectively [1, 2]. Thus, production cost is increased. Thus, we used D-AE and L-RhI complex (AERIC) which was prepared from *Shinella* sp. NN-6, resulting that D-allulose and D-allose were simultaneously produced from D-fructose. Furthermore, characterization of immobilized D-AE and L-RhI complex (iAERIC) and purified D-AE were investigated.

RESULTS AND DISCUSSIONS

Shinella sp. NN-6 was used to prepare D-AE and L-RhI. When NN-6 was cultivated with YE medium containing 1.0% L-rhamnose, these enzymes were simultaneously produced in NN-6. The collected cells were disrupted by sonication. A crude extract was partially purified by polyethylene glycol #6000 fractionation, providing partially purified AERIC, and then it was immobilized to HPA25L, named iAERIC.

D-AE and L-RhI activity in iAERIC was determined. The maximal activity D-AE from D-fructose to D-allulose and that of L-RhI from L-rhamnose to L-rhamnulose was given at acetate buffer (pH 5.5) and sodium phosphate buffer (pH7.0), respectively. These enzymes showed wide pH stability in a range of pH 5.5 to 9.0 (D-AE) and pH 8.0 to 10

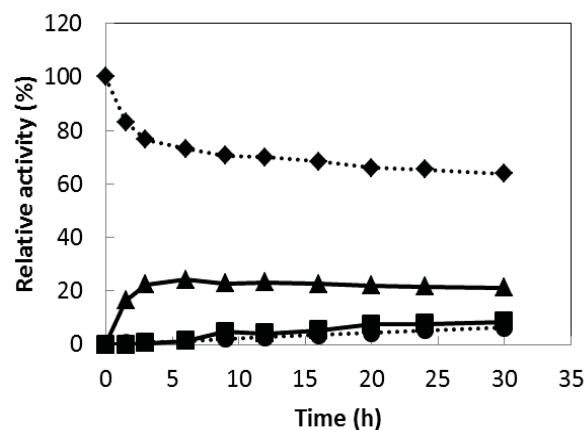


Fig. 1. Time-course of the production of D-allulose and D-allose from D-fructose by immobilized D-allulose 3-epimerase and L-rhamnose isomerase complex from NN-6. D-Allulose (▲), D-allose (■), D-fructose (◆) and D-glucose (●).

(L-RhI). These enzymes activity were determined an effect of temperature using D-fructose and L-rhamnose as substrate. D-AE and L-RhI exhibited an optimum temperature at 80°C and 55°C, respectively. Furthermore, they exhibited high thermostability up to 70°C and 50°C for 1 h, respectively.

D-Allulose and D-allose were produced from D-fructose by iAERIC in sodium phosphate buffer (pH7.0) or glycine-NaOH buffer (pH8.5 or 9.0) at 45°C. Unexcitingly, D-glucose was also produced as a by-product from D-fructose, resulting that the equilibrium of D-glucose, D-fructose, D-allulose and D-allose was in a ratio of 7: 64: 9: 7 (Fig. 1).

The molecular weight of purified D-AE was 37 kDa on SDS-PAGE and 148 kDa by gel filtration, suggesting that this D-AE was four identical subunits. D-AE was the most specific for D-allulose, however it was able to epimerize for all ketohexoses. This enzyme was a metal-dependent enzyme and required strongly Co^{2+} as cofactor and was the most active at pH 5.5 and 80 °C. The kinetics parameter, K_m , turnover number (k_{cat}), and catalytic efficiency (k_{cat}/K_m) toward D-allulose was 108 mM, 21765 min^{-1} , and 201 $\text{min}^{-1} \text{mM}^{-1}$, respectively.

ACKNOWLEDGMENT

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REFERENCES

- [1] Itoh H, Sato T, Izumori K. Preparation of D-psicose from D-fructose by immobilized D-tagatose 3-epimerase. *J Ferment Bioeng* 1995;80:101-103.
- [2] Morimoto K, Park CS, Ozaki M, Takeshita K, Shimonishi T, Granström BT, Takata G, Tokuda M, and Izumori K. Large scale production of D-allose from D-psicose using continuous bioreactor and separation system. *Enzyme Microb Technol* 2006;38: 855-859.

D-Allulose separation by boronic acid gel chromatography

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D-Allulose and D-allose exist rarely in nature. They have physiological functions for human body such as arteriosclerosis-preventing and anticancer, respectively. These rare sugars are able to be produced two enzymatic reactions or chemical reaction. In this study, D-allulose and D-allose were produced by a coupling reaction of D-allulose 3-epimerase (D-AE) and L-rhamnose isomerase (L-RhI) from D-fructose as a starting material. Meanwhile, Rare sugar sweet (RSS) containing D-allulose, D-allose, and several kinds of rare sugars is produced from a high fructose corn syrup by chemical procedure. D-Allulose was separated from enzymatic reaction mixture and RSS using a boronic acid gel column. Boronic acid gel column system was able to work in sodium phosphate buffer (pH 8.0 or 8.5). D-Allulose was the highest affinity to a boronic acid gel among the tested sugars, suggesting that D-allulose was easily purified alone. This separation system will be available for rare sugar separation.

