School of Allied Health Sciences and Public Health

Walailak University

Telephone: 0 7567 2104-5, 0 7567 2113
Fax: 0 7567 2106
E-mail: rjitbanj@wu.ac.th
Homepage: http://ihh.wu.ac.th
Anti-Methicillin Resistant *Staphylococcus aureus* Activity of *Brevibacillus laterosporus* Strain SA14

Apinya CHOOPAN, Krisanawan NAKBUD, Kung DAWVEERAKUL, Kittisak CHAWAWISIT and Monthon LERTCANAWANICHAKUL

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

We isolated strain SA14 that produced an antibacterial agent against *Staphylococcus aureus* and clinical isolates of methicillin-resistant *S. aureus* from air samples and identified it to be *Brevibacillus laterosporus* using API 50 CHB strips. It showed a broad range of antibacterial activity against bacteria in contaminated drinking water such as *Escherichia coli* and *Pseudomonas* and even the opportunistic microorganism *Candida albicans*, when investigated by the cross streak method. It excreted antimicrobial peptides into culture broth on the first day of cultivation. The peptide molecular weight determined by SDS-PAGE was 116 kDa. Characteristic measurements indicate that the peptides had a relatively gram-positive bacteria inhibitory spectrum, especially, *S. aureus* and MRSA, when investigated by agar well diffusion. The anti-MRSA activity was not affected by a wide pH, chemical compounds and temperature range.

**Keywords:** *Brevibacillus laterosporus*, antibacterial activity, methicillin- resistant *Staphylococcus aureus*

**Grant:** Walailak University (Grant No. 10/2550) / Bioresources Research Network, National Center for Genetic Engineering and Biotechnology (Grant No. BRN 001G-50)

**Published:** Walailak Journal of Science and Technology 2008; 5(1), 47-56.
Prevalence of Hemoglobin E in Thai Malayu-Muslim: Identification by DNA Analysis

Jitbanjong TANGPONG¹, Sitthichai PANYASAI², Orawan SARAKUL¹, Tanrat SAKSRI³, Patchara RATTANAPORN³ and Methaporn SIRIROOP³

¹School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
²Hematology and Clinical Microscopy, Medical Technology Department, School of Allied Health Sciences, Naresuan University Phayao, Phayao 56000, Thailand
³Medical Technology Student, School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: rjitbanj@wu.ac.th)

To study the prevalence of hemoglobin E (HbE) in Thai Malayu-Muslims. Two hundred Thai Malayu-Muslims EDTA bloods were used for identification HbE. All samples were analyzed for hematological data and red cell indices using automated cell count analyzer, NIHON KOHDEN MEK-8222K (Tokyo, Japan). Types and levels of hemoglobin fractions were performed using automated analyzer, VARIANT II (Philadelphia, PA, USA). Molecular characterization of HbE was performed by Allele Specific PCR (ASPCR). The mean of red blood cell indices data from two hundred subjects were RBC 4.49±0.49 cell/mm³, Hb 12.6±1.3 g/dL, Hct 39.1±4.0 %, MCV 87.4±6.7 fl, MCH 28.1±2.6 pg, MCHC 32.2±0.8 g/dL and RDW-CV 11.3±0.9 %. Hb typing showed 93.5 % A₂A (187 subjects) and 6.5 % EA (13 subjects). HbE subjects showed RBC 4.8±0.5 cell/mm³, Hb 12.0±1.1 g/dL, Hct 38.2±3.6 %, MCV 79.1±3.32 fl, MCH 4.8±1.4 pg, MCHC 31.4±0.8 g/Dl, RDW-CV 11.4±0.7 %, Hb F 1.1±0.2 % and Hb A₂/E 31.6±1.9 %. The MCV and MCHC showed significantly lower in Hb E positive group compared with normal hemoglobin, A₂A, group (p<0.001). All of 12 subjects were positive for HbE using ASPCR. These results showed that the prevalence of HbE in Thai Malayu-Muslim was found to be 6.5 %. The Hb typing and molecular levels would therefore provide an effective diagnosis of HbE and further benefit for counseling and prevent the increasing incident of HbE and Thalasemia/HbE disease.

Keyword: Hemoglobin E, Thai Malayu-Muslims, Thalasemia/HbE, Allele Specific PCR (ASPCR)

Grant: Walailak University (WU 51/204)

Published: Journal of Health Research 2008; 22(3), 125-30.
Prevalence of Metabolic Syndrome in Walailak University Personnel

Jitbanjong TANGPONG¹, Uthai TRIAPIRUK¹, Warangkana CHUNGLOK¹, Dararat PUNWONG² and Thunyaluk PLYDAUNG²

¹School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
²Center for Scientific and Technological Equipments, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: rjitbanj@wu.ac.th)

The prevalence of metabolic syndrome (MetS) among Walailak University personnel was estimated through the cross-sectional study of 304 participants (115 men and 189 women) aged between 25-65 years. The National Cholesterol Educational Program Adult Treatment Panel III (NCEP-ATP III) criteria were used to estimate the prevalence of MetS, in which; 1) waist circumference (WC) ≥ 80 cm. for women and ≥ 90 cm. for men, 2) high blood pressure (BP) ≥ 130/85 mm.Hg, 3) hypertriglyceridemia ≥ 150 mg/dL, 4) low HDL-cholesterol < 40 mg/dL for men or < 50 mg/dL for women, and high fasting glucose ≥ 110 mg/dL. The participants with three any of the five components were classified as having MetS. The overall prevalence of MetS was 13.2%, with significant differences between men (9.9%) and women (3.3%). The prevalence of MetS increased from 7.5, 14.7, 24.2, and 31.2% among the 25-35, 36-45, 46-55, and 56-65 age groups respectively and were significantly higher in older age groups more than younger age groups($X^2$, p<0.05). The results of over waist circumference, high blood pressure, hypertriglyceridemia, low HDL-cholesterol, and high fasting glucose were 41.4, 17.4, 19.7, 45.4 and 7.9%. There is also need to study the possible underlying factors for the increased in the prevalence of MetS in young staffs with special emphasis on the nutritional habits and/or exercise. The efficiency intervention program designed to prevent and treat MetS will likely reduced the risk factors of diabetes and cardiovascular disease.

Keywords: Metabolic syndrome (MetS), NCEP-ATP III, cardiovascular disease, diabetes

Grant: Walailak University (Grant No. WU 51/204)

Tartrate-Resistant Acid Phosphatase 5b Activity as a Bone Resorption Marker in Normal Pre- and Post-Menopausal Women

Jitbanjong TANGPONG, Khorsepa YUSO, Tuansakiah DOLOH and Attakorn NUMFAK

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: rjitbanj@wu.ac.th)

Osteoporosis is a widespread in post-menopausal women. The present study determines tartrate-resistant acid phosphatase 5b (TRACP 5b) activity in normal pre- and post-menopausal women. Heparinized plasma samples from 25 health volunteers were collected for measurement of TRACP 5b activity by using an improved spectrophotometric assay. TRACP 5b activities among pre- and post-menopausal women were compared by using independent t-test. TRACP 5b activity in four different age ranged which were 31 - 40, 41 - 50, 51 - 60 and over 61 years were statistically tested using ANOVA and correlation between age and time of menopause with TRACP 5b activity were statistically tested using Pearson’s correlation. There were significant positive correlation between TRACP 5b activity with age ($r = 0.80$, $p < 0.001$). TRACP 5b activities among pre- and post-menopausal women were $2.25 \pm 0.53$ U/L and $5.80 \pm 1.62$ U/L, respectively. The activity of TRACP 5b were significantly increased in post-menopausal women compared with pre-menopausal women ($p < 0.001$). TRACP 5b activities from different age ranged of 31 - 40, 41 - 50, 51 - 60 and over 61 years, compared with the age of 31 - 40 years group ($p < 0.001$, $p < 0.0001$). There were significant positive correlation between the duration of menopause and TRACP 5b activity ($r = 0.63$, $p < 0.001$). The levels of 17-estradiol among pre- and post-menopausal women were $74.85 \pm 14.76$ and $25.30 \pm 8.20$ pg/mL and were show significant different between pre- and post menopausal groups ($p < 0.001$). The activity of TRACP 5b were negative correlation with 17-estradiol ($r = -0.82$, $p < 0.001$). To conclusion, there were significantly increased of TRACP 5b activity in post-menopausal women in comparison pre-menopausal women. TRACP 5b was proved useful as a marker for bone resoprsion.

