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Postpartum Psychiatric Disorders

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Use of Lao Kra Top mai dance in patients with Parkinson's disease

Environmental Friendly materials for Food and Water Quality

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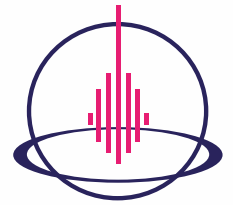
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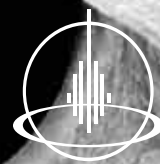


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ental and physical health problems take their toll not only on individuals and their families, but also on the socio-economic well-being of entire nations. Though the nature of public health problems resulting from infectious diseases has changed over the ages due to enhanced environmental sanitation systems and the ability to access public health systems even in relatively remote rural areas, new challenges are constantly emerging. Non-communicable diseases (NCDs) are increasing in relevance because changing social and nutritional status, stress, lack of exercise, environmental pollution and other lifestyle factors. Moreover, health services worldwide are encountering emerging infectious diseases and 'Re-emerging Infectious Diseases,' which may be triggered by climate change and/or increased cross-border mobility. Given this constantly changing battlefield, research into public health guidelines must be prioritized to establish management plans to deal with potential outbreaks of new diseases and protect people's health and quality of life.

The advancement of basic science, tools, and technologies to support medical and public health research is rapid, resulting especially from technology convergence-combining with other disciplines such as materials science, nanotechnology, and even music therapy and alternative medicine. Such convergence has led to ground-breaking medical advances across the board- in epidemiology, diagnostics, imaging, remote medicine, drug targeting and many other key challenges. Technology has helped reduce the financial cost of treatment and rehabilitation, and improve quality of life for patients undergoing therapy or rehabilitation.

Prioritizing research into the linkages between medical advances and public health needs is therefore a key national priority. Thai people need improved access to medical and public health services, higher standards of care, more skilled personnel, especially in rural areas, and greater access to news and information on medical advances through the media. By such basic measures we can contribute to an improved quality of life for the country's citizens as well as to national development.

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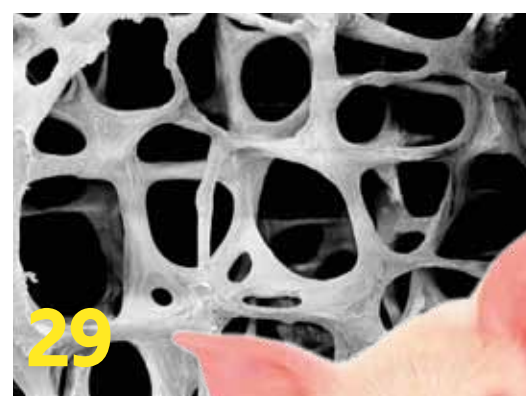
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Postpartum Psychiatric Disorders

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Introduction

For women, the postpartum period is the most vulnerable time for psychiatric disorders (Miller 2002; Burt and Hendrick, 2005). Correct diagnosis of any psychiatric disorder at this time (e.g. 'postpartum blues', postpartum depression, or postpartum psychosis) is vital to design an appropriate treatment regimen.

Postpartum blues

Postpartum blues, which may referred as maternity blues or baby blues, can be defined as a condition of emotional changes following childbirth, and was considered as mildest severity compared to other postpartum disorders (Table 1). In fact, it is regarded as a normal reaction of new mothers as it is found in 50-85 percent of new mothers (O'Hara and Swain, 1996; Burt and Hendrick, 2005; Epperson and Ballew, 2006). The common symptoms are sadness, crying spells, irritability, anxiety, headaches, fatigue, forgetfulness, and difficulty in sleeping (Arnold et al., 2002; Beck and Driscoll, 2006). Postpartum blues may begin within the first two to four days after childbirth, and usually resolved within two weeks without treatment.

No specific etiology has been identified, but postpartum blues is believed to be caused by alteration of reproductive hormones level around delivery which affect the central nervous system function (Dalton, 1985). Some patients are at higher risk of developing postpartum blues, especially



Table 1 Incidence, time course, and clinical features of postpartum psychiatric disorders

Disorder	Incidence (%)	Time course	Clinical features
Postpartum blue	70-85	Onset within first postpartum week, abates after 10-14 days	Mood instability, tearfulness, anxiety, insomnia
Postpartum depression	10	Onset within first postpartum month; duration similar to that of major depressive episode	Depressed mood, guilt, anxiety, fear of harm coming to baby, obsessional features
Postpartum psychosis	0.1-0.2	Onset within first postpartum month; duration variable weeks to month	Disorientation, confusion, delusions, hallucinations, often rapid mood cycling

Source: Burt and Hendrick (2005)

those with a history of depression, postpartum depression, premenstrual dysphoric disorder (PMDD), unplanned/ unwanted pregnancy, inability to adapt to pregnancy, stress during pregnancy, fear of childbirth, or positive family history of depression (Arnold et al., 2002).

Since postpartum blues has a mild severity and self-limited within 2 weeks, prescription of antidepressants might not be necessary. Doctors may assist the patient by providing information, comfort, and supportive therapy (Burt and Hendrick, 2005). In addition, the therapist should monitor the patient to ensure that symptoms do disappear within 2 weeks, because the disorder can in some cases develop into postpartum depression, requiring more specific treatment.

Postpartum depression

Postpartum depression (PPD), also known as postnatal depression (PNP), is a major depressive disorder with postpartum onset. It is more severe but less commonly encountered than postpartum blues, affecting an average of 12-13 percent of mothers. The symptoms are similar to major depressive disorder (MDD), including sadness, lack of pleasure, lethargy, reduced concentration, and anxiety about infant care. For example, the patient may question her ability to take care of the newborn baby, think or do something repeatedly, or wake up to check on the baby very frequently for fear that the baby may stop breathing. They may fear they are not a “good mother”, and sometimes unable to feel connected

to the baby as do other mothers. They would sometimes feel guilty or useless, guilty about the need to rely on others to care for her baby. Some new mothers become so desperate that they do not wish to live, leading to self-harm and even harm to the baby (Epperson and Ballew, 2006).