INTRODUCTION

In our laboratory, production procedure of rare sugars is studied by means of various kinds of rare sugars producing enzymes [1]. Especially, D-allulose which is produced from inexpensive D-fructose by enzymatic reaction, has arteriosclerosis-preventing function. D-Allulose is also included in RSS which is produced cheaply by chemical reaction. A separation of only D-allulose from RSS is difficult because RSS contains about 50 kinds of sugars such as D-glucose, D-fructose and D-allose. Moreover the separation of D-allulose from a reaction mixture and RSS spends time and cost. In this study, thus, we focused on boronic acid gel for efficient separation of rare sugars. The separation method can simplify this step because monosaccharides interact to this gel under alkali condition. Providing that desalting after reaction to produce rare sugars is not necessary.

Here, we report a novel separation method of D-allulose from reaction mixture and RSS (Fig. 1).

RESULTS AND DISCUSSIONS

D-Allulose from enzymatic reaction mixture and RSS was separated successfully. D-Allulose in enzymatic reaction mixture was separated in three fractions under sodium phosphate buffer (pH8.5) at a flow rate 0.7 mL/min and 25 °C. The first fraction was included D-allose and D-glucose as by-products due to enzymatic reaction, the second fraction was included only D-fructose. D-Allulose was collected individually in the third fraction. Meanwhile RSS was separated in two fractions under glycine-NaOH buffer (pH8.5) at a flow rate 0.5 mL/min and 25 °C. The first fraction was included several kinds of sugars such as D-glucose, D-fructose and D-allose and the second fraction was included only D-allulose (Fig. 2).

These results suggested that D-allulose was the highest affinity to the boronic acid gel among tested sugars. More studies need more efficient separation condition such as temperature, buffer and pH.

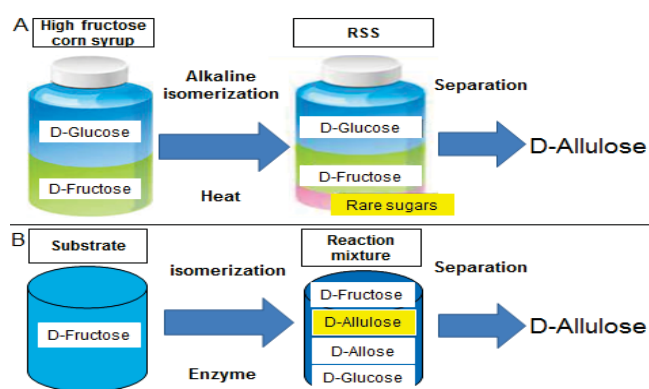
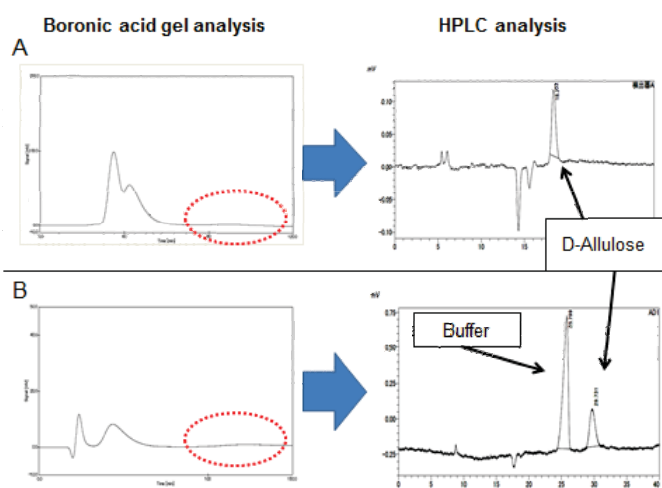


Fig.1 The separation strategy of RSS (A) and enzymatic reaction mixture (B) using boronic acid gel.



DPPH Free Radical Scavenging and α -Glucosidase Inhibition Activities of the Extracts of Five Indonesian Underutilized Fruits from Java Island

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INTRODUCTION

Plants have been used for traditional medicines by different cultures around the world since ancient times [1]. The objective of this study was to explore the bioactive compounds, in particular antioxidants and antidiabetics, from natural resources.

Five Indonesian underutilized fruits, *Baccaurea racemosa*, *Mangifera caesia*, *Pouteria campechiana*, *Sandoricum koetjape*, and *Syzigium cumini* (Fig. 1) from Java Island were screened for DPPH free radical scavenging activity and α -glucosidase inhibitory activity. Successive extraction of these fruits was done with ethyl acetate and methanol.

B. racemosa belongs to the family *Phyllanthaceae* and is indigenous to Thailand, Peninsular Malaysia, Sumatra, Java, Lesser Sunda Islands, Borneo, Celebes, and Moluccas. Its acid-sweet arillode is edible fresh stewed, pickled, fermented or made into drinks. [2]. *M. caesia* is related to the 'Mango' fruit (*Mangifera indica*). The genus *Mangifera* belongs to the family *Anacardiaceae* [3]. From the bark, collected in Java, many alkenylphenols and alkenylsalicylic acids were isolated [4]. *P. campechiana* is in the *Sapotaceae* family that bears edible fruits. The pulp is yellow and the flavor is sweet, like that of a baked sweet potato. Seven polyphenolic antioxidants, gallic acid, (+)-gallo catechin, (+)-catechin, (-)-epicatechin, dhydromyricetin, (+)-catechin-3-*O*-gallate, and myricitrin, were isolated from the fresh fruit [5]. *S. koetjape* is widely distributed in tropical regions and used for various traditional medical purposes such as childbirth tonic, diarrhea, and leucorrhoea. Analysis of the chemical composition has found some kinds of terpenoids [6]. *S. cumini* is commonly known as 'jamu'. The bark, fruits, seeds or leaves of this plant, collected from various regions of the world and administered in different pharmaceutical preparations (e.g. tinctures and aqueous extracts), decrease blood glucose levels in diabetic animals [7].