Keywords: Tartrate-resistant acid phosphate 5b, 17-estradiol, Osteoporosis, Pre- and post-menopausal women

Grant: Walailak University

Published: Journal of the Medical Technologist Association of Thailand 2008; 36(3), 2572-84.
Tumor Necrosis Factor Alpha-Mediated Nitric Oxide Production Enhances Manganese Superoxide Dismutase Nitration and Mitochondrial Dysfunction in Primary Neurons: An Insight into the Role of Glial Cells

Jitbanjong TANGPONG1, Pradoldej SOMPOL2,5, Mary VORE2, William St CLAIR3, D Allan BUTTERFIELD4 and Daret K St CLAIR2

1School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
2Graduate Center for Toxicology, University of Kentucky, Lexington, KY 40536, USA
3Department of Radiation Medicine, University of Kentucky, Lexington, KY 40536, USA
4Department of Chemistry, University of Kentucky, Lexington, KY 40536, USA
5Faculty of Medical Technology, Mahidol University, Bangkok 10700, Thailand

(E-mail: rjibjoy@yahoo.com)

Tumor necrosis factor-alpha (TNF-alpha), a ubiquitous pro-inflammatory cytokine, is an important mediator in the immune-neuroendocrine system that affects the CNS. The present study demonstrates that treatment with TNF-alpha activates microglia to increase TNF-alpha production in primary cultures of glial cells isolated from wild-type (WT) mice and mice deficient in the inducible form of nitric oxide synthase (iNOSKO). However, mitochondrial dysfunction in WT neurons occurs at lower concentrations of TNF-alpha when neurons are directly treated with TNF-alpha or co-cultured with TNF-alpha-treated microglia than iNOSKO neurons similarly treated. Immunofluorescent staining of primary neurons co-cultured with TNF-alpha-treated microglia reveals that the antioxidant enzyme in mitochondria, manganese superoxide dismutase (MnSOD), is co-localized with nitrotyrosine in WT but not in iNOSKO primary neuronal cells. Importantly, the percentage of surviving neurons is significantly reduced in WT neurons compared with iNOSKO neurons under identical treatment conditions. Together, the results suggest that TNF-alpha activates microglia to produce high levels of TNF-alpha and that production of nitric oxide (NO) in neurons is an important factor affecting MnSOD nitration and subsequent mitochondrial dysfunction.

Keywords: Tumor necrosis factor-alpha, mitochondrial dysfunction, MnSOD nitration, iNOSKO, nitric oxide, CNS toxicity

Grant: -

Published: Neuroscience 2008; 151(2), 622-9.
Screening, Identification and Antibacterial Activities of Effective Thermotolerant *Bacillus* spp. Strains Isolated from Raw Milk

Kannikar SANTONG¹, Sumeth NAORUNGROTE¹, Phuwadol BANGRAK¹, Warangkana CHUNGLOK² and Monthon LERTCANAWANICHAKUL²

¹School of Science, Walailak University, Nakhon Si Thammarat 80161, Thailand
²School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

Forty-one isolates of *Bacillus* species were isolated from raw milk, analyzed using the spot on lawn and agar diffusion method in terms of their general inhibition effects to test bacteria (*Escherichia coli* TISTR 887 and *Staphylococcus aureus* TISTR 517). The results demonstrated that most isolates are effective against Gram-positive and Gram-negative bacteria whereas their extensive inhibition effect is particularly against Gram-positive bacteria. Only 2 effective thermotolerant isolates, BA8 and BA16, exerted broad spectrum antibacterial activities against both test bacteria. Based on biochemical and physiological properties, they were classified as *Brevibacillus laterosporus* and *Geobacillus thermoglucosidasius*, respectively.

**Keywords:** *Bacillus* species, *Escherichia coli*, *Staphylococcus aureus*

**Grant:** Walailak University (Grant No. WU51/109)

**Published:** Walailak Journal of Science and Technology 2008; 5(1), 39-46.
Minimum Inhibitory Concentration (MIC) of Crude Preparations of Brevibacillus Laterosporus SA14 Bioactive Material Compared to Vancomycin and Oxacillin, Against Clinical Isolates of Methicillin-Resistant Staphylococcus Aureus

Kittisak CHAWAWISIT and Monthon LERTCANANICHAKUL

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

Secondary metabolites, particularly bioactive compounds, from probiotic bacteria, are good candidates for replacing antibiotics to which bacteria have become resistant. In order to compare bioactive crude material from strain SA14 of Brevibacillus laterosporus with two antibiotics, the MICs of this bioactive crude and those of antibiotics vancomycin and oxacillin, against methicillin-resistant Staphylococcus aureus (MRSA), were determined. The result indicated that the MIC (3.6 - 19.2 μg/ml) of bioactive crude was higher than vancomycin (MIC = 1.28 - 2.56 μg/ml) when tested against MRSA. Interestingly, all tested strains of MRSA were susceptible to bioactive crude and were approximately 5.2-fold more potent than oxacillin (MIC > 100 μg/ml). Its activity against MRSA gives support for further evaluation, and the development of this substance for therapeutic use.

Keywords: Brevibacillus laterosporus, D-test, MIC, MRSA

Grant: Thailand Research Fund (Grant No. RSA5080008) / Bioresources Research Network, National Center for Genetic Engineering and Biotechnology (Grant No. BRN 001G-50)

Published: World Journal of Microbiology and Biotechnology 2008; 24(10), 2199-204.
A Comparison of Two Methods Used for Measuring the Antagonistic Activity of *Bacillus* Species

Monthon LERTCANAWANICHAKUL and Songtham SAWANGNOP

*School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand*

(E-mail: lmonthon@wu.ac.th)

In this study, we have aimed to determine antagonistic effects of various *Bacillus* against representatives of Gram (+) and Gram (−) bacteria, (*Staphylococcus aureus* TISTR 517 and *Escherichia coli* TISTR 887) with a comparison between the cross streak method and agar well diffusion method. Both methods used in the experiment gave better inhibition results on the *S. aureus* TISTR 517 compared to the *E. coli* TISTR 887. Interestingly, in the case of the cross streak method, both indicator bacteria were clearly inhibited in their growth by the *Bacillus* species used in this study. The cross streak method was suitable for a preliminary assessment of the antagonistic effects of *Bacillus* species.

**Keywords:** Antagonistic activity, cross streak method, well diffusion method

**Grant:** Walailak University (Grant No. WU51/109)

**Published:** Walailak Journal of Science and Technology 2008; 5(2), 161-71.
Antimicrobial Activity of Biocompounds Produced by Bacteria Strain SA14

Monthon LERTCANAWANICHAKUL, Saranya NUCHOOM, Sarawut PALIPOAT and Vassana JONGTA

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

To study on antibiotic activity of biocompounds produced from bacteria which may lead to develop for using as a model of antimicrobial substances. The bacterial isolated number SA14 from air sample of Walailak University, later identified as Brevibacillus laterosporus, was concerned to study the activity. It could produce biocompounds, excreted into cultured broth, that inhibited growth of antibiotic resistant/non resistant bacteria (Staphylococcus aureus, Escherichia coli, Klebsiella sp.) by means of cross streak and/or agar well diffusion. Moreover, the biocompounds could resist to high temperature (121 °C) and proteinase K. The arbitrary unit (AU) per milliliter of media showed the antibiotic activity against S. aureus ATCC 25923 and E. coli ATCC 25922, equal as $7.1 \times 10^{-4}$ and $5.8 \times 10^{-3}$, respectively. The molecular weight of this biocompounds, protein, is approximately 6.21 kDa.

Keywords: Antibacterial activity, biocompound, bacterial strain SA14

Grant: Walailak University / Bioresources Research Network / National Center for Genetic Engineering and Biotechnology / National Science and Technology Development Agency

Published: Bulletin of the Department of Medical Sciences 2008; 50(2), 75-86.
Incidence of Contaminated Air of Cryptococcus neoformans in Walailak University Campus’s Buildings

Monthon LERTCANAWANICHAKUL, Jomkwan KONGPRADIT, Thatree CHUAY-CHANA and Pittayapol CHOO-CHARD

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

This descriptive experiment aims to determine the Cryptococcus neoformans contamination in air of Walailak University campus’s buildings by using Sabouraud Dextrose agar (SDA) as medium for selection of C. neoformans. The 151 air samples were collected by 1) Gravity Setting Plate (GSP) and 2) Biosampler [Microflow 90 (Innovative)], including swab on a surface of the tables in buildings and bird’s dropping, were collected around buildings. The colony count was examined by spread plate technique. The simple staining was used as preliminary identification of suspected colonies, then the urease test was used as confirmatory test for C. neoformans. It was found that all of the air samples, including swab samples and bird’s dropping samples did not contain C. neoformans. However, other groups of microorganisms was found, i.e., bacteria and other groups of fungi, especially mould. It was concluded that the air in Walailak’s buildings was not contaminated by C. neoformans.

Keywords: Air, Cryptococcus neoformans, gravity setting plate
Grant: Walailak University
Published: Thailand Journal of Health Promotion and Environmental Health 2008; 31(1), 108-18.
Study on Segretional Stability of pbc 16-Derived Plasmid in Bacillus Thuringiensis subsp. Kurstaki

Monthon LERTCANAWANICHAKUL

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

A 6100-base pair (bp) plasmid vector pBCE was derived from pBCX (6900-bp). A 800-bp EcoRI fragment of pBCX was deleted out and the remaining plasmid was relegated. Both of them were comprised of Gram-positive pBC16 and Gram-negative plasmid pBluescript II KS. They act as bifunctional plasmids conferring ampicillin and tetracycline resistance in Escherichia coli but only tetracycline resistance in Bacillus thuringiensis (Bt). They were structurally stable in both E.coli and Bt. However, pBCX was more segregationally stable than pBCE in Bt subsp. Kurstaki, which may be correlated with tetracycline resistance gene expression.