In order to diagnose postpartum depression (PPD), doctors may use major depressive disorder (with peripartum onset) according to criteria of DSM-5 (Table 2) or ask the patient to respond to the Thai version of the Edinburgh Postnatal Depression Scale assessment form, using a cutoff score of 11 or more (Vacharaporn, Pitanupong, and Samangsri, 2003).

The symptoms of PPD usually occur slowly (insidious onset) and appear weeks after delivery (normally within 6 weeks after childbirth (Arnold et al., 2002)) and may last as long as a year without treatment. In that case, it may affect the relationship between the mother and the baby, her ability to take care of the baby, and inappropriate behaviours such as neglect or aggression towards the baby. Such behaviours may then affect the child’s development. In addition, babies born to mothers with PPD are more likely to develop emotional problems in the future, including low self-esteem, aggressiveness, and emotional control problems. Some behavioural problems may be expected, such as misbehaviour, aggressiveness, and deception. In term of society, such children are likely to have problems with learning and socializing, which will further affect their lives until adulthood. They are more prone to difficulties

Table 2 Major Depressive Disorder diagnostic criteria according to criteria of DSM-5

Major Depressive Disorder
Diagnostic Criteria A. Five (or more) of the following symptoms have been present during the same 2-week period and represent change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure. Note: Do not include symptoms that are clearly attributable to another medical condition. 1. Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad, empty, hopeless) or observation made by others (e.g., appears tearful). (Note: In children and adolescents, can be irritable mood.) 2. Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation). 3. Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or in appetite nearly every day. (Note: In children, consider failure to make expected weight gain.) 4. Insomnia or hypersomnia nearly every day. 5. Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down). 6. Fatigue or loss of energy nearly every day. 7. Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick). 8. Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others). 9. Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide. B. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning. C. The episode is not attributable to the physiological effects of a substance or to another medical condition. Note: Criteria A-C represent a major depressive episode. Note: Response to a significant loss (e.g., bereavement, financial ruin, losses from a natural disaster, a serious medical illness or disability) may include the feelings of intense sadness, rumination about the loss, insomnia, poor appetite, and weight loss noted in Criterion A, which may resemble a depressive episode. Although such symptoms may be understandable or considered appropriate to the loss, the presence of a major depressive episode in addition to the normal response to a significant loss should also be carefully considered. This decision inevitably requires the exercise of clinical judgment based on the individual's history and the cultural norms for the expression of distress in the context of loss¹. D. The occurrence of the major depressive episode is not better explained by schizoaffective disorder, schizophrenia, schizophreniform disorder, delusional disorder, or other specified and unspecified schizophrenia spectrum and other psychotic disorders. E. There has never been a manic episode or a hypomanic episode. Note: This exclusion does not apply if all of the manic-like or hypomanic-like episodes are substance-induced or are attributable to the physiological effect of another medical condition.

Source: American Psychiatric Association (2013)

in establishing or maintaining relationships with others, and in social interaction in general (Beach et al., 2005).

Patients exposed to a high risk of developing PPD are those with a previous history of PPD (recurrence rates reach as high as 50 percent) (Garfield et al., 2004),

patients who suffer depression in the second trimester of pregnancy (whose risk of developing PPD are tripled), who have depression in the third trimester of pregnancy (increased 6 times risk to develop PPD), and who have postpartum blues. Other risk factors include

Table 3 Risk factors for postpartum psychiatric disorders

Disorder	Risk factor
Postpartum blue	Depressive symptoms during pregnancy History of depression History of premenstrual dysphoric disorder
Postpartum depression	Depression during pregnancy History of depression, especially postpartum depression Dysfunctional marital relationship Inadequate social supports Stressful life events during pregnancy
Postpartum psychosis	History of bipolar disorder Primiparity Previous postpartum psychosis

Source: Burt and Hendrick (2005)

young or adolescent mother, unintended or unplanned pregnancies, poverty, poor relationship with spouse, dissatisfaction with the marriage, inadequate social support and stress during pregnancy or before delivery (Beck, 2001; Arnold et al., 2002; Nonacs, 2005) as shown in Table 3 (Burt and Hendrick, 2005).

It is important to differentiate PPD from other physical illness after delivery such as postpartum thyroid dysfunction. Such indications can be derived from patient medical history, physical examination, or by laboratory tests as appropriate, and distinguished from similar psychiatric disorders such as postpartum blues, postpartum psychosis, anxiety disorder, and bipolar disorder, as shown in Table 4.

Multiple factors must be considered in terms of the treatment regime. For example, the possibility of self-harm or harm to the baby, and long-term emotional and behavioural impacts for both mother and child must all be evaluated. Side-effects of the treatment itself must also be taken into account. For example, the inability of the mother to breast-feed during a drug regimen may impair CNS development and the immune system, increasing risks to the baby of infections in the respiratory, alimentary, and genitourinary systems, infection in middle ears, meningitis, and allergies (Epperson and Ballew, 2006). There is also the possibility that the baby may receive medications/ their metabolites from breast milk. Some antidepressants have been shown to be passed

on through mother's milk at a very low rate i.e. lower than 10 percent of the level of medicine in the mother's plasma; they are considered as safe to use among breast-feeding mothers. Examples include Selective Serotonin-Reuptake Inhibitors (SSRIs) with a short half-life such as sertraline or paroxetine, as shown in Table 5 (ACOG Committee on Practice Bulletins--Obstetrics 2008). However, doctors should be very careful when treating mothers who deliver prematurely, because premature newborns are less efficient in eliminating drugs than those delivered at full term. In addition, mothers may discard their milk during the peak level of antidepressant in the milk (about 7-9 hours after taking the medicine). However, in most other countries, it is not advisable to discard the milk because the level of drug in the mother's milk is very low, and discard the milk unnecessarily increases the level of anxiety for postpartum patients (Epperson and Ballew, 2006).

Postpartum psychosis

Postpartum psychosis is a rare psychiatric disorder found only in 0.01 – 0.2 percent of new mothers (Table 1). However, it is a very severe disorder and an emergency, requiring immediate hospitalization and treatment (O'Hara and Swain, 1996; Burt and Hendrick, 2005) since patients may abandon, harm or kill their baby, or commit suicide. Patients experience emotional swings, high anxiety, difficulty sleeping,

confusion, rambling and incomprehensible speech, auditory hallucinations, or delusions. Studies have also revealed that postpartum psychosis is related to bipolar disorder. That is to say, it may be a bipolar disorder spectrum (Chaudron and Pies, 2003) since long-term follow up studies shown that this group of patients are at high risk to develop manic-depressive episodes that are unrelated to the pregnancy or childbirth (Rohde and Marneros, 1992).