RESULTS AND DISCUSSIONS

S. cumini ripe seeds (ethyl acetate extract) exhibited significant DPPH free radical scavenging activity (IC_{50} 4.91 μ g/mL), which was stronger than trolox (IC_{50} 7.08 μ g/mL).

P. campechiana ripe fruit pulp (methanol extract), *P. campechiana* raw fruit pulp (methanol extract), *B. racemosa* ripe fruit peel (ethyl acetate extract), *B. racemosa* ripe fruit peel (methanol extract), *S. cumini* ripe seeds (ethyl acetate extract), and *S. cumini* ripe seeds (methanol extract) exhibited significant α -glucosidase inhibitory activity (IC_{50} 0.13, 0.19, 0.14, 0.15, 0.15, and 0.12 mg/mL, respectively).

Our results indicated that *S. cumini* and *P. campechiana* were prospective fruits for use as natural antioxidant and antidiabetic sources among the five fruits studied. In addition, we have found that *S. cumini* ripe seeds (ethyl acetate extract) contained gallic acid, known as a typical antioxidant.

Furthermore, our group reported antihyperlipidemic activity of these five Indonesian underutilized fruits, and showed that the acetone extracts of both raw and ripe peels of *B. racemosa* fruit were potent inhibitors for HMG CoA reductase activity [8]. *B. racemosa* ripe fruit peel has both antihyperlipidemic and antidiabetic activities.

REFERENCES

- [1] H.J. Jeong, *et al.*, "In vitro antioxidant and antidiabetic activities of *Rehmannia glutinosa* tuberous root extracts," *Science Asia*, vol. 39, pp. 605-609, 2013.
- [2] T.K. Lim, "*Baccaurea racemosa*," *Edible Medicinal And Non-Medicinal Plants*, vol. 4, pp. 243-247, 2012.
- [3] N. Yamanaka, M. Hasran, D. H. Xu, H. Tsunematsu, S. Idris, and T. Ban, "Genetic Relationship and Diversity of Four *Mangifera* Species Revealed through AFLP Analysis," *Genet. Resour. Crop Evol.*, vol. 53, pp. 949-954, 2006.
- [4] D. Masuda, *et al.*, "Alkenylphenol and alkenylsalicylic acid from *Mangifera caesia*," *Biochem. Syst. Ecol.*, vol. 30, pp. 475-478, 2002.
- [5] J. Ma, H. Yang, M.J. Bashile, and E.J. Kennelly, "Analysis of Polyphenolic Antioxidants from the Fruits of Three *Pouteria* Species by Selected Ion Monitoring Liquid Chromatography-Mass Spectrometry," *J. Agric. Food Chem.*, vol. 52, pp. 5873-5878, 2004.
- [6] M. Efdi, *et al.*, "Sentulic acid: A cytotoxic ring A-seco triterpenoid from *Sandoricum koetjape* Merr.," *Bioorg. Med. Chem. Lett.*, vol. 22, pp. 4242-424, 2012.
- [7] A. Bopp, K.S. De Bona, L.P. Bellé, R.N. Moresco, and M.B. Moretto, "*Syzygium cumini* inhibits adenosine deaminase activity and reduces glucose levels in hyperglycemic patients," *Fundam. Clin. Pharmacol.*, vol. 23, pp. 501-507, 2009.
- [8] D. Andrianto, T. Katayama, and T. Suzuki, "Screening of Antioxidant and Antihyperlipidemic Potencies of Indonesian Underutilized Fruits" *Journal of the Forest Biomass Utilization Society*, vol. 10, pp. 19-25, 2015.



Fig. 1. Ripe fruits of (a) *B. racemosa*, (b) *M. caesia*, (c) *P. campechiana*, (d) *S. koetjape*, and (e) *S. cumini*.

Search of Putative Complex Proteins with Rice Glucose 6-Phosphate Dehydrogenase1 (OsG6PDH1)

Aki, A., Matsudaira, K., Kano, A., Mochizuki, S., Ohtani, K., Fukumoto, T., Yoshihara, A., Izumori, K., Ichimura, K., Gomi, K. and Akimitsu, K.

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Rare sugars including D-allose are defined as monosaccharides with low abundance in nature. D-Allose has the ability for induction of disease resistance to *Xanthomonas oryzae* pv. *oryzae* in rice. Phosphorylation of D-allose at C6 by hexokinase (HXK) is essential for the D-allose-induced reactions, and the HXK-product of D-allose 6-phosphate (A6P) is necessary for the signal transduction. D-Glucose 6-phosphate dehydrogenase (G6PDH) is a putative target enzyme of A6P. Rice G6PDH (OsG6PDH1)-defective mutant was less sensitive to D-allose, and OsG6PDH1 complementation restored full sensitivity, indicating that OsG6PDH1 has also some role in D-allose-signal transduction. G6PDH activity was maintained for a long time in D-allose treatment than D-glucose treatment. We generated polyclonal anti-OsG6PDH1 antibodies for the western blotting, and OsG6PDH1 signal was detected more in extracts from D-allose-treated rice than D-glucose-treated rice. Since G6PDHs have been known to form a protein complex for their functions, we further studied to identify the component proteins of OsG6PDH1 complex. Immunoprecipitation and the following TOF-MS analyses identified multiple complex protein candidates including Glutaredoxin (GRX), Calcineurin B-like protein (CBL), Calmodulin (CAM), and Serine/threonine-protein kinase (SAPK).