Keyword: pBC16, pBluescript II KS, bacillus thuringiensis
Grant: Walailak University
Study on *Brevibacillus Laterosporus* Strain SA14 for Associated Anti-Methicillin Resistant *Staphylococcus Aureus* Activity

Monthon LERTCANAWANICHAKUL, Apinya CHOOPAN, Krisanawan NAKBUD and Kung DAWVEERAKUL

*School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand*

(E-mail: lmonthon@wu.ac.th)

We isolated a *Brevibacillus laterosporus* strain SA14 producing antibacterial agent against *Staphylococcus aureus* and clinical isolates of methicillin-resistant *S. aureus*. The strain SA14 was isolated from air sample, identified using the API 50 CHB strips, classified according to its ability to ferment 49 different carbohydrates. Spectrum of the antibacterial agent was also tested against routine observed bacteria with drinking water contamination such as *Escherichia coli*, *Pseudomonas*, including opportunistic yeast, *Candida albicans*, and these were found to be sensitive when investigated by cross streak method. An antimicrobial peptides-producing strain excreted the peptides into culture broth on the 1st day of cultivation. The characteristic measurements indicated the peptides had a relatively gram positive bacteria inhibitory spectrum, especially, *S. aureus* and MRSA, when investigated by agar well diffusion. The anti MRSA activity remained over a wide pH, chemical compounds and temperature range.

**Keywords:** *Brevibacillus laterosporus*, antibacterial activity, methicillin-resistant *Staphylococcus aureus*

**Grant:** Thailand Research Fund (Grant No. RSA5080008) / Partial supported from the Walailak University (Grant No. 10/2550) / Bioresources Research Network, National Center for Genetic Engineering and Biotechnology (Grant No. BRN 001G-50)

**Presented:** The 34th Congress on Science and Technology of Thailand (STT 34), 31 October - 2 November 2008, Queen Sirikit National Convention Center, Bangkok, Thailand.
Characterization of Bioactive Crude from Culture Broth of *Brevibacillus Laterosporus* SA14 Against Clinical Isolates of Methicillin-Resistant *Staphylococcus Aureus* and *In-Vitro* Cytotoxicity to Human Colon Cancer HT-29 Cell

Monthon LERTCANAWANICHAKUL and Warangkana CHUNGLOK

*School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand*

(E-mail: lmonthon@wu.ac.th)

*Brevibacillus laterosporus* SA14 excreted the antimicrobial peptides into culture broth on the 1st day of cultivation. The antimicrobial peptides in 1-day culture broth were precipitated by using ammonium sulfate of 50% saturation, named as bioactive crude. Its characteristic measurements indicated that the bioactive crude had a relatively gram-positive bacteria with inhibitory spectrum especially *Staphylococcus aureus TISTR 517* and tested MRSAs by agar well diffusion. The MICs of bioactive crude (ranged from 0.003 to 0.049 mg/ml) against all tested MRSAs was documented. The anti-MRSA activity of bioactive crude was not affected by a wide pH (pH 2 - 10), surfactant agents and temperature range (121 °C). The inhibitory activity of bioactive crude was not affected by trypsin. Bioactive crude at the concentration used against MRSA did not cause toxicity to human colon cancer HT-29 cells. Its activity of bioactive compound against MRSAs will provide further evaluation of known chemical structure and may be helpful for its clinical implication.

**Keywords:** *Brevibacillus laterosporus*, cytotoxicity, HT-29 cell, MIC, MRSA

**Grant:** Thailand Research Fund (Grant No. RSA5080008)

**Presented:** The 35th Congress on Science and Technology of Thailand (STT 35), 15 - 17 October 2009, Burapha University, Chonburi, Thailand.
Selection of Probiotic Lactic Acid Bacteria from Vegetables and Fruits

Nayika TAVINTRAPAKTI\(^1\), Phuangthip BHOOPONG\(^2\),
Warangkana CHUNGLOK\(^2\) and Monthon LERTCANAWANICHAKUL\(^2\)

\(^1\)M.Sc. Student in Biomedical Sciences,
School of Allied Health Sciences and Public Health, Walailak University,
Nakhon Si Thammarat 80161, Thailand
\(^2\)School of Allied Health Sciences and Public Health, Walailak University,
Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

A total of 138 representatives of lactic acid bacteria (LAB) were isolated from 22 samples of vegetables and fruits. For this study, 10 LAB-selected strains, CC1, CC2, CC3, CC4, CC5, CC6, CC7, CC8, CC9 and CC11 were selected for potentially probiotic lactic acid bacteria and efficiently for lipid utilization. An in vitro study has been used to evaluate various characters of potentially probiotic bacteria. In order to be used as human probiotic, they tolerated to 0.15 % and 0.30 % bile salt and showed survival rate at pH 1 - 10. They showed survival in both aerobic and anaerobic conditions. Some probiotic-selected strains had showed ability to inhibit growth of Staphylococcus aureus TISTR 517 and Escherichia coli TISTR 887 using agar well diffusion. An in vitro for application use, they were observed for antibiotic susceptibility test that they exhibited resistant to antibiotic as follows: bacitracin (10 mcg), gentamycin (10 mcg), kanamycin (30 mcg), streptomycin (10 mcg) and polymyxin B (300 mcg). In addition, the strains were more efficiently utilized lipid than Lactobacillus casei TISTR 390 and Lactobacillus paracasei, isolated from fermented milk. Further study, in vivo study of all of 10 probiotic-selected strains to reduce serum cholesterol property would evaluate.

Keywords: -
Grant: -
Presented: The 35\textsuperscript{th} Congress on Science and Technology of Thailand (STT 35), 15 - 17 October 2009, Burapha University, Chonburi, Thailand.
Exposure to Wood Dust and Its Particle Size Distribution in a Rubberwood Sawmill in Thailand

Nutjaree SAEJIW¹, Naesinee CHAIEAR² and Steven SADHRA³

¹School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
²Department of Community Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand
³Institute of Occupation and Environmental Medicine, University of Birmingham, Birmingham, W Midlands, England

(E-mail: cnutjare@wu.ac.th)

A cross-sectional study on wood dust exposure and respiratory health effects was conducted at one of the largest rubberwood sawmills in Thailand. All workers (N = 340) from all jobs on a day shift were recruited for personal sampling. Overall, the personal inhalable dust (n = 742) and respirable dust (n = 241) of full-shift samples were collected from 27 job titles. These data were used to classify workers into high, moderate, and low exposure groups based on the concentrations found in each job. Static samples were also collected to determine the particle size distribution. Geometric means (GM) are used to present the concentrations of the rubber wood dust. Inhalable dust concentrations were clearly high, ranging between 0.2 to 59.4 mg/m³ and with GM of 4.7 mg/m³. The GM of inhalable dust in each job title enabled classification of the workers into three exposure groups: (1) high exposure; > 5 mg/m³, (2) moderate exposure; 2.0-5.0 mg/m³, and (3) low exposure; 0.18-1.9 mg/m³. Among the high exposure group, the highest GM inhalable dust concentrations were found in sawing green lumber (12.8 mg/m³) and cutting dry lumber (7.3 mg/m³). The respirable dust concentrations were generally low, in the range of 0.1 to 6.0 mg/m³ with a GM of 0.5 mg/m³. The largest percentage of dust in major operations belonged to the thoracic fraction; 50% cutoff diameter was smaller than 9 mu m. The size distribution of wood dust indicated a high proportion in the large particle sizes.

Keywords: Exposure assessment, inhalable dust, respirable dust, rubberwood, sawmill, wood dust

Grant: -

Published: Journal of Occupational and Environmental Hygiene 2009; 6(8), 483-90.
A Neuronal Model of Alzheimer’s Disease: An Insight into the Mechanisms of Oxidative Stress-Mediated Mitochondrial Injury

Pradoldej SOMPOL,1,2 Wanida ITTARAT2, Jithanjong TANGPONG5, Yumin CHEN1, I DOUBINSKAIA1, Ines BATICIC-HABERLE4, H Mohammad ABDUL3, D Allan BUTTERFIELD3 and Daret K St CLAIR1

1Graduate Center for Toxicology, University of Kentucky, Lexington, KY 40536, USA
2Faculty of Medical Technology, Mahidol University, Bangkok 10700, Thailand
3Department of Chemistry, University of Kentucky, Lexington, KY 40536, USA
4Department of Radiation Oncology, School of Medical, Duke University, Durham, NC 27710, USA
5School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: dstcl00@uky.edu)