The risk factors to develop this condition are (a) a medical record of bipolar disorder' (b) have suffered postpartum psychosis in the previous pregnancy; (3) direct family members who have suffered postpartum psychosis; or (4) their first pregnancy (Jones and Craddock, 2001). In contrast, patients with schizophrenia are not at risk from this illness (Miller, 2002). To diagnose postpartum psychosis, it is necessary to differentiate it from physical illnesses that might be caused by childbirth such as postpartum thyroiditis, Sheehan's syndrome, intoxication/withdrawal states, pregnancy-related auto-immune disorders, and intracranial mass.

Regarding treatment, hospitalization is necessary to separate patients from the baby due to high risk of inflicting harm on both themselves and their baby. Medication is based mainly on mood stabilizers such as lithium carbonate, valproic acid, carbamazepine, and lamotrigine; antipsychotics such as haloperidol, risperidone, and olanzapine are also recommended. Medication should begin with both antipsychotic and mood stabilizer, since mood stabilizers may take several days to gain a therapeutic control over the symptoms, while antipsychotics will be effective from the outset in controlling aggressiveness (Burt and Hendrick, 2005). These two groups of medicines may not be safe for breastfeeding mothers, especially lithium carbonate which is dangerous and prohibited for breast-feeding patients. On the other hand, valproic acid and carbamazepine are listed as permitted for administration to breast-feeding mothers (Table 6) (ACOG Committee on Practice Bulletins-Obstetrics, 2008). However, valproic acid has been reported to

Table 4 Comparison of postpartum psychiatric disorders

<i>Characteristics</i>	<i>Baby blues</i>	<i>PPD</i>	<i>Postpartum psychosis</i>
Prevalence	40-60%	10-15%	0.2%
Timing			
Peaks 3-4 d postpartum	✓		
Onset within 6 mo postpartum		✓	
Onset within 2-4 wk postpartum			✓
Duration			
Hours to a few days	✓		
>2 wk to month		✓	
>4 d to month			✓
Symptoms			
Feeling overwhelmed	✓	✓	
Anxiety	✓	✓	
Mood lability	✓	✓	✓
Depressed mood	✓	✓	
Decreased interest or pleasure		✓	
Inappropriate guilty		✓	
Appetite/weight change		✓	
Obsessions		✓	
Irritability	✓	✓	
Decreased libido ^a		✓	
Difficulty sleeping but tired	✓	✓	
Suicidal/infanticidal thoughts		✓	✓
Agitation		✓	✓
Decreased need for sleep			✓
Unusual thoughts or behaviors			✓
Hallucinations			✓
Hypersexuality			✓
Hyperactivity			✓
Confusion/disorientation			✓

^aSymptom included in the DSM-IV criteria for major depressive disorders.

Source: Roomrungwong, processed in December 2015

Table 5 Safety data for using antidepressants in pregnant women and breast-feeding mothers

Generic Name	Trade Name	Pregnancy Risk Category [†]	American Academy of Pediatrics Rating [‡]	Lactation Risk Category [§]
Amitriptyline	Elavil, Endep	C _m	Unknown, of concern	L2
Amoxapine	Asendin	C _m	Unknown, of concern	L2
Clomipramine	Anafranil	C _m	Unknown, of concern	L2
Desipramine	Norpramine	C	Unknown, of concern	L2
Doxepin	Sinequan, Adapin	C	Unknown, of concern	L5
Imipramine	Tofranil	C	Unknown, of concern	L2
Maprotiline	Ludiomil	B _m	N/A	L3
Nortriptyline	Pamelor, Aventyl	C	Unknown, of concern	L2
Protriptyline	Vivactil	C	N/A	N/A
<i>Selective Serotonin Reuptake Inhibitors</i>				
Citalopram	Celexa	C _m	N/A	L3
Escitalopram	Lexapro	C _m	N/A	L3 in order infants
Fluoxetine	Prozac	C _m	Unknown, of concern	L2 in order infants, L3 if used in neonatal period
Fluvoxamine	Luvox	C _m	Unknown, of concern	L2
Paroxetine	Paxil	D _m	Unknown, of concern	L2
Sertraline	Zoloft	C _m	Unknown, of concern	L2
<i>Other Antidepressants</i>				
Bupropion	Wellbutrin	B _m	Unknown, of concern	L3
Duloxetine	Cymbalta	C _m	N/A	N/A
Mirtazapine	Remeron	C _m	N/A	L3
Nefazodone	Serzone	C _m	N/A	L4

Abbreviation: N/A, not available

*The average half-life of elimination for major metabolites.

[†]The U.S. Food and Administration classifies drug safety using the following categories: A, controlled studies show no risk; B, no evidence of risk in humans; C, risk cannot be ruled out; D, positive evidence of risk; X, contraindicated in pregnancy. Risk category adapted from Briggs GG, Freeman RK, Yaffe SJ. *Drugs in pregnancy and lactation*. 7th ed. Philadelphia (PA): Lippincott Williams & Wilkins; 2005. The “m” subscript is for data taken from the manufacturer’s package insert.

[‡]American Academy of Pediatrics 2001

[§]Lactation risk categories are listed as follows: L1, safest; L2, safer; L3, moderately safe; L4, possibly hazardous; L5, contraindicated. For more information, see Hale TW. *Medications in Mother’s Milk*. Amarillo (TX): Pharmasoft Publishing, 2004.

^{||}Original committee report 1994 listed as “compatible,” and a correction was later published.

[¶]Not listed in Briggs. Risk category taken from Physicians’ Desk Reference 1992, 1993, 1994, 1996, and 2004.