INTRODUCTION

D-Allose, an epimeric monosaccharide at C3 of D-glucose, is one kind of rare sugars. D-Allose has the ability for induction of disease resistance to *Xanthomonas oryzae* pv. *oryzae* (*XOO*) in rice (Fig. 1) [1]. Transgenic rice plants overexpressing *OsrbohC*, encoding NADPH oxidase, were enhanced their sensitivity to D-allose. 6-Deoxy-D-allose did not induce resistance to *XOO* in rice [2]. Phosphorylation of D-allose at C6 by hexokinase (HXK) is essential for the D-allose-induced reactions, and the HXK-product of D-allose 6-phosphate (A6P) is necessary for the signal transduction [2-4]. A putative target enzyme of A6P was considered as D-glucose 6-phosphate dehydrogenase (G6PDH). Rice G6PDH (OsG6PDH1)-defective mutant was less sensitive to D-allose, and OsG6PDH1 complementation restored full sensitivity, indicating that OsG6PDH1 has also some role in D-allose-signal transduction [2]. We generated polyclonal anti-OsG6PDH1 antibodies for western blotting. Furthermore, since G6PDHs have been known to form protein complex for their functions, we achieved immunoprecipitation and TOF-MS analyses for identification of candidate proteins forming complex with OsG6PDH1.

RESULTS AND DISCUSSIONS

G6PDH1 activity and signal detection

OsG6PDH1 gene expression was induced in D-allose-treated rice, and G6PDH activity was maintained longer than

D-glucose-treated rice. Western blotting analysis using polyclonal anti-OsG6PDH1 antibodies for detection of OsG6PDH1 stability revealed that OsG6PDH1 signal was detected more in extracts from D-allose-treated rice than D-glucose-treated rice.

G6PDH1 complex candidate protein and interaction

Proteins from immunoprecipitation using polyclonal anti-OsG6PDH1 antibodies were separated by SDS-PAGE for TOF-MS analyses. TOF-MS analyses identified multiple OsG6PDH1 complex candidate proteins including OsGRX14, OsCBL6, OsSAPK5, and OsCAM2 related to reactive oxygen species. We isolated the full length of genes encoding these candidate proteins, and the confirmation of interaction with OsG6PDH1 using yeast two hybrid is currently progressing.

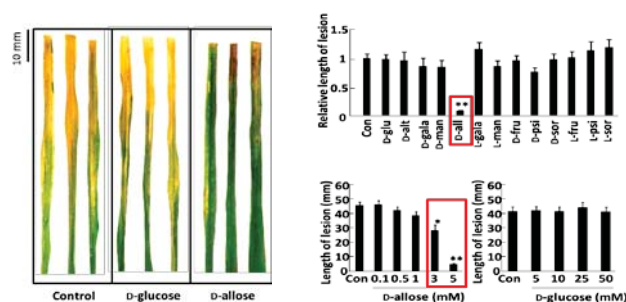


Fig. 1. The length of lesions on 5th leaf blades at 10 days after inoculation with *Xoo*.

ACKNOWLEDGMENT

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REFERENCES

- [1] Kano, A., Gomi, K., Yamasaki-Kokudo, Y., Satoh, M., Fukumoto, T., Ohtani, K., Tajima, S., Izumori, K., Tanaka, K., Ishida, Y., Tada, Y., Nishizawa, Y., and Akimitsu, K. (2010). A rare sugar, D-allose, confer resistance to rice bacterial blight with upregulation of defense-related genes in *Oryza sativa*. *Phytopathology* 100:85-90.
- [2] Kano, A., Fukumoto, T., Ohtani, K., Yoshihara, A., Ohara, T., Tajima, S., Izumori, K., Tanaka, K., Ohkouchi, T., Ishida, Y., Nishizawa, Y., Ichimura, K., Tada, Y., Gomi, K., and Akimitsu, K. (2013). The rare sugar D-allose acts as a triggering molecule of rice defence via ROS generation. *Experimental Botany* 64: 4939-4951
- [3] Fukumoto T, Kano A, Ohtani K, et al. 2011. Rare sugar D-allose suppresses gibberellin signaling through hexokinase-dependent pathway in *Oryza sativa* L. *Planta* 234:1083-1095.
- [4] Fukumoto T, Kano A, Ohtani K, et al. 2013. Phosphorylation of D-allose by hexokinase involved in regulation of *OsABF1* expression for growth inhibition in *Oryza sativa* L. *Planta* 237:1379-1391.

Isolation and Characterization of Rough Lemon cDNA Encoding Protease

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Little is known about defense-related genes and the defense response pathway on crops of economic importance, especially fruit plants, compared to a few model plants such as *Arabidopsis*, tobacco, and rice. In this study, to identify and characterize citrus genes that respond to pathogen attacks or various types of stress, we made a profile of defense/stress induced transcripts from rough lemon (*Citrus jambhiri* Lush). These induced genes were categorized into five groups representing the oxylipin pathway, phytoalexin biosynthesis, PR proteins, cell wall fortification, and others. The PR proteins group contained genes encoding proteases including cysteine proteinases and an aspartic protease. These proteases may be involved in citrus defense responses, therefore we have been examining genes encoding proteases including cysteine proteinases and an aspartic protease.