Alzheimer's disease (AD) is associated with 3-amyloid accumulation, oxidative stress and mitochondrial dysfunction. However, the effects of genetic mutation of AD on oxidative status and mitochondrial manganese superoxide dismutase (MnSOD) production during neuronal development are unclear. To investigate the consequences of genetic mutation of AD on oxidative damages and production of MnSOD during neuronal development, we used primary neurons from new born wild-type (WT/WT) and amyloid precursor protein (APP) (NLh/NLh) and presenilin 1 (PS1) (P264L) knock-in mice (APP/PS1) which incorporated humanized mutations in the genome. Increasing levels of oxidative damages, including protein carbonyl, 4-hydroxynonenal (4-HNE) and 3-nitrotyrosine (3-NT), were accompanied by a reduction in mitochondrial membrane potential in both developing and mature APP/PS1 neurons compared with WT/WT neurons suggesting mitochondrial dysfunction under oxidative stress. Interestingly, developing APP/PS1 neurons were significantly more resistant to beta-amyloid 1-42 treatment, whereas mature APP/PS1 neurons were more vulnerable than WT/WT neurons of the same age. Consistent with the protective function of MnSOD, developing APP/PS1 neurons have increased MnSOD protein and activity, indicating an adaptive response to oxidative stress in developing neurons. In contrast, mature APP/PS1 neurons exhibited lower MnSOD levels compared with mature WT/WT neurons indicating that mature APP/PS1 neurons lost the adaptive response. Moreover, mature APP/PS1 neurons had more colocalization of MnSOD with nitrotyrosine indicating a greater inhibition of MnSOD by nitrotyrosine. Overexpression of Mn-SOD or addition of MnTE-2-PyP5+ (SOD mimetic) protected against beta-amyloid-induced neuronal death and improved mitochondrial respiratory function. Together, the results demonstrate that compensatory induction of MnSOD in response to an early increase in oxidative stress protects developing neurons against beta-amyloid toxicity. However, continuing development of neurons under oxidative damage conditions may suppress the expression of MnSOD and enhance cell death in mature neurons.

Keywords: Alzheimer’s disease, APP/PS1, MnSOD, oxidative stress, beta-amyloid, SOD mimetic

Grant: -
Published: Neuroscience 2008; 153(1), 120-30.
DNA Copy-number Loss on 1p36.1 Harboring RUNX3 with Promoter Hypermethylation and Associated Loss of RUNX3 Expression in Liver Fluke-Associated Intrahepatic Cholangiocarcinoma

Somkid DACHRUT, S BANTHAISONG, M SRIPA, A PAEYAO, C HO, SA LEE, C KOSINSKI, MA PATIL, J ZHANG, X CHEN, Banchob SRIPA and Chawalit PAIROJKUL

1Department of Biopharmaceutical Sciences, University of California, San Francisco, CA 94143, USA
2Liver Fluke and Cholangiocarcinoma Research Center, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand
3Division of Experimental Pathology, Department of Pathology, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand
4School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
5Beijing Cancer Hospital, School of Oncology, Department of Surgery, Peking University, Beijing 100871, Peoples R, China

(E-mail: chenx@pharmacy.ucsf.edu, chawalit_pjk@hotmail.com)

Runt-related transcription factor 3 (RUNX3) is a candidate tumor suppressor gene, localized on 1p36, involved in TGF-beta-Smads signaling. To assess its role in liver fluke-associated intrahepatic cholangiocarcinoma (ICC), the promoter methylation status was investigated in 53 ICCs by methylation-specific PCR, with determination of loss of 1p36.1 by microarray comparative genomic hybridization and RUNX3 protein expression by immunohistochemistry. Loss at 1p36.1 was found 41.5% of ICCs (22/53). In addition, DNA hypermethylation of the RUNX3 promoter was found in 49.1% (26/53) of cancers and 57.1% (4/7) of ICC cell lines. The protein was highly expressed in normal bile ducts but mostly decreased in ICCs, 67.9% (n = 36) being negative for immunohistochemical staining. Promoter hypermethylation of RUNX3 was associated with reversible decrease or absence of RUNX3 protein expression (p < 0.001), but this was not found to differ with the ICC subtype. In contrast, loss of 1p36.1 demonstrated a significant link (p = 0.020). In conclusion, RUNX3 promoter hypermethylation and loss of 1p36.1 are causal mechanisms for loss of RUNX3 function in liver fluke-associated ICC carcinogenesis.

Keywords: RUNX3, DNA hypermethylation, chromosome 1p36, microarray comparative genomic hybridization

Grant: Commission on Higher Education / Ministry of Education of Thailand and the Division of Research Affairs / Faculty of Medicine, Khon Kaen University (Grant No. KKU5103200017 (I51117))

Phenolic Compounds in *Thunbergia Laurifolia* Linn. Against Lead-Induced Neurodysfunction

Suksun CHANGLEK and Jitbanjong TANGPONG

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: rjitbanj@wu.ac.th)

Recent studies have shown that heavy metal poisoning, particular lead poisoning, causes oxidative stress by inducing the generation of reactive oxygen species (ROS) and reducing the antioxidant defense system. *Thunbergia laurifolia* Linn. (TL) is used as Thai traditional medicine and is widely used in the Southeast Asia. Whether TL has been reported for a protective effect against oxidative stress or chelating agent after lead exposure in vivo systems remains unclear. In this study, we hypothesize that phenolic compounds in TL, the antioxidant properties, may play an important role in the treatment of lead poisoning as a kind of excellent scavenger of free radicals and chelator of heavy metal. We design to evaluate the protective effects of phenolic compounds in TL crude extract against cognitive dysfunction by considered neuropsychological test, Morris water-maze swimming, in mice exposure with lead at 1 g/l in drinking water, alone or combined with phenolic compounds in TL crude extract or vitamin E at 100 μg/kg/day for 8 weeks.

The results showed significant increasing the latency time and decreasing the percentage of crossing platform quadrant in lead-exposure mice ($p < 0.05$). Treatment with phenolic compounds in TL significantly improve latency time and the percentage of crossing platform quadrant in lead-exposure mice in a dose-dependent manner as found in treatment with vitamin E ($p < 0.05$). It is concluded that phenolic compounds in TL and vitamin E significantly improved the learning and memory impairment induced by lead exposure. Treatment with phenolic compounds in TL generally involves correcting an underlying cognitive dysfunction.

Keywords: -
Grant: -
Presented: The 35th Congress on Science and Technology of Thailand (STT 35), 15 - 17 October 2009, Burapha University, Chonburi, Thailand.
Epidemiological Study of Strongyloidiasis in Southern Thailand, 2007

Thitima WONGSAROJ1, Wanchai PHATIHATAKORA2, Pongrama RAMASOOTAR2, Witthaya ANAMNAR3, Nantawan KAEWPOONSRI1 and Bongkoch CHIEWCHANYON1

1Department of Disease Control, Ministry of Public Health, Nonthaburi 11000, Thailand
2Faculty of Tropical Medicine, Mahidol University, Nakhon Pathom 73170, Thailand
3School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: tmthelmal@yahoo.com)

A survey of Strongyloides stercoralis infection was conducted in 11 southern provinces of Thailand by agar-plate culture technique. A total of 1,308 stool sample were collected by 30-cluster sampling technique during July-August 2007. The results that the overall prevalence of S. stercoralis in study areas was 20.6 % and the intensity was mostly low. The highest infection rate was found in Phatthalung Province (29.9 %), and the lowest in Phuket Province (7.5 %). The highest positive finding was among the group aged 60 years and over (28.5 %), and the rate of infection was comparatively high among males (25.4 %). At cluster or village level, the highest infection rate was 51.9 % in Ban Don Gun Village, Nakhon Si Thammarat Province, and the lowest 203 % in Ban Yang Mark Village, Trang Province.

The results of the surveillance showed that a majority of the population had high strongyloidiasis related risk behaviors-poor hygiene and inappropriate footwear behaviors, such as wearing open sandals, so that 89.9 % had an enhanced risk of infection, and only 22.2 % wore casual shoes. Only 24.1 % habitually wore boots when they worked in the paddy field, with the remaining 75.9 % at higher risk of infection. However, it was also instructive to learn that the proportion of people who routinely washed fresh vegetable thoroughly before eating, to prevent larval contamination, was quite high (94.4 %). Almost all (96.0 %) of the people habitually defecated in a sanitary latrine when at home; however, when they worked in the field, the rate was far lower, at only 37.7 %. It was interesting to find that 11.6 % of the people habitually defecate outside a latrine, on the ground, while about 50.1 % sometimes defecated on the ground, which would also result in a higher risk of the spread of disease.

The information obtained from the behavioral survey also showed that high-level risk behaviors for the transmission of strongyloidiasis in southern Thailand, where potential hosts do exist, higher than the previously reported data about the prevalence of S. stercoralis infection. Proactive health education and empowerment of the community are recommended to control strongyloidiasis, and so prevent health problems among the people in such areas.