Source: ACOG Committee on Practice Bulletins—Obstetrics (2008)

Table 6 Safety data of mood stabilizers and antipsychotics in pregnant and breast-feeding mothers

Generic Name	Trade Name	Pregnancy Risk Category [†]	American Academy of Pediatrics Rating [‡]	Lactation Risk Category [§]
Antiepileptic and Mood Stabilizing Medications				
Lithium carbonate	Eskalith, Lithobid, Lithonate	D	Contraindicated	L4
Valproic acid	Depakote (divalproex sodium)	D _m	Compatible	L2
Carbamazepine	Tegretol	D _m	Compatible	L2
Lamotrigine	Lamictal	C _m	Unknown	L3
Antipsychotic Medications				
<i>Typical Antipsychotics</i>				
Chlorpromazine	Thorazine	C	Unknown, of concern	L3
Fluphenazine	Prolixin	C	N/A	L3
Haloperidol	Haldol	C _m	Unknown, of concern	L2
Loxapine	Loxitane	C	N/A	L4
Perphenazine	Trilafon	C	Unknown, of concern	N/A
Pimozide	Orap	C _m	N/A	L4
Thioridazine	Mellaril	C	N/A	L4
Thiothixene	Navane	C	N/A	L4
Trifluoperazine	Stelazine	C	Unknown, of concern	N/A
<i>Atypical Antipsychotics</i>				
Aripiprazole	Abilify	C _m	N/A	L3
Clozapine	Clozaril	B _m	Unknown, of concern	L3
Olanzapine	Zyprexa	C _m	N/A	L2
Quetiapine	Seroquel	C _m	Unknown, of concern	L4
Risperidone	Risperdal	C _m	N/A	L3
Ziprasidone [¶]	Geodon	C	Unknown, of concern	L4

Abbreviation: N/A, not available

*The average half-life of elimination is listed for major metabolites.

[†]The U.S. Food and Drug Administration classifies drug safety using the following categories: A, controlled studies show no risk; B, no evidence of risk in humans; C, risk cannot be ruled out; D, positive evidence of risk; X, contraindicated in pregnancy. Risk category adapted from Briggs GG, Freeman RK, Yaffe SJ. *Drugs in pregnancy and lactation*. 7th ed. Philadelphia (PA): Lippincott Williams & Wilkins; 2005. The “m” subscript is for data taken from the manufacturer’s package insert.

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[‡]Not listed in Briggs. Risk category taken from Physicians’ Desk Reference 1992, 1993, 1994, 1996, and 2004.

Source: ACOG Committee on Practice Bulletins—Obstetrics (2008)

cause hepatotoxicity among many babies, one of which even suffered thrombocytopenia and anemia; for its part, carbamazepine can also lead to hepatic dysfunction in many babies. Therefore, should these medicines be prescribed for the mother, hepatic function should be closely monitored in the baby (Burt and Hendrick, 2005). Antidepressants can be used for patients who also have depression, but should be prescribed with care because they may complicate treatment and cure of postpartum psychosis (Sichel, 1992). For patients who are unresponsive to psychotic treatment, it may be necessary to introduce electroconvulsive therapy (ECT) as well.

After improvement of patient's symptoms, treatment should be continued for at least 9-12 months with close monitoring because the disorder may recur at any time throughout the patient's life, with a recurrence rate as high as 60 percent. Patients with bipolar disorder

are at a higher risk of recurrence and may need long-term medication (Burt and Hendrick, 2005). It is also very important to inform patients with postpartum psychosis of the possibility that the condition may recur following a subsequent pregnancy/delivery. In such cases it may be beneficial to prescribe preventive medicine (prophylaxis) and mood stabilizers immediately post-delivery. Finally, it is worth noting that patients who show first symptoms within 3 weeks after delivery generally show a better prognosis than those where symptoms appear long after childbirth.

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Program and Media for Providing Empirical Information

With Tapioca Starch Tracer Technique To Prevent Health Hazard from Pesticide Exposure

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Introduction



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Approximately 12.09 million Thai people or 31.74 percent of the population work in the agricultural sector (Total population work 38.09 million Thai people) (data as of October 2015) (National Statistical Office, 2015). This huge number makes agriculture the country's top occupation. Each year, increasing volumes of pesticides and fertilizers are imported to serve the agricultural sector (Panuwet et al., 2012). It was reported in that as much as 164,383 tons of pesticides was imported in 2013, valued at 22,044 million baht (Department of Agriculture, 2014). Agrochemicals have brought a wide range of environmental and health problems such as contamination of crops, soil, water, and air, as well as harm to animal and human health (Panuwet et al., 2012). The Bureau of Occupational and Environmental Diseases reports an increasing number of patients suffering from pesticide-related illnesses. The most recent data in 2013 reported 12.37 people affected by pesticides per 100,000 mid-year population, 37.07 of whom were working in the agricultural sector. Furthermore, blood cholinesterase levels in farmers' blood (an indicator of exposure to organophosphate and carbamate pesticides) showed that 30.57 percent of farmers were at the risk and vulnerable to pesticides (Bureau of Occupational and Environmental Diseases, 2015). The study concluded that lack of awareness and knowledge of the risks of pesticides were major contributory factors. For example, some farmers used 'cocktails' of many kinds of chemicals to increase pest control effectiveness, while others wore no protective equipment while mixing or spraying dangerous chemicals, or else did not use protective equipment properly (Norkaew, 2009; Panuwet et al., 2012; Taneepanichskul et al., 2012a, 2012b; Taneepanichskul et al., 2010; Tirado et al., 2008; Wilaiwan and Siriwong, 2014).

Therefore, this research aimed to investigate the current status of chemical pesticide usage and behaviors, and health impacts of pesticide use among farmers. The results provide empirical data that contribute to development of farmer education programmes and media to reduce farmer exposure and prevent health problems caused by pesticides.

Pesticide study location

The study area was Hua Ruea Sub-district, Mueang District, Ubon Ratchathani Province. This area was chosen because it has the second largest agricultural area in the country and also has a large population (Information Technology Center, Department of Agricultural Extension, 2014). It was also reported that farmers in this area have been affected by pesticides (Norkaew et al., 2015; Norkaew et al., 2010; Taneepanichskul et al., 2012a, 2012b; Taneepanichskul et al., 2010).