INTRODUCTION

Citrus is one of the major fruit trees planted around the world, however little is known about molecular basis. To understand the defense and stress responses against various exogenous factors, partial sequences of 500 cDNAs were identified by PCR-based subtractive hybridization using rough lemon (*Citrus jambhiri* Lush) inoculated/or non-inoculated with incompatible strain of *Alternaria alternata* (Fig. 1) [1]. Based on the sequence information of these cDNA clones, we had isolated and characterized 12 defense-related genes; e.g., epoxide hydrolase (*RlemEH*) [1] and thaumatin-like protein (*RlemTLP*) [2]. Some of the subtraction clones also showed a sequence similarity to cysteine proteinase or aspartic protease. Plant proteases are reported as important players in plant immunity [3]. However, proteases have not been investigated their functions in citrus. Thus, we are characterizing roles of both cysteine proteinase and aspartic protease in citrus defense.

RESULTS AND DISCUSSIONS

Partial sequences of 500 cDNAs were cloned from rough lemon leaves that were inoculated with incompatible strain of *A. alternata* after subtraction with that of non-inoculated leaves by using PCR-based subtractive hybridization [1]. Homology analysis using BLAST was performed for the sequence information of these 500 cDNA clones. As a result, these sequences were further categorized into five groups representing the oxylipin pathway, phytoalexin biosynthesis, PR proteins, cell wall fortification, and others. The PR proteins group contained genes encoding proteases including cysteine proteinases and an aspartic protease.

We isolated cDNA encoding putative cysteine proteinase (Cys) and aspartic protease (Ap) of rough lemon by primers which were designed from untranslated regions of sweet orange cDNA. The deduced amino acid sequences of these

Cys and Ap consist of 468 and 496 amino acids, and the deduced amino acid sequences of these clones are 99% and 99% similar to those of sweet orange, respectively. Further, Cys has about 70% identities to *Arabidopsis* (At1g47128) and tomato (AF172856) cysteine proteinase RD21a involved in defense response to fungus [4]. These have same putative domains of signal peptide, prodomain, protease domain and Granulin. Ap has 62% identities to CDR1 that releases systemic signaling molecules that trigger defense responses in *Arabidopsis* [5]. These have deduced amino acid sequences of Gly-Thr-Pro-Pro and Asp-Thr-Gly-Ser that are aspartic activation sites. That gives expectation of that these proteases are also likely to involve in citrus defense.

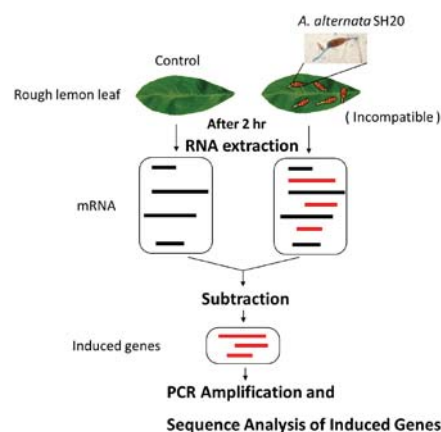


Fig. 1. Induced genes identified by PCR-based subtractive hybridization

REFERENCES

- [1] Gomi, K., Yamamoto, H., and Akimitsu K. (2003). Epoxide hydrolase: a mRNA induced by the fungal pathogen *Alternaria alternata* on rough lemon (*Citrus jambhiri* Lush). *Plant Mol. Biol.* 53: 189-199.
- [2] Kim, B. G., Fukumoto, T., Tatano, S., Gomi, K., Ohtani, K., Tada, Y., and Akimitsu, K. (2009). Molecular cloning and characterization of a thaumatin-like protein-encoding cDNA from rough lemon. *Physiol. Mol. Plant Pathol.* 74: 3-10.
- [3] Shabab, M., Shindo, T., Gu, C., Kaschani, F., Pansuriya, T., Chinthia, R., and van der Hoorn, R. A. (2008). Fungal effector protein AVR2 targets diversifying defense-related cys proteases of tomato. *Plant Cell* 20: 1169-1183.
- [4] Shindo, T., Misas-Villamil, J. C., Hörger, A. C., Song, J., and van der Hoorn, R. A. (2012). A role in immunity for *Arabidopsis* cysteine protease RD21, the ortholog of the tomato immune protease C14. *PLoS one* 7: e29317.
- [5] Xia, Y., Suzuki, H., Borevitz, J., Blount, J., Guo, Z., Patel, K., Dixon, R.A., and Lamb, C. (2004). An extracellular aspartic protease functions in *Arabidopsis* disease resistance signaling. *EMBO J.* 23: 980-988.

Analysis of the effect of D-allose on *Itea* plants

Tsuji, N., Fukumoto, T., Mochizuki, S., Ohtani, K., Matsudaira, K., Shimagami, T., Yoshihara, A., Izumori, K., Ichimura, K., Gomi, K., and Akimitsu, K.

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Although plants are a major producer of monosaccharides and provide D-glucose and D-fructose as energy sources to all livings in nature, only *Itea* plants can produce rare sugars, D-psicose and allitol, addition to D-glucose and D-fructose. In this study, we examined the effect of D-allose, in which *Itea* cannot produce, on *Itea*. D-allose inhibits *Itea* shoot growth at a concentration of 0.5mM, whereas D-glucose (the epimer of D-allose at C3) does not inhibit even at up to 100mM. Phosphorylated D-allose at C6 was detected in extracts from D-allose-treated *Itea*. These findings suggest that *Itea* plants are insensitive to D-psicose but sensitive to D-allose and have similar D-allose-signal pathway identified previously in rice.