Keywords: Strongyloides stercoralis, epidemiological study, prevalence, southern Thailand, agar plate culture technique
Grant: Department of Disease Control, Ministry of Public Health, Thailand
Methemoglobin and Sulfhemoglobin Levels in Students of Walailak University

Uthai TRIAPIRUX, Prasit NA-EK, Chinnaphat KITTHIPONGVIVAT and Surachate CHALAJIT

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: tuthai@wu.ac.th)

Methemoglobin (MHb) and Sulfhemoglobin (SHb) are abnormal oxygen-carrying protein hemoglobins (Hbs) in blood circulation which can be used to represent the degree of pollution in the surrounding environment including air, food and drinks. The MHb is an oxidized form of hemoglobin (Hb) in which the ferrous ion (Fe\(^{2+}\)) in the heme group is oxidized to the ferric ion (Fe\(^{3+}\)) by oxidizing agents mostly from the air, food, drinks and drugs. The SHb is a sulfated form of Hb derived from hydrogen sulfide (H\(_2\)S) and sulfur dioxide (SO\(_2\)) gas contained in the air and drugs found in sulfur therapy, respectively. These types of Hb derivatives are unable to bind and carry oxygen to the tissues of the body. This makes inspiration insufficient and may cause cyanosis in increased amounts. The aim of this study is to measure MHb and SHb levels in Walailak University students. EDTA blood samples were collected from 200 students. The MHb and SHb were analyzed by spectrophotometry. The results revealed that the mean MHb and SHb levels of the 200 subjects were 1.29 ± 0.57 % and 0.66 ± 0.28 %, respectively. The level of MHb and SHb in population of Walailak University was very low compared to people in large cities such as Bangkok. The study proves that the environment of Walailak University remains clean, good and fresh.

Keywords: Methemoglobin (MHb), Sulfhemoglobin (SHb), spectrophotometry
Grant: Walailak University
Decreased Glutathione Peroxidase Activities with Concomitant Increased Oxidized Glutathione Levels among Residents in an Arsenic Contaminated Community of Southern Thailand

Warangkana CHUNGLOK

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: cwarang@wu.ac.th)

Glutathione peroxidase (GPx) and glutathione are important antioxidants responsible for the scavenging of reactive oxygen species (ROS). It has been shown that changes in GPx activities and glutathione levels are associated with various diseases including toxic chemical related diseases and cancers. The study aimed to determine the levels of GPx activity and glutathione among residents in Ron Phibun district, an arsenic-exposed area. Blood samples were obtained from 32 volunteers in the Thasala group, a nearby nonarsenic-exposed area and 36 residents in the Ron Phibun group. Red cell lysates were subjected to analysis of GPx activity and glutathione. The results showed that GPx activities were significantly decreased among study subjects from Ron Phibun ($p < 0.05$). Interestingly, oxidized glutathione (GSSG) levels were significantly increased compared with those from Thasala ($p < 0.05$). Total glutathione and reduced glutathione (GSH) levels were not different among the two groups. Mean values of GPx activities, total glutathione and GSH tended to decrease among high-exposure subjects compared to low-exposure subjects. This was concomitant with a slight increase in GSSG levels among high-exposure subjects. The levels of GPx activities and GSSG may be early biomarkers for low levels of oxidative stress in a mining area affected with arsenic poisoning.

**Keywords:** Glutathione peroxidase, glutathione, antioxidants

**Grant:** -

**Published:** Walailak Journal of Science and Technology 2008; 5(1), 57-65.
Risk Factor Assessment for Diabetes Mellitus in Walailak University Personnel

Yenrudee KEAWPITUK¹, Valla TANTAYOTHAI², Surasi VADHANAVIKIT³ and Jitbanjong TANGPONG³

¹MSc. Student in Biomedical Sciences, School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
²School of Nursing, Walailak University, Nakhon Si Thammarat 80161, Thailand
³School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: rjitbanj@wu.ac.th)

The objective of this study was to assessment the risk factor for diabetes mellitus in Walailak university personnel in Nakhon Si Thammarat province. The cross-sectional study of 241 participants (80 men and 161 women) aged between 25 - 65 years. The risk factors for diabetes mellitus were assessment follow up the criteria which predicting incident diabetes consist of age, sex, body mass index (BMI), waist circumference (> 90 cm. in men and > 80 cm. in women), hypertension > 140/90 mmHg and history of diabetes in parent or sibling. The overall risk factor for diabetes mellitus was 26.97 % separated to be 16.18 % in men and 10.69 % in women. The prevalence increased from 19.38, 31.46, 37.50 and 85.71 % among the 25 - 35, 36 - 45, 46 - 55, and 56 - 65 age groups respectively. The results of over body mass index (BMI), central obesity, hypertension and history of diabetes in parent or sibling were 41.08, 29.88, 7.05 and 24.90 % respectively. The risk factors for diabetes mellitus in Walailak university personnel were higher in young age groups and older age groups. The efficiency intervention program designed to prevent and treat diabetes mellitus will likely reduced the risk factors of diabetes disease.

Keywords: -
Grant: -
Presented: The 34th Congress on Science and Technology of Thailand (STT 34), 31 October - 2 November 2008, Queen Sirikit National Convention Center, Bangkok, Thailand.
Risk Factor Assessment and Intervention for Diabetes Prevention in Walailak University Personnel

Yenrudee KEAWPITUK¹, Piyanut KHUNSAWAT², Voranunt SUPHIPHAT³, Saifon AEKWARANGKOON⁴, Jiraporn SONPAVEERAWONG⁴, Valla TANTAYOTHAI⁴, Surasi VADHANAVIKIT⁵ and Jitbanjong TANGPONG¹

¹School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
²School of Liberal Arts, Walailak University, Nakhon Si Thammarat 80161, Thailand
³School of Medicine, Walailak University, Nakhon Si Thammarat 80161, Thailand
⁴School of Nursing, Walailak University, Nakhon Si Thammarat 80161, Thailand
⁵(E-mail: rjitbanj@wu.ac.th)

This study was to assess effectiveness of the intervention for diabetes prevention in Walailak University Personnel by dietary control and exercise. Eighty two subjects were participated and were randomly divided into four groups using diabetes risk score (DRS) level to either the intervention groups. The four groups are 1) Low DRS + intervention (LRI), 2) Low DRS + non intervention (HRNI), 3) High DRS + intervention (HRI) and 4) High DRS + non intervention (HRNI). The intervention groups received dietary education and exercise aimed to reduce weight through 6 sessions in 24 weeks. Physical examinations, 3-day food records and food behavior dietary note were used as main discussion tools during follow-up visits. Calories intake, frequency and duration of exercise, diabetes risk score, weight, waist circumference, body mass index (BMI), blood pressure (BP) and fasting blood glucose (FBG) were recorded and analysed. The intervention groups showed improvement in each intervention goal such as reduction of DRS, weight, waist circumference, BMI, blood pressure and fasting blood glucose. After 24 weeks, low risk intervention and high risk intervention showed reduction of calories intakes from 1516.3 ± 27.4 and 1660.7 ± 30.2 Kcal to 1205.7 ± 10.2 and 1249.0 ± 12.6 Kcal (20.5 % and 24.8 %) respectively. Increased frequency and duration of exercise led to a significant reduction in DRS and waist circumference when compared pre- and post-intervention in the HRI group (p < 0.01). The intensive lifestyle intervention produced long-term beneficial changes in dietary behaviors and physical activity which resulted in reduction of DSR, body composition, blood pressure and fasting blood glucose in both LRI and HRI groups while the values in LRNI and HRNI groups tended to increase. Based on these results, the intervention program for Walailak University Personnel seemed to be effective that could reduce diabetes risk.

Keywords: Diabetes Mellitus, diabetes risk score, body mass index, waist circumference, fasting blood glucose, blood pressure, health promotion program

Grant: Walailak University (Grant No. WU51/204 and 21/2551)
Published: Journal of Health Research 2009; 23(1), 47-54.
RISK FACTOR ASSESSMENT FOR DIABETES MELLITUS IN WALAILAK UNIVERSITY PERSONNEL

Yenrudee KEAWPITUK1, Valla TANTAYOTHAI2, Surasi VADHANAVIKIT1 and Jitbanjong TANGPONG1

1School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
2School of Nursing, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: rjitbanj@wu.ac.th)

The objective of this study was to assess the risk factor for diabetes mellitus in Walailak University Personnel in Nakhon Si Thammarat province. This cross-sectional study covered 241 participants (80 men and 161 women) aged between 25 - 65 years who participated in annual health examinations at Walailak University Medical Laboratory Center (WU-McT) in September 2007. The risk factors for diabetes mellitus were assessed using the criteria developed by Ekplakhorn et al, 2006. The criteria consisted of age, sex, body mass index (BMI), waist circumference (> 90 cm. in men and > 80 cm. in women), hypertension over than 140/90 mmHg and history of diabetes in parent or sibling. It was found that the overall risk factor for diabetes mellitus was 26.97 %, and 16.18 % for men and 10.69 % for women. The prevalence by age groups were 19.38, 31.46, 37.50 and 85.71 % for the 25 - 35, 36 - 45, 46 - 55 and 56 - 65 age groups respectively. It was also found that the body mass index (BMI), obesity, hypertension and history of diabetes in parent or sibling were 41.08, 29.88 7.05 and 24.90 % respectively. The risk factors for diabetes mellitus in Walailak University personnel were higher in young age group and older age groups. There was also a need to study possible underlying factors for the increased in the prevalence of diabetes mellitus in young staff with special emphasis on the nutritional habits and/or exercise. The efficient intervention program designed to prevent and treat diabetes mellitus should reduce the risk factors of diabetes disease.