Data collection and tools

This research was a cross-sectional study, with data collected using face-to-face interviews. A total of 90 people were randomly selected as research samples during the chili growing season (April – May 2015). Data gathered included personal information, usage of pesticides, any abnormal symptoms after using pesticides, knowledge of, and behaviour in using pesticides, including protective measures when using pesticides. Respondents were also tested for levels of blood cholinesterase enzyme (Cholinesterase: ChE), including acetyl cholinesterase (AChE) and plasmacholinesterase (PChE), indicators of exposure to organophosphate and carbamate type pesticides. Test-mate ChE, Model 400 (EQM Research, 2003) was used as a tool to assess the risk level of pesticide exposure.

This human study has been approved by the Committee for Research Involving Humans (Group 1),

Chulalongkorn University under the terms of the Ethical Conduct for Research Involving Humans (registration number 078/2558). The average criteria of the risk (units per milliliter: U/mL) of the research participants are AChE = 2.73 U/mL (SD = 0.88) and PChE = 1.58 U/mL (SD = 0.56). After evaluation, samples were divided into 2 groups as follows:

1) Samples with normal level with AChE > 2.73 U/mL and PChE > 1.58 U/mL

2) Samples with abnormal level (at risk) with AChE ≤ 2.73 U/mL and PChE ≤ 1.58 U/mL

Results

The study found an average respondent age of 49.23 (± 10.44). There was a majority of males (53.30%) and 76.70% of respondents reported education level at only primary school level. Regarding abnormal symptoms, some (20.00%) reported illnesses such as gastritis and hypertension. Apart from this, some drank (28.90%) and smoked (20.00%), which might contribute to health impacts. Most farmers (83.30%) mixed or loaded the pesticide themselves before spraying, and 92.70% sprayed the pesticides themselves. 80.00% of respondents had received some training on use of pesticides, with most reporting training for more than 1 year (66.30%).

Nevertheless, 48.89% still had a low level of knowledge in using pesticides and protecting themselves from hazards, while 46.67% had intermediate knowledge of proper usage. Moreover, respondents had little knowledge in self-protection

Table 1 results of cholinesterase enzyme examination in blood samples of farmers

Biomarkers	Average ± STD (U/mL)	Min (U/mL)	Max (U/mL)	Percentage	
				Normal (%)	Abnormal (%)
AChE	2.73 ± 0.88	1.20	7.17	50.00	50.00
PChE	1.58 ± 0.56	0.47	3.11	51.11	48.89

Source: Siriwong (2015)

from pesticides such as wearing face masks to prevent pesticide mist from entering the respiratory system. Also, respondents were unaware of color-coding (pesticides with a yellow label are low-toxicity). Inappropriate use of pesticide found was because of not wearing goggles or face shield, gloves, respirators while spraying, or not wearing personal protective equipment (PPE) properly.

The results of cholinesterase enzyme examination in the blood sample of farmers (Table 1) showed that 50% of the farmers had abnormally high level of AChE (high level of risk). To clarify, the results indicated that half of farmers tested were at high risk of chronic exposure to organophosphates and carbamates; these categories of pesticides present serious risks of damage to long-term memory and the central nervous system (Lotti, 1995). In addition, 48.89% of the farmers had abnormal level of PChE (high level of risk), indicating a high risk from acute exposure to both types of pesticides (Mason, 2000). Symptoms of acute exposure may include headaches, dizziness, cough, itches and skin rash, excessive sweating and salivation (Taneepanichskul et al., 2012a).

The concept of Designing Program and Media for Providing Empirical Knowledge

Based on the literature review and the above empirical results, the fundamental problem and causes of improper usage of pesticide by farmers were better understood. This understanding facilitated the development of an outreach programme, planning of training, as well as the making of educational media to raise awareness of the dangers of pesticides and promote appropriate usage of pesticides and use of personal protective clothing (PPE) among at-risk farmers.

1) The program for safe pesticide usage training consisted of general knowledge on pesticides, pesticide exposure pathways, pesticides and health

hazards, safe use of pesticides, personal protective equipment, and personal hygiene to minimize pesticide exposure and risk (Siriwong and Nganchamung, 2015).

2) Empirical Information Media on “Tapioca Starch Tracer Technique” (TST) is a simple tool developed using local resources and wisdom. It can be used in the training to visualize otherwise invisible exposure to pesticides on skin, clothes and other surfaces. This contributed to an understanding among trainees of exposure patterns on their body and environment, and provided a focus for wider discussion and opinion sharing about the importance of using PPE, by learning from the empirical information media and visibility. The concept was derived from application of the fluorescent tracer technique (FT) developed by the University of Washington, USA (Pacific Northwest Agricultural Safety and Health Center, 2007). FT uses non-hazardous fluorescent chemicals to simulate pesticide residues on skin, clothes, and other exposed surfaces. When mixed with water, the fluorescent dye is invisible, but glows under ultra-violet light to show the exposure pattern. FT has been widely and successfully used in pesticide use training in many countries, including Thailand (Boonyakawee, Taneepanichskul, and Chapman, 2013; Fenske, 1988, 1990; Fenske, Birnbaum, and Methner, 2002; Ivancic et al., 2004).

Despite its widespread use as an effective training tool, FT was found to have certain limitations, as follows:

- Materials and equipment must be imported, resulting in complicated processes and higher costs.
- The target group for the safe usage of pesticide training are those living upcountry, while trainers are academics or public health officials. It is often difficult to introduce and prepare FT to apply in the rural areas.

To overcome these limitations, the TST tool was developed using low-cost, locally-available materials and equipment. This makes the tool more suitable for training in local communities, villages, or schools.