INTRODUCTION

Monosaccharides and their derivatives with low abundancy in nature are defined as rare sugars. Rare sugars, D-psicose (known as D-allulose) and allitol, are the major monosaccharide components in *Itea* plants, and only *Itea* can produce these rare sugars in nature. D-psicose and D-allose inhibit shoot growth transiently and induce resistance to phytopathogens with various defense responses in rice. Moreover, enzymatic phosphorylation of D-allose and D-psicose at C6 is essential, and a fail of the phosphorylation dismisses both growth inhibition and resistant induction. However, the effect of D-allose, in which *Itea* cannot produce, on *Itea* and the mechanism to affect are not known. In this study, we show that shoot growth of *Itea* was inhibited by D-allose at very low concentration such as 0.5mM, and D-allose-6-phosphate (A6P) was detected in extracts from D-allose-treated *Itea*.

RESULTS AND DISCUSSION

Effect of D-allose on *Itea* shoot growth. To examine the effect of D-allose on shoot growth of *Itea*, *Itea* was grown in the medium, which contains various concentration of D-allose. The effect of treatments with D-psicose and two common sugars, D-fructose and D-glucose were also tested. The growth was inhibited by D-allose; the mean relative value of shoots were $81 \pm 7\%$ that of the control (no sugar added) with 0.5mM D-allose, $59 \pm 7\%$ with 1mM, $30 \pm 4\%$ with 2mM, and less than 0.5mM D-allose did not affect the growth. In contrast, there was no effect on *Itea* growth after treatment with 100mM D-psicose, D-fructose and D-glucose as compared to the control (Fig. 1B).

Detection of D-allose-6-phosphate (A6P) in D-allose-treated *Itea*. When D-allose affects (resistance induction and growth inhibition) on rice, the phosphorylation of D-allose at carbon 6 (D-allose-6-phosphate, A6P) is essential. 6-Deoxy-D-allose, a derivative of D-allose with a methyl group provided by conversion of a hydroxyl group to hydrogen on

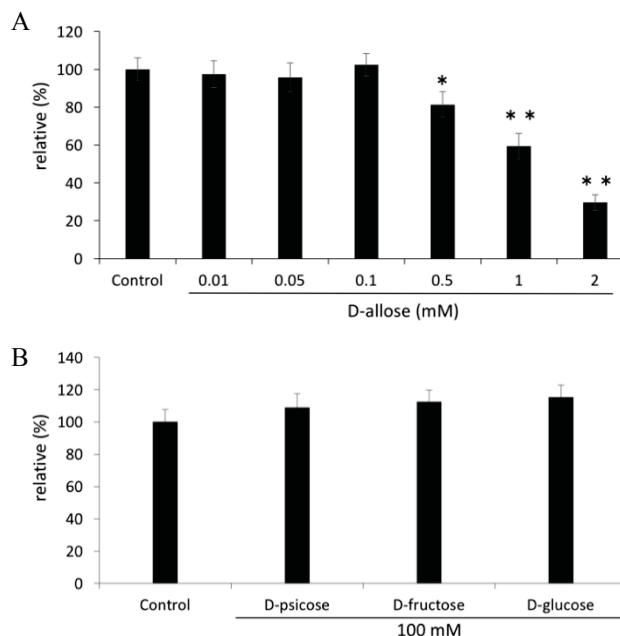


Fig. 1. Effects of sugar treatments on *Itea* shoot growth. Relative of length of *Itea* shoots after **A**, 0.01-2mM D-allose treatment, and **B**, 100mM D-psicose and other monosaccharides treatments for 20 days. Values are relative (\pm SE, $n \geq 17$) to the control (no sugar added, * $P < 0.05$, ** $P < 0.001$).

carbon 6, did not confer these effects on rice. HPLC was used to check for A6P in D-allose-treated *Itea*. A peak of A6P was not detected in the extract of the control (no sugar treatment) and D-psicose-treated *Itea*. In contrast, a peak of A6P was detected in the extract of D-allose-treated *Itea*.

These results suggest that *Itea* is insensitive to exogenous and endogenous D-psicose but sensitive to D-allose. Since phosphorylation of D-allose to A6P is the first crucial step in the D-allose-signal pathway in rice, the detection of A6P in D-allose-treated *Itea* shows a possibility that *Itea* has the similar D-allose-signal pathway identified previously in rice.

REFERENCES

- [1] Kano A, Gomi K, Yamasaki-Kokudo Y, *et al.* 2010. A rare sugar, D-allose, confers resistance to rice bacterial blight with upregulation of defense-related genes in *Oryza sativa*. *Phytopathology* 100, 85–90.
- [2] Kano A, Hosotani K, Gomi K, *et al.* 2011. D-Psicose induces upregulation of defense-related genes and resistance in rice against bacterial blight. *Journal of Plant Physiology* 168, 1852–1857.
- [3] Fukumoto T, Kano A, Ohtani K, *et al.* 2011. Rare sugar D-allose suppresses gibberellin signaling through hexokinase-dependent pathway in *Oryza sativa* L. *Planta* 234, 1083–1095.
- [4] Fukumoto T, Kano A, Ohtani K, *et al.* 2013. Phosphorylation of D-allose by hexokinase involved in regulation of OsABF1 expression for growth inhibition in *Oryza sativa* L. *Planta* 237, 1379–1391.
- [5] Kano A, Fukumoto T, Ohtani K, *et al.* 2013. The rare sugar D-allose acts as a triggering molecule of rice defence via ROS generation. *Journal of Experimental Botany* 64(16):4939-4951