Keyword: -
Grant: Walailak University (WU 51/204)
Published: Thai Journal of Health Promotion and Environmental Health 2009; 32(3), 53-61.
Evaluation of Mutagen and Heavy Metal in Communal Health Products

Monthon LERTCANA WANCHAKUL¹, Panatda PIBUL¹, Supaporn KONGSAWAT¹, Supawadee SINTARAPRASAT¹ and Sheepsumon WIBOONWORAKUL²

¹School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
²Faculty of Science, Rangsit University, Pathumtani 12000, Thailand

(E-mail: lmonthon@wu.ac.th)

The microbiological quality of 116 communal health products has been reported in Thailand Journal of Health Promotion and Environmental; 28(4): (2005) (http://advisor.anamai.moph.go.th/284/28406.html). It reported that, the most of products were microbiological acceptable according to the medicinal preparations standard. However, it should be concerned about other qualities of these products, such as contamination of heavy metals and mutagenicity properties. This research was carried out accordingly. It was found that 108 samples (96.42 %) were contaminated with lead in amount of 0.02 part per million (ppm). Four residual samples (3.57 %) contained lead in the amount of 0.02 - 1.00 ppm. However, all of tested communal products, lead content did not exceed 10 ppm according to standard. In addition, arsenic was detected in 72 samples (64.29 %) in the amount of 0.05 ppm. The 40 samples were found to contain arsenic in the amount of 0.052 - 7.578 ppm. Unfortunately, 2 residual samples contained arsenic at a high level, in the amount of 307.7 and 488.55 ppm which exceeded the standard of 4 ppm. The communal health products, both powder and tablet forms, showed the positive result for Ames test in the percentage of 13.22. However, it did not imply mutagenicity and, thus, the communal health products should be tested for mutagenicity for safer to use.

Keywords: Communal health products, heavy metal, mutagenicity
Grant: The Higher Education Commission / Walailak University
Published: Thailand Journal of Health Promotion and Environmental Health 2009; 32(3), 96-111.
Detection of Mutagenicity of Biocompound from Bacillus spp. by the Salmonella Mutagenicity Test

Jutharat KAOIAN¹, Pattamawadee THAWORN¹ and Monthon LERTCANAWANICHAKUL²

¹School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
²Division of Medical Technology, School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

The protein concentration of partially purified biocompounds (PPBs) prepared from culture broth of Brevibacillus laterosporus SA14, SA15, Bacillus pumilus BA16/2 and Bacillus megaterium BA6 were 1.746, 1.188, 0.355 and 0.242 mg/ml, respectively. It was found that only PPBs prepared from culture broth of Brev. laterosporus SA14 and SA15 could inhibit the growth of Staphylococcus aureus, Salmonella typhimurium TA98 and TA100. However, PPBs prepared from culture broth of SA14 and SA15 at the titer of 1:128 did not inhibit the growth of TA98 and TA100. The PPBs obtained from all tested Bacillus species were used to determine the mutagenic properties using Ames test. It was found that all PPBs did not show mutagenic properties by this Ames’ test at the mutagenicity index (MI) 4. However, further tests using other systems should also be carried out to evaluate its useful safety.

Keywords: Ames’ test, Salmonella typhimurium, Bacillus species
Grant: Walailak University (WU51/109)
Published: Journal of Medical Technology and Physical Therapy 2009; 21(1), 40-9.
Characteristic Changing of *Brevibacillus Laterosporus* SA14 by Ultraviolet and Chemical Mutagenesis

Sudawan RATTANAPARIKON\(^1\), Suthidee PETSONG\(^1\), Uthoomporn RATTANA\(^1\) and Monthon LERTCANAWANICHAKUL\(^2\)

\(^1\)School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
\(^2\)Division of Medical Technology, School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

*Brevibacillus laterosporus* SA14, Gram-positive spore-forming bacterium, could produce biocompounds which inhibit the growth of Gram-positive cocci in cluster (*Staphylococcus aureus*), including methicillin-resistant *Staphylococcus aureus* (MRSA). The characteristic changing of this bacterium was done by random mutagenesis, using ultraviolet (UV) or 1-hexyl-3-nitro-1-nitrosoguanidine (NTG). Five mutants were isolated, three from UV mutagenesis, named as UV1, UV2, LZ1; and two from chemical mutagenesis, named as NTG1, NT8. The cells and culture broth of all mutants could inhibit the growth of indicating bacteria, *Staphylococcus aureus* TISTR 517 and *Bacillus subtilis* ATCC 6633 and still had hemolytic activity when tested by means of spot on lawn and agar well diffusion. The mutant cells were less resistant to acid, oxgall bile and antibiotics than those of wild type (SA 14). However, only culture broth of LZ1 mutant gave the least hemolytic activity. It may be used for further study as a model to develop the antimicrobial drugs.

**Keywords:** *Brevibacillus laterosporus*, mutagenicity, hemolytic activity, antibacterial activity

**Grant:** Walailak University (WU51/109) / National Research Council of Thailand

**Published:** Journal of Medical Technology and Physical Therapy 2009; 21(2), 113-22.
Evaluation of Cholinesterase Screening Test Using Reactive Paper

Uthai TRIAPIRUX, Patcharin PANSOMBUN, Sutisa UTHAIRUNGSRI and Amomrat NOOKLIENG

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: tuthai@wu.ac.th)

Cholinesterase screening test using reactive paper which produced by GPO (government pharmaceutical organization) has been used for testing the toxicity of organophosphate pesticide in gardeners for long time. In this study we tried to evaluate the efficiency of the test in order to diagnosis the level of toxicity of such pesticide by comparing this test with a standard procedure which is the determination of cholinesterase activity using spectrophotometric method. The 20 students at Walailak University were used as control group for determination of normal baseline and 30 fruit gardeners at amphur Nobpitum were be test group which had been tested for determination of cholinesterase by both reactive paper and spectrophotometric method. The results shown that reactive paper had given true positive 4 of 18 (22.2 %), false positive 14 of 18 (77.8 %) and true negative 12 of 12 (100 %) without false negative (0 %). Therefore, calculation of accuracy was 53 %, sensitivity was 100 %, specificity was 46 %, positive predictive value was 22 % and negative predictive value was 100 %. Since this reactive paper still has very high sensitivity and negative predictive value, it remains can be used for screening of organophosphate toxicity in gardeners to prevent accumulation of such pesticide in the body.

Keywords: Cholinesterase, screening, reactive paper, spectrophotometric method

Grant: -

Phytoestrogen in Young Coconut Juice Reduced Hyperlipidemia and Lipid Peroxidation in Overweight Rats

Jitbanjong TANGPONG, Thipparat NASRISUK, Wannisa SUANGYAYA and Waraporn JANTAMATTUKAN

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: rjitbanj@wu.ac.th)

Objective: Young coconut juice (YCJ), Cocos nucifera (Arecaceae), which contains phytoestrogens, estradiol, estrone-3-β-D-glucuronide and progesterone, is extensively used as a hormone supplement and anti-depressant in East and Southeast Asia traditional medicine. Phytoestrogen consumption has been shown to reduce risk of cardiovascular disease and neurodegenerative disease, such as Alzheimer’s disease. The aim of this study was to investigate the effect of YCJ extract on blood lipid profile, lipid peroxide, glucose, and body weight in overweight and normal rats.

Method: YCJ of 5 - 6 month old fruits were collected from Nakhon-Si-Thammarat, and was concentrated freeze dried (×20 concentration). Phytoestrogen, estradiol, level were measured in Freeze dried YCJ using ELISA assay. YCJ were administrated orally in Milli Q water suspension at dose 400 pg/kg/day of estradiol as an equal original volume 100 mL/mg/day for 4 weeks to both overweight and normal rats. Glucose, lipid profile and lipid peroxide were determined and were statistical analysed.

Result: The effect of YCJ showed significant reduction of lipid profile including, total cholesterol, LDL-cholesterol and triglyceride ($p < 0.05$), but not HDL-cholesterol and glucose level in overweight rats as compared to control rats. Treatment with YCJ also significantly reduced malondialdehyde (MDA), the lipid peroxidation marker, in both normal and overweight rats compared to control rats ($p < 0.05$).

Conclusion: YCJ has an effect on reducing cholesterol, LDL-cholesterol and triglyceride and no effect on glucose, HDL-cholesterol and body weight. The consumption of YCJ improved the lipid profile and reduce lipid peroxide, suggesting that young coconut juice might contribute to a reduction of cardiovascular risk and neurodegenerative disease.