Application of TST in Training for Safe Use of Pesticides

In this technique, tapioca starch was used to simulate the pesticide. Typical high-risk farmer practices in mixing and use of pesticides were simulated, including mixing the starch with bare hands, spraying the starch-diluted solution without wearing proper PPE, and spraying the starch-diluted

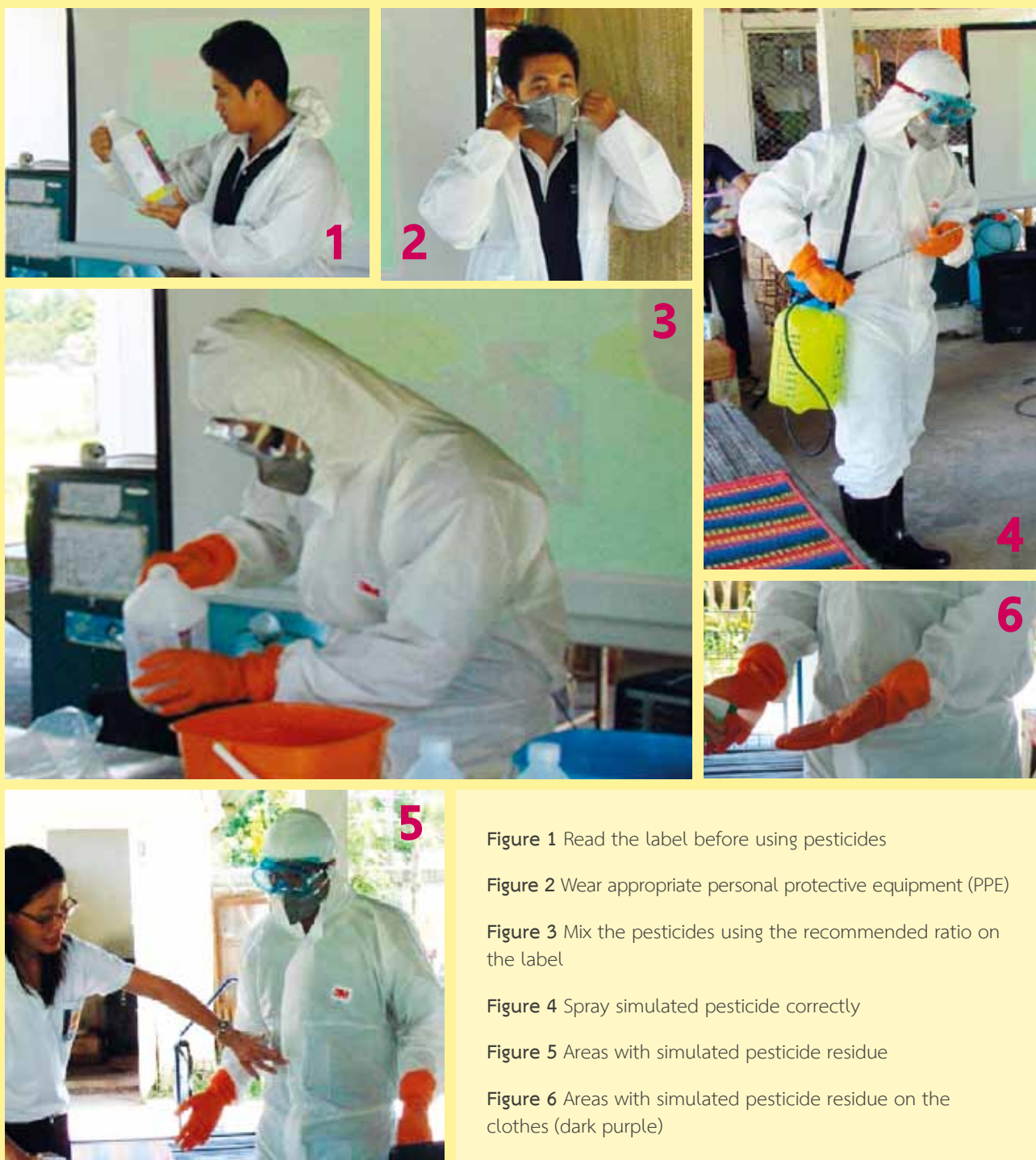
solution against the wind direction. The starch-diluted solution was kept in the same type of container used for pesticide mixing and spraying. The patterns of exposure to the simulated pesticide were made visible by spraying an iodine solution on the skin or spray equipment. The exposed areas turned purple on exposure to the iodine solution, allowing trainees to see how much pesticides may remain on their skin, clothes, and other surfaces. Seeing that, trainees understand the various pathways of pesticide exposure and become aware of the importance of PPE at every step of working, including mixing, loading, spraying and disposal. Also, awareness of the danger of improper usage of pesticides would lead to changed behaviour in using pesticides in a safer manner. The researchers have demonstrated the safe usage of pesticides using TST (Figures 1-6). Cooperation from participants was very positive. They were willing to share their opinion and practice using personal protective equipment (Figures 7-10).

After applying TST in the training, the researchers summarized the advantages and limitations of the technique as follows:

Advantages of TST as a training tool

- The technique encourages training participants to pay particular attention to the training subject and content
- TST motivates training participants to join the practice and voice their opinions
- Trainees can try the experiment by themselves, helping them understand and make a conclusion for the training
- The materials and equipment are easy to find locally, and are inexpensive.
- TST can be applied very easily and is suitable for local training provided by scholars, public health agents, health volunteers, farmer leaders, or teachers in agricultural area.





Figures 1-6 Demonstration of safe usage of pesticide using TST

Source: Siriwong, et al. taken in 2015

Limitations of TST

- Trainers have to prepare materials and equipment in advance.
- Trainers have to consider time management because this workshop training may take quite some time.
- It may be suitable only for training for small groups of participants so that everyone can get hands-on experience and share their opinions equally.
- Application of TST in the training may leave stains on furniture in the venue room. It is therefore necessary to prepare preventive measures and cleaning equipment.



Figure 7 Farmers were asked to use pesticide 1) their way and 2) use TST to demonstrate simulated pesticide residue on their hands

Figure 8 Demonstration of simulated pesticide residue from farmers' hands

Figure 9 Farmers participated in a discussion group after the demonstration session

Figure 10 Farmers learn how to use personal protective equipment

Figure 7-10 Farmers participated in the discussion group and were trained to use PPE

Source: Siriwong, et al., taken in 2015

Conclusion

A training programme and media was developed for providing empirical information to prevent health impacts from pesticide use in an application of FT widely used for training in other countries. In order to tailor the technique to be more appropriate to the Thai context, low-cost locally-available materials were used to replace expensive imported FT chemicals. In this case, the “Tapioca Starch Tracer Technique” (TST), tapioca starch was used to simulate the pesticide, and the residue spray pattern was made visible by the reaction of the starch with iodine solution sprayed on to the materials after exposure. Using this technique as a training tool, farmers have become more aware of pesticide hazards and have learned to use pesticides more safely. The awareness

will contribute to reductions in acute and chronic health impacts and risks faced by pesticide applicators. More importantly, it can be applied to further use with local training.