Identification of Volatile Compounds in Dried Kaffir Lime Leaves by Liquid-Liquid Extraction Method

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INTRODUCTION

Kaffir lime (*Citrus hystrix* D.C.) is one kind of citrus plants and the leaf has aromatic essential oils which are used to flavor ingredient of Thai cuisine. Moreover, kaffir lime has an antioxidant activity and other medicinal benefits. Citronellal is the major volatile compound. The other volatile compounds found in kaffir lime leaves are α -pinene, limonene, linalool, citronellyl acetate and citronellol [2]. Some of those ingredients are heat-sensitive and too volatile to isolate them. In order to isolate them, new isolation techniques are required under the mild conditions. The aim of this study is to develop a unique technique for the isolation and identification of the volatile compounds in dried kaffir lime leaves by means of liquid-liquid extraction by capillary gas chromatography and also evaluate radical scavenging activity by DPPH method in order to add the values of the aromatic isolates.

RESULTS AND DISCUSSIONS

Liquid-liquid extraction method has 2 steps: hexane-methanol extraction and methanol-diethyl ether extraction. The yields of diethyl ether layer and hexane layer are shown in Fig. 1. The percent yields of non-volatile oil (after this, referred as Oil) + Volatile compounds and Oil in diethyl ether layer and hexane layer are 75.5, 73.7 and 23.0, 21.5 (%), respectively. The yields of the diethyl ether layers were higher than the hexane layers. By the duo-trio test, 100% of 19 assessors chose diethyl ether layer in the similarity with kaffir lime aromas. It means that volatile compounds mainly stay at diethyl ether layer because its layer is higher-polarity and aroma rich rather than hexane layer [1].

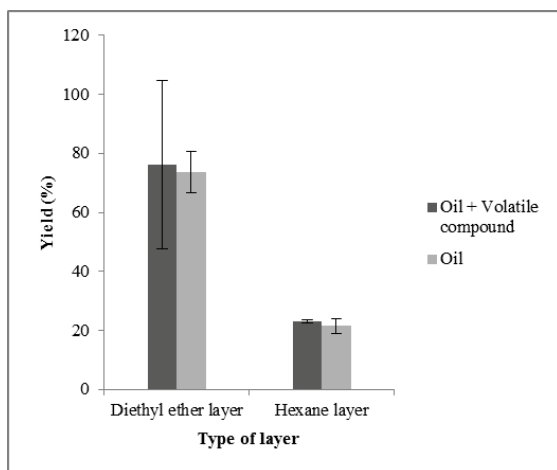


Fig. 1. The yield of oil and volatile compound in between hexane layer and methanol layer of dried kaffir lime leaves oil ($P < 0.05$)

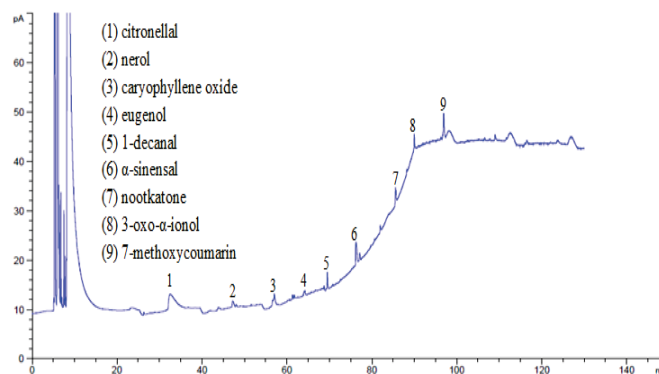


Fig. 2. Gas chromatogram of the volatile compounds in kaffir lime leaves.

Gas chromatogram of the volatile compounds in diethyl ether layer as shown in Fig. 2 indicates that kaffir lime leaves contain citronellal as the major compounds (0.34 ppm). Other compounds found in great amounts were caryophyllene oxide (0.1 ppm) and α -sinensal (0.06ppm). The occurrence of citronellal as the major component was reported in many papers [1], [2].

Antioxidant activity of methanol layer of dried kaffir lime leaves was measured by the using DPPH free radical scavenging assay [3]. The value of the 50% inhibition of radical scavenge (IC_{50}) must be less than 100 mg/mL to be considered an antioxidant [3]. The IC_{50} of the methanol layer was 29.3 mg/mL. This value is close to those of lemon grass (28.1 mg/mL) and herbs well known in Thailand with similarity in chemical structures [4].

In conclusion, liquid-liquid extraction method introduced here should be high efficient for getting aroma chemicals and antioxidant active substances.

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REFERENCES

- [1] C. Hanny Wijaya, "Oriental natural flavor: liquid and spray-dried flavor of "Jeruk purat" (*Citrus hystrix* DC) leaves," *Elsevier Science*, 1995, pp. 235-248.
- [2] Jirapakkul W., Tinchan P. and Chaseri S, "Effect of drying temperature on key odourants in kaffir lime (*Citrus hystrix* D.C., Rutaceae) leaves," *International Journal of Food Science and Technology*, 2013, pp. 143-149.
- [3] Petchrung Teptong, Jitpisuth Junthongoon, Ornmanee Prachuapjinda, Srisopa Ruangnoo and Arunporn Itharat, "Comparative Study of antioxidant activity and total phenolic content of ethanolic Extracts of ginger, black pepper and long pepper" *1st Conference on Graduate Student Network of Thailand*, Bangkok: 2012.
- [4] Sujira Ayusuk, Sunisa Siripongvutikorn, Paiboon Thummaratwasik and Worapong Usawakesmanee, "Effect of heat treatment on antioxidant properties of tom-kha paste and herbs/spices used in tom-kha Paste," *Kasetsart Journal*, 2009, pp. 305-312.