Keyword: Young coconut juice, phytoestrogens, cardiovascular disease

Grant: Walailak University

Presented: The 2nd International Conference on Natural Products for Health and Beauty (NATPRO), 17-19 December 2008, Naresuan University, Phayao, Thailand.
Antimicrobial Activities of Thai Herb Extracts

Putcharida SAMATI, Penchom JANWAN, Paspimon MAKKONG and Monthon LERTCANAWANICHAKUL

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lmonthon@wu.ac.th)

The antimicrobial activity of 5 Thai herbs [Acanthus ebracteatus Wall., Glycyrrhiza glabra (Linn.), Zingiber zerumbet (L.) Smith, Andrographis paniculata wall.ex Nees and Centella asiatica (Linn.) Urban] extracts using water, 35 % ethanol and boil down water were evaluated against indicator microorganisms (Staphylococcus aureus TISTR 517, Escherichia coli TISTR 887, Bacillus subtilis ATCC 6633, and Candida albicans TISTR 5779) by means of broth microdilution method. The minimal Inhibitory Concentration (MICs) and Minimum Bactericidal Concentration (MBCs) values of the extracts were compared with antimicrobial drugs (Amphotericin B, Kanamycin and Gentamicin). MBCs were determined by spread plate technique when less than 5 colonies were formed. Moreover, the effects of temperature and pH on the antimicrobial activity of herb extracts were elucidated. The result indicated that water extracts of all the herbs had no antimicrobial activity against all tested indicator microorganisms, exceptionally, S. aureus and B. subtilis were susceptible to water extracts of Glycyrrhiza glabra (Linn.), gave MIC as 2.36 mg/ml. and B. subtilis was susceptible to water extracts of Andrographis paniculata (MIC = 9.42 mg/ml.). 35 % ethanol extracts of Glycyrrhiza glabra (Linn.) had adverse effects on S.aureus and B. subtilis showing MICs at 0.08 and 0.04 mg/ml, respectively. Boil down water extracts of all tested herbs inhibited the growth of any tested microorganism. MICs from boil down water extracts of Glycyrrhiza glabra (Linn.) against S. aureus and B. subtilis were 0.59 mg/ml. The extracts of all tested herbs had lower antimicrobial activity than that antimicrobial drugs. Moreover, the temperature and pHs had no effect on antimicrobial activity of, the most, Thai’s extracts. Interestingly, the anti-B. subtilis activity of water extracts of Glycyrrhiza glabra (Linn.) and boil down water extracts of Acanthus ebracteatus wall. Was increased after treated at 121 °C., gave MIC decreased to 1.18 mg/ml. activity. Overall, it could assume that Glycyrrhiza glabra (Linn.) had the broadest spectrum of the antimicrobial activity but still had lower activity in comparison with antimicrobial drugs. B. subtilis was proved to be most sensitive microorganism. The temperature and pH had no effect on antimicrobial activity of, the most, the herb extracts.

Keywords: Minimum inhibitory concentration, antimicrobial activity, Thai herbs, extracts

Grant: Walailak University

Application of Iron Oxide - Coated Volcanic Rock for Arsenic Removal from Surface Water

Pattida THONGKAOW\(^1\) and Utchara DUANGDEUN\(^2\)

\(^1\)School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
\(^2\)Department of Environmental Engineering, Faculty of Engineering, Kasetsart University, Bangkok 10900, Thailand

(E-mail: tpattida@wu.ac.th)

This research studied the efficiency of arsenic removal from water by volcanic rock (VR) and iron oxide - coated volcanic rock (IOCVR) as adsorbents. The experiments were to study optimum parameters for arsenic adsorption in synthetic water by batch experiments and compare the efficiency of arsenic removal with VR and IOCVR from surface water in an absorber. The results showed that the volcanic rock coated with iron-oxide provided higher effectiveness in removal arsenic than the volcanic rock without being coated. The optimum pH for arsenic adsorption was 7 – 8. The contact time at equilibrium for both adsorbents was 4 hours. The continuous experiments for 24 hours were conducted with the initial arsenic concentration of synthetic water of 1.05 mg/L, and filtration rates of 0.1 and 0.4 m\(^3\)/m\(^2\)-hr for VR and IOCVR, respectively. The removal efficiencies of both adsorbents were more than 95% (arsenic concentration not more than 0.05 mg/L). For the surface water with 0.311 mg/L of arsenic concentration, the efficiencies of VR and IOCVR were at 96.60 and 99.85%, respectively.

Keywords: Arsenic, surface water, volcanic rock, adsorption

Grant:

An Assessment of the Depression and Physical Health Conditions of Elders in Southern Rural Communities, Chianyai District, Nakhon Si Thammarat Province

Peeungjun SWEATSRISKUL¹ and Venaporn SUMANGSRI²

¹School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
²Southern Regional Training Center for Primary Health Care Development, Ministry of Public Health, Nakhon Si Thammarat 80000, Thailand

(E-mail: speeungj@wu.ac.th and jsum2008@gmail.com)

The objective of this study was to assess the depression and physical health conditions of elders in southern rural communities, Chianyai district, Nakhon Si Thammarat province, before developing a model by health personnel, students, teachers and researchers (HSTR). The sample group included 200 elderly respondents purposively selected by 100 seventh grade students, 50 students each from Chianyai Samakiwitthaya and Wichianprachasathan schools, 1 student selecting 2 elders. The criteria for selecting the elders included having a residence near the student’s and being 55 years old and over. The Thai Geriatric Depression Scale (TGDS) was changed to southern dialogue and tested with 30 elders for reliability in a district close to area of study; its reliability level was 0.86. Blood pressure, blood sugar level, body mass index and personal illness history were measured/taken by health personnel for their physical health.

The study found that 171 elders consented to join this research; most of them were females (66.7 %), married (60.2 %), completed primary education (74.3 %), had an average age of 71.35 years (range 55 - 104 years), 40.9 % in the 61 - 70 age group and 38.6 % in the 71 - 80 age group. Mostly they were in normal mental health condition (74.9 %); the rest had mild, moderate, and severe depressions (14.6, 7.6 and 2.9 % respectively). Most of them (59.1 %) had no chronic illness, but based on their levels of blood pressure, 30.4 % were regarded as hypertensive, 25.7 % were at risk and 19.9 % were suspected cases. Blood sugar tests showed that 49.1 % were at high risk, 21.6 % were suspected cases and 14.6 % were ill. And based on their body mass index, 50.9 % were normal, 18.1 % were at high risk and 16.4 % were overweight. These findings will be used for comparing with the health conditions after implementing the model which was developed by HSTR and treatment in severe case.

Keywords: Elder, rural community, depression, physical health
Grant: Office of the Higher Education Commission
Determination of Lead (II) in Cane-Sugar by Stripping Chronopotentiometry

Uthai TRIAPIRUX¹, Prasen LEELAWUTPRASERT², Duankamon SONGKONGKA² and Roongroje RATANA-OHPAS²

¹Division of Medical Technology, School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand
²Division of Chemistry, School of Science, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: tuthai@wu.ac.th)

Cane-sugar is one of the most popular sugar in the world. It has been used to make foods sweet especially candy and dessert. Contamination of lead (II) in cane-sugar is probably come from the process of production or the growing of plant that used to made sugar which is sugar cane. The stripping chronopotentiometric method has been used to determination of lead (II) in cane-sugar using standard addition method. The instrument was PSU 22 connected to personal computer which installed TAP2 program for control of all procedures. Parameters of analysis were electrolysis potential of −1.1 Volt, electrolysis time was 100 seconds, mercury (II) ion in plating solution was 40 ppm in 1.0 M HCl with vibration rate of 5 a.u. Linearity if lead (II) for this method was up to 4000 ppb. The results showed that the concentration of lead (II) in cane-sugar was 43014 ± 1.14 ppb (mean ± SD) with % RSD of 1.36 (n = 5) and was less than the allowable limit of lead (II) in cane-sugar of 2 ppm provided for standard cane-sugar manufacturing product. Sensitivity of the test was 8.4 msL µg⁻¹ and limit of detection was 0.12 µg⁻¹. This method is suitable for determination of lead (II) in fruit juices, syrups or kind of sugar added mixtures because it is save, very simple, easy to use, high selectivity and no sample pretreatment.

Keywords: Stripping chronopotentiometry, lead (II), cane-sugar

Grant: -

Water-Supply-Floc Utilization in Coagulation Process

Weerapong LERDRATTRANATAYWEE, Wichien CHOO SAMER, Weeranuch BOONRUNG, Tibpawan PRAB-CASEN and Sirisopar SIUE-AIUM

School of Allied Health Sciences and Public Health, Walailak University, Nakhon Si Thammarat 80161, Thailand

(E-mail: lweerapo@wu.ac.th)

This research study of quantity water purification floc alum utilization in coagulation process. The experiment use alum 0.1 % only for control system. It used floc alum only and it used alum 0.1 % with floc alum 20, 30, 40, 50, 60, 70, 80 and 90 %. This experiment lab scale used JAR test method for fine optimum condition that pH optimum, optimum dosage. And continuous performance by pilot scale model. In this research analyze aluminium concentration in alum 0.1 % and floc alum before. aluminium concentration in alum 0.1 % and floc alum have 0.00378 and 0.203 ppm respectively, Lab scale Experiment found optimum dose is 1.7 ppm and pH optimum is 6 alum 0.1 % only. It can decrease turbidity to 1.9 NTU. Then it found optimum dose is 9.76 mL/L (V2V) and pH optimum is 6 for floc alum only. It can decrease turbidity to 4.5 NTU and then it found high effectiveness ratio of turbidity removal is 1:9 for alum 0.1 %:floc alum. It found pH Optimum is 6 and decrease turbidity to 6.8 NTU. Continuous performance used alum optimum dose is 3.6 ppm and floc alum is 5.86 mL/L:(V/V). It decrease turbidity from 20 - 35 NTU to 14.9 NTU.