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Use of Lao Kra Top Mai dance in patients with Parkinson's disease

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Introduction

Parkinson's disease is the second most common neurodegenerative disease after Alzheimer's disease. Parkinson's disease affects nerve cells in deep parts of the brain called the basal ganglia and the substantia nigra. Nerve cells in the substantia nigra produce the neurotransmitter dopamine and are responsible for relaying messages that plan and control body movement. Degeneration of cells in the substantia nigra leads to a decreased dopamine level in the brain resulting in the poor control of movement and coordination. Therefore, continuous movement is impaired and movement abnormalities, such as tremor, rigidity, bradykinesia and postural instability (Nolden, Tartavouille, and Porche, 2014).

Principle and concept of using Lao Kra Tob Mai dance in patients with Parkinson's disease

In the middle stages of Parkinson's disease the patients have an impaired walking and balancing ability, with gait freezing, difficulty in starting movements, small shuffling steps and hesitation, reduced stride length and walking speed, reduced arm swing, a stooped posture, a tendency to follow their own gravity point, and difficulties when turning (Nutt et al. 2011). Patients with Parkinson's disease have an altered walking pattern as follows:

- Reduced stride length
- Increased double support time
- Reduced ground clearance
- Reduced gait velocity
- Increased cadence

These walking patterns lead to imbalance gait which is the important reason of falling over in Parkinson's disease patients. (Latt et al., 2009; Kerr et al., 2010) This all leads to a decreased quality of life for the patients (Moore, Peretz, and Giladi, 2007; Rahman et al., 2008)

During the congress in 2010 with medical doctors and scientists, a working definition of freezing was proposed as "the absence of any known cause other than parkinsonism or high-level gait disorders. It is most commonly experienced during start hesitation, turning, and step initiation but also when faced with spatial constraints, stress and distraction. Focused attention and external stimuli (cues) can overcome the episode (Giladi and Nieuwboer, 2008; Bloem et al., 2004).

Other important features that can be found with gait freezing are (Nutt et al., 2011):

1. The foot or toe does not leave the ground or barely lift from the ground surface
2. Alternative trembling of the legs occurs at a frequency of 3-8 Hz
3. An increased cadence and a decreased step length

4. The patient feels that the feet are glued to the floor, which is accompanied by gait freezing
5. Gait freezing can happen all of a sudden but can be relieved using various cues
6. Gait freezing can be asymmetrical, affecting mainly one foot or being elicited easily by changing direction

Nevertheless, the occurrence of gait freezing depends on the situation, and commonly occurs when a person is starting to walk, turning, passing through narrow passages, or approaching a destination, such as a chair. Although less likely, gait freezing can also occur while walking straight ahead in open spaces (Snijders et al., 2008).

Gait freezing in patients with Parkinson's disease is related to the severity of the disease (Tan et al., 2011) and the longterm treatment with levodopa, but is not related to the parkinsonism symptoms, such as tremors, bradykinesia and rigidity. Abnormalities in the walking patterns, including gait freezing, in patients with Parkinson's disease include an increased time for stepping, impaired coordination between the two sides of the body (Plotnik, Giladi, and Hausdorff, 2008), reduced arm swinging and step length (Chee et al., 2009), and an increased cadence.

Rehabilitation methods for the gait pattern in patients with Parkinson's disease have become very popular during the last decade, and use attentional strategies and cueing. These methods can prevent gait freezing and can be practiced at home easily and efficiently (Nieuwboer et al., 2007).

Cueing in patients with Parkinson's disease

Cueing is one of the methods used to rehabilitate abnormal gait patterns in patients with Parkinson's disease. The external cues are normally in the form of auditory and visual cues, and can treat abnormalities in the brain's neural circuits by using the external cues to compensate for the lack or reduced level of nerve impulses in the brain. They directly affect the



walking efficiency of parkinsonsim (Ford et al. 2010). External cues bypass the impaired basal ganglia and get into the cortical circuit. Auditory cues go to the thalamus via the supplementary motor area (SMA) or to the cerebellum via the pre-motor cortex and use the visuomotor control to respond to the visual cue as movement guiding. After auditory and visual cues, the cadence, stride length, velocity and postural stability are much improved (Ford et al., 2010; Suteerawattananon et al., 2004; Spaulding et al., 2013) with a reduced risk of falling.

Other methods to cure patients with Parkinson's disease include various drug treatments and deep brain stimulation. However, symptoms like gait walking and balancing are only partially responsive to the drugs. Therefore, exercise is very beneficial to patients because it improves their gait pattern and balance problems.

Dancing is an exercise therapy used for patients with Parkinson's disease that can improve the gait pattern and balance issues. Moreover, dancing is an enjoyable and socially engaging activity so the patients tend to do this activity habitually (Earhart, 2009). Previous studies have reported that tango (Hackney and Earhart, 2009a; Hackney et al., 2007), waltz and foxtrot (Hackney and Earhart, 2009a) improved the balance, walking ability and movement in the everyday life of patients with Parkinson's disease. In Thailand, Khongprasert, Bhidayasiri, and

Kanungsukkasem (2012) studied the effect of a Thai classical dance exercise programme in patients with Parkinson's disease, and reported that it improved the movement, balance, walking ability and life quality of the patients.