Regional Comparison of Cassava Production Profitability by Risk Analysis

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INTRODUCTION

As the globally grain crop, cassava has come to be extending crops. This paper aimed the comparative study in Thailand. The markets status farmers have faced regarding risk for input and output prices, are varied among regions. This study involved the risk analysis by fitting the probability distribution function to the past dataset. As the results, we can obtain the risk situation for profit and can quantify by probability.

As the globally grain crop, cassava has come to be extending crops.

This paper aimed the comparative study in Thailand. The markets status farmers have faced regarding risk for input and output prices, are varied among regions. This study involved the risk analysis by fitting the probability distribution function to the past dataset. As the results, we can obtain the risk situation for profit and can quantify by probability.

METHOD AND DATASET

Hardaker, Huirne, Anderson, Lien [1] applies the risk analysis to agriculture. Ngamsomsuke, Ekasingh, Taungngarm[2] applied to rice and maize production in Thailand.

As the input, price yield, fertilizer price, and wage rate are used in 1980 – 2009. As the output, profit, which is defined as the difference of gross sale and costs, is used and by monte carlo simulation with software @risk [3].

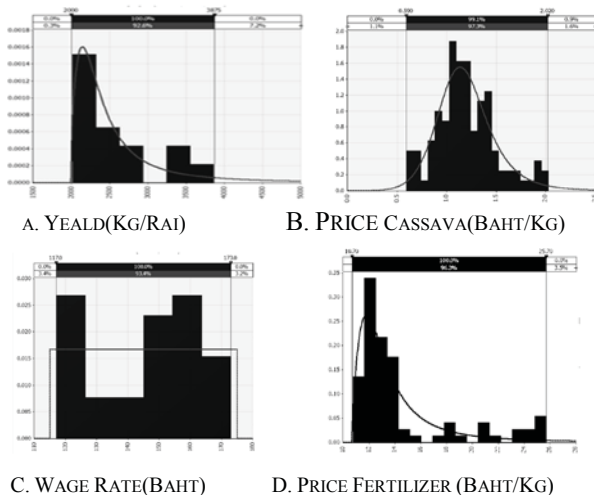


FIG 1. INPUT DATA

RESULTS AND DISCUSSIONS

The physical differences are considered as major factors to explain the outputs.

In Northern East region, the irrigation is not suitable with micro-topography, the processing factories have been implementing from the agricultural products from the dry field.

In Northern Thailand, the paddy fields are suitable for irrigation, so paddy field is major land use. The rice is major crops and then cassava is not. The consumption is limited as local use.

In Table, in ②Nakhon Ratchasima, the coefficients are small for the fertilizer price and the yield contribution is rather larger. In ④ Kohn Kaen, fertilizer price and wage rates contribute more. It reflects the urban location, the center of Northern East region.

TABLE I SENSITIVITY ANALYSIS RESULT

Province	Price	Yield	Fertilizer price	Wage rate
Kampaeng Petch	078	0.53	-0.26	-0.11
Nakhon Ratchasima	0.78	0.57	-0.09	-0.06
Karnchanaburi	0.88	0.38	-0.20	-0.17
Srakaew	0.91	0.38	-0.08	-0.06
Karasinth	0.82	0.50	-0.09	-0.07
Khon Kaen	0.76	0.50	-0.34	-0.13
Chaiyaphum	0.69	0.53	-0.43	-0.08

Note: standard coefficients

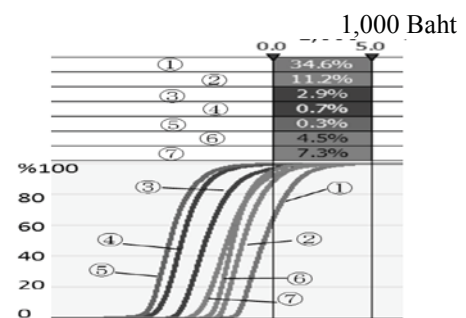


FIG.2 THE CUMULATIVE PROBABILITY FUNCTION OF THE PROFIT BY MONTE CARLO SIMULATION

- ①Kampaengpetch, ②Nakhon Ratchasima,
- ③Karasinth, ④Khon Kaen, ⑤Chaiyaphum
- ⑥Karnchanaburi, ⑦Srakaew,

REFERENCES

[1] Hardaker J. B., Huirne R. B. M., Anderson J. R. and G. Lien: Stochastic Simulation, *Coping with Risk in Agriculture*, CABI Publishing, 2004, pp. 157-180.

[2] Ngamsomsuke K., B. Ekasingh and G. Taungngarm, Rice and maize production farmer under risk in Phayao and Lampang Province. (in Thai), *The National Symposium on Agricultural System*, 4th, 2008, pp. 140-159.

[3] Palisade Corporation: *@Risk: Advanced Risk Analysis for Spreadsheet*, Palisade Corporation, (<http://www.palisade.com/risk/jp/>)