Keywords: Water-supply-floc, coagulation process, jar-test
Grant: Walailak University
Screening of Insecticide Residue in Fruits and Vegetable Sold at Hua-It Market

Weerapong LERDRATTRANATAYWEE and Mardinyana SAMORBASAR

School of Allied Health Sciences and Public Health, Walailak University,
Nakhon Si Thammarat 80161, Thailand

(E-mail: lweerapo@wu.ac.th)

The objective of this research was it screen the insecticide residue in fruits and vegetables sole at Hua-It Markte, Nakhon Si Thamarat province. For 115 sample 20 kinds of fresh consumed (without pelling) vegetables and fruits including Spring onion, Celery, Parsley, Morning glory, Chinese chives, Lettuce, Tomato, Red cabbage, Angle bean, Queen tomato, Long green bean, Cucumber, Gotukola, Courgettes Chili, Aubergine, Devil's Fig, Rose apple, Guava, and Mariam Plum were collected by purposive sampling, Ratchaburi province, Bangkok, Chiangmai province, Nakhon Si Thamarat province, Chanthaburi province, Si Sa Ket province, Chumphon province, Krabi province, Nakhonrajsima province, Nakhon Pathom province, Surat Thani province. The results of this research showed that insecticide residue was found at unsafe level, safe level in 57 samples (49.56 %) and 51 samples (44.43 %), respectively, whereas insecticide residue was found in 7 samples (6.80 %). Vegetables with the most unsafe level of insecticide residue were Chinese chives, Parsley, Gotu Kola, Morning glory and Tomato. It is suggested from the study that fruits and vegetables be properly rinsed before consumption.

**Keywords:** Insecticide, vegetable and fruits, Hua-It Market

**Grant:** Walailak University

**Presented:** Research Network and Transfer Technology to Community, Commission on Higher Education Conference 2009, 2-4 April 2009, Nakhon Si Thammarat, Thailand.
การปรับปรุงสภาพความเป็นอยู่และสภาพการทำงานของเกษตรกร ตําบลไทยบุรี อําเภอทําศาลา จังหวัดนครศรีธรรมราช

จํานง ธนะภพ

สํานักสหเวชศาสตรและสาธารณสุขศาสตร มหาวิทยาลัยวลัยลักษณ ตําบลไทยบุรี อําเภอทําศาลา จังหวัดนครศรีธรรมราช 80161

(อีเมล: tchamnon@wu.ac.th)

การปรับปรุงสภาพความเป็นอยู่และสภาพการทำงานของเกษตรกร ตําบลไทยบุรี มีวัตถุประสงคเพื่อสำรวจและปรับปรุงสภาพความเป็นอยู่และการทำงานของเกษตรกร โดยเทคนิค WIND (Work Improvement in Neighbourhood Development) และกระบวนการที่มีสวนกับเกษตรกร ตําบลสภาพบ้าน ที่พักอาศัย อาหาร การกิน การจัดการควบคุมสภาพแวดล้อม การจัดการค่าใชจ่าย และการดูแลสุขภาพ ทําการสำรวจและเรียนรู้ตัวอย่างการจัดสภาพความเป็นอยู่และสภาพการทำงานที่ดีและที่ควรปรับปรุง อย่างละ 3 จุด ภายในกลุ่ม พรอมนำเสนอแผนการปรับปรุงในแต่ละครัวเรือน และติดตามผลการปรับปรุงหลังเขารวมโครงการ 2 สัปดาห โดยมีเกษตรกรเขารวมโครงการ จำนวน 20 ครัวเรือน

ผลการศึกษาพบว่า จำนวนครัวเรือนที่ควรทําการปรับปรุงสภาพความเป็นอยู่และสภาพการทำงานมีทั้งหมด 11 ครัวเรือน จำนวน 30 จุด ด้านที่พบปัญหามากที่สุด คือ สภาพบ้านหรือที่พักอาศัย โดยมีจุดที่ต้องปรับปรุง 13 จุด รองลงมาคือ ด้านสิ่งแวดล้อมในการทำงาน ด้านอาหารการกิน และการจัดการค่าใชจ่าย จำนวน 8 7 และ 2 ตามลำดับ ผลการปรับปรุงหลังดําเนินโครงการพบว่า เกษตรกรไดทําการปรับปรุงเสร็จสิ้นทั้งหมด 22 จุด สภาพบ้านหรือที่พักอาศัยไดรับการปรับปรุงมากที่สุด ไดแก การจัดเก็บเครื่องมือในงานเกษตรที่ปลอดภัย เพื่อสําหรับลํางงาน และการจัดเก็บขยะของกลุ่ม คําอาหารการกิน ไดแก การจัดเก็บสิ่งของ เครื่องกําเนิดและจัดให้มีการรับประทานอาหารครบ 3 มื้อ และด้านสิ่งแวดล้อมในการทำงาน ไดแก การจัดเก็บสิ่งของ การปรับปรุงการอยู่อาศัยและแสงสว่างภายในบ้าน

โดยภาพรวม เกษตรกรสามารถปรับปรุงสภาพความเป็นอยู่และการทำงานด้วยวิธีการที่ง่าย ๆ โดยใชกลยุทธ์การจัดเก็บเครื่องมือในงานเกษตรที่ปลอดภัยเพื่อสําหรับลํางงาน และการจัดเก็บขยะของกลุ่ม และจัดเก็บสิ่งของในการทำงาน ไดแก การจัดเก็บสิ่งของ การปรับปรุงการอยู่อาศัยและแสงสว่างภายในบ้าน

คําสําคัญ: การปรับปรุงสภาพความเป็นอยู่ เกษตรกร การมีสวนกับ WIND
แหล่งทรัพยากร: -
การประกาศ: การปองกันควบคุมโรคจากการประกอบอาชีพและสิ่งแวดล้อมแหงชาติ ครั้งที่ 4 วันที่ 19-17 มิถุนายน 2552 โรงแรมอาร์เดน กรุงเทพมหานคร

School of Allied Health Sciences and Public Health

134
กรณีศึกษา: การใช้เกมในการเรียนการสอนวิชาสถิติพื้นฐาน

เพียงจันทร์ เสนศรีสกุล

ส商城ด ศสกุล มหาวิทยาลัยวลัยลักษณ์ ต.ไทยบุรี อ.ท่าศาลา จ.นครศรีธรรมราช 80161 (อีเมล: speeungj@wu.ac.th)

สภาพปัญหาทั่วไปของนักศึกษาเมื่อต้องเริ่มต้นเรียนวิชาสถิติ มักจะขาดความกระตือรือร้น และขาดความพร้อมในการเรียนรู้ การศึกษานี้มีวัตถุประสงค์ เพื่อจัดการเรียนการสอนวิชาสถิติให้นักเรียนมีความกระตือรือร้น สนุก ต้องการพัฒนาตนเอง และฝึกฝนตนเองให้มีความเข้าใจในการเรียนวิชาสถิติที่ยากยิ่งขึ้น โดยสร้างเครื่องมือเป็นลักษณะเกมที่นักศึกษาต้องใช้ความสามารถของตนเอง ในเวลาที่จำกัด ใช้ชื่อเครื่องมือว่าแบบ PJ-smart test โดยทดลองในนักศึกษาหลักสูตร วิทยาศาสตรบัณฑิต สาขาความเสี่ยงวัยโภชนาการ ผ่านการทดสอบครั้งแรก แล้วทดลองใช้ชื่อของตนเองเพื่อทำความเข้าใจและทำความเข้าใจเกี่ยวกับการวิเคราะห์ข้อมูลด้วยสถิติพื้นฐาน การแจกแจงความถี่ การวัดแนวโน้มเข้าสู่ส่วนกลาง สัมประสิทธิ์ของการกระจาย ซึ่งมีความแตกต่างกันตามตัวบุคคล โดยทำในห้องเรียน ใช้เวลา 4 สัปดาห์ แล้วทดสอบความสามารถในการพัฒนาตนเองอีกครั้ง ผลการศึกษาโดยการวิเคราะห์ group t-test และ paired test พบว่า นักศึกษาสามารถในการคิดคำนวณเพิ่มขึ้น อย่างมีนัยสtatที่ (p < 0.05) เมื่อพิจารณารายละเอียดของนักเรียนแต่ละคน พบว่า ร้อยละ 94 มีความสามารถในการคิดคำนวณเพิ่มขึ้นอย่างมีนัยส tatที่ (p < 0.05) สรุปได้ว่า นักศึกษาสามารถสนใจ สนุกที่ได้ทดสอบตัวเอง พัฒนาตนเอง ทราบความเปลี่ยนแปลงของตนเอง และเตรียมพร้อมกับการเรียนสถิติที่ยากยิ่งขึ้น

คำสำคัญ: -
แหล่งทุน: -
การนำเสนอ: การประชุมวิชาการสมัครสถานการณ์จ้างลงและเกมเพื่อการเรียนรู้แห่งประเทศไทย วันที่ 20 เมษายน 2552 มหาวิทยาลัยนเรศวารุ  กรุงเทพมหานคร