Dance movement therapy

Dance movement therapy is a psychological treatment for individuals with Parkinson's disease, that helps to obtain a positive combination of body and mind, such as feelings, social, thinking and strength. Dance movement therapy is an alternative physical activity and exercise designed for patients with Parkinson's disease. Dance is an activity performed with music, which serves as the external cue to promote the movement. Dance also involves teaching specific movement patterns and specific exercise programmes for balance improvement. Additionally, dance is an enjoyable activity and sociable, thus providing the motivation to regularly participate in this activity. From these beneficial reasons, dancing has become an alternative form of exercise that is highly suitable and recommended for patients with Parkinson's disease. Previous studies have examined the benefits of dancing in patients with Parkinson's disease, and reported that dance therapy improved the movement initiation compared to normal exercise. Following dance therapy the



Figure 1 Practicing Lao Kra Tob Mai dance
Photographed by: Khongprasert, November 2015

United Parkinson's Disease Rating Scales (UPDRS) were much better (Duncan and Earhart, 2012; Hackney and Earhart, 2009a; Hackney et al., 2007; Hackney and Earhart, 2009b; McKee and Hackney, 2013; Hackney and Earhart, 2009c; Heiberger et al., 2011; Marchant, Sylvester and Earhart, 2010), with improved balance (Duncan and Earhart, 2012; Hackney and Earhart, 2009a; McKee and Hackney, 2013; Hackney and Earhart, 2009b; Marchant et al., 2010; Hackney, Kantorovich, and Earhart, 2007; Hackney and Earhart, 2010; Volpe et al., 2013), improved gait and movement (Hackney and Earhart, 2009a; Hackney et al., 2007; Hackney and Earhart, 2009b; Heiberger et al., 2011; Marchant, Sylvester, and Earhart, 2010; Hackney et al., 2007; Volpe et al., 2013), a better life quality (Heiberger et al., 2011; Volpe et al., 2013; Shanahan et al., 2015) and also an improved patients' mood (Hackney and Earhart, 2009a; Hackney et al.,

2007; Khongprasert, Bhidayasiri, and Kanungsukkasem, 2012; McGill, Houston, and Leea, 2014). Therefore, using Lao Kra Tob Mai dance as therapy in patients with Parkinson's disease was evaluated in this research.

Lao Kra Tob Mai or Ten Sak is a traditional dance that originated in Surin province, northeastern Thailand. For centuries, Thailand has been an agricultural country with rice as one of the main foods for Thais and one of the main export products. Therefore, for many rural Thai people their daily routines have largely been associated with rice paddy fields, starting from ground preparation, sowing, plowing, farming and harvesting. Thai farmers use the rice pestles to rhythmically knock as a trappings stroke and people dance to the music. Initially the rhythm is provided by two people who stand and pound the rice, and later the rice pestles



are laid parallel to the ground with a person holding the head and tail ends, using a pillow knock to provide the rhythm.

This traditional dance was studied and dancing patterns developed as a treatment for patients with Parkinsons without departing from the traditional acts. Ajarn Montri Tramot composed the song and Lady Paew Sanitwongsenee composed the dance movement. The first show of Lao Kra Tob Mai was performed in the Thai-Laos exchange culture show in 1957 (Na Ayudhya, D.B. 1992).

Nowadays, Lao Kra Tob Mai is well known for using two equal sized bamboo sticks, 2-4 metres long and placing a pillow knock made from hard wood at both ends of the bamboo sticks. The two players sit opposite each other on the floor holding the end of the sticks so that they can make them hit harmonically and the dancers then dance according to the rhythm of the knocking sticks. The harmonic sound produced from hitting the bamboo sticks is of two types:

Sound 1 “keung” when the sticks are parted and knock down on the pillow knock

Sound 2 “kok” when the sticks hit each other

The knocking rhythm is divided into eight tempos as follows:

rhythm	1	2	3	4	5	6	7	8
beating tempo	together	parted	parted	-	parted	parted	beating tempo	together



Conclusion

Lao Kra Tob Mai dance is a Thai traditional exercise that combines dancing and external cues together. Specific movements and direction are performed according to the rhythm. The body weight is transferred using coordinated movements of the body, arms and legs (Na Ayudhya, 1992). Moreover, external cues are used to stimulate the patients: a visual cue by using bamboo sticks as barriers for the patients to jump pass and an auditory cue from listening to the bamboo-beating tempo and the Thai classical music.

Lao Kra Tob Mai has been developed as an exercise specifically for treating patients with Parkinson’s disease by dancing together with external cues and is enjoyable.

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Environmental Friendly Materials for Food and Water Quality

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Introduction

It is general to say that the four requisites, i.e. food, clothing, medicines, and accommodation, are the basic in the lives of human beings. But nowadays, with the social and cultural changes driven by the industrial revolution and the advancements of technology, the living becomes the lives in the conditions of convenience, wealth, speed and readiness, etc. It is no wonder that on the bright side of the prosperity that brings the quality of life, the dark side of it also leads to the environment issues to damage the four requisites indirectly.

Food and water are the primary requisite that reflects the impact from the environmental problems. At present, most technologies focus on the approaches to obtain or maintain the quality of food and water under the requirements of clean and safe. Therefore, the spotlights of the themes of research, development, and innovation are sensors, storages, packaging, purification, etc. whereas the practical materials are polymers. In fact, polymers were developed for decades and the products, such as bags, bottles, boxes and bowls, etc. have supported the quality of life for human beings. Traditionally, polymeric materials are produced from petroleum, so-called petroleum-based polymers, and the commodity polymers are polyethylene (PE), polypropylene (PP), polystyrene, polyvinyl chloride (PVC), and polyethylene terephthalate (PET). Although those plastics are cheap and produced in a large scale production, the fact that they are not bio degradable, the reuse and recycle have to be considered as a part of the using cycle of petrochemical products. However, almost all petrochemical-based

plastics were ended with waste disposal or the burning garbage and this brings environmental issues.

Therefore, the demand for environmental friendly materials increased because of humanity has awareness of environmental sustainability had affected to his quality of life. Bio-based polymers such as polylactic acid (PLA) from sugar-based resource, polyhydroxyalkanoates (PHA) produced from bacteria, starch from rice; polyisoprene from natural rubber and chitin-chitosan from the shells of crustaceans. (Figure 1) become the main materials in the production of bio-based polymer.

Bio-Based polymers are the environmentally friendly materials (Figure 2) which the cycle is renewable. Biodegradable polymer resins can be obtained from agricultural products. The fermentation brings the monomers and the industrial polymerization process develops the monomers to polymer resins. The well-known resins are for example, poly (lactic acid) or polylactide, polybutylene succinate (PBS), polybutylene adipate terephthalate (PBAT) and at the present time, several product items are launched in the market.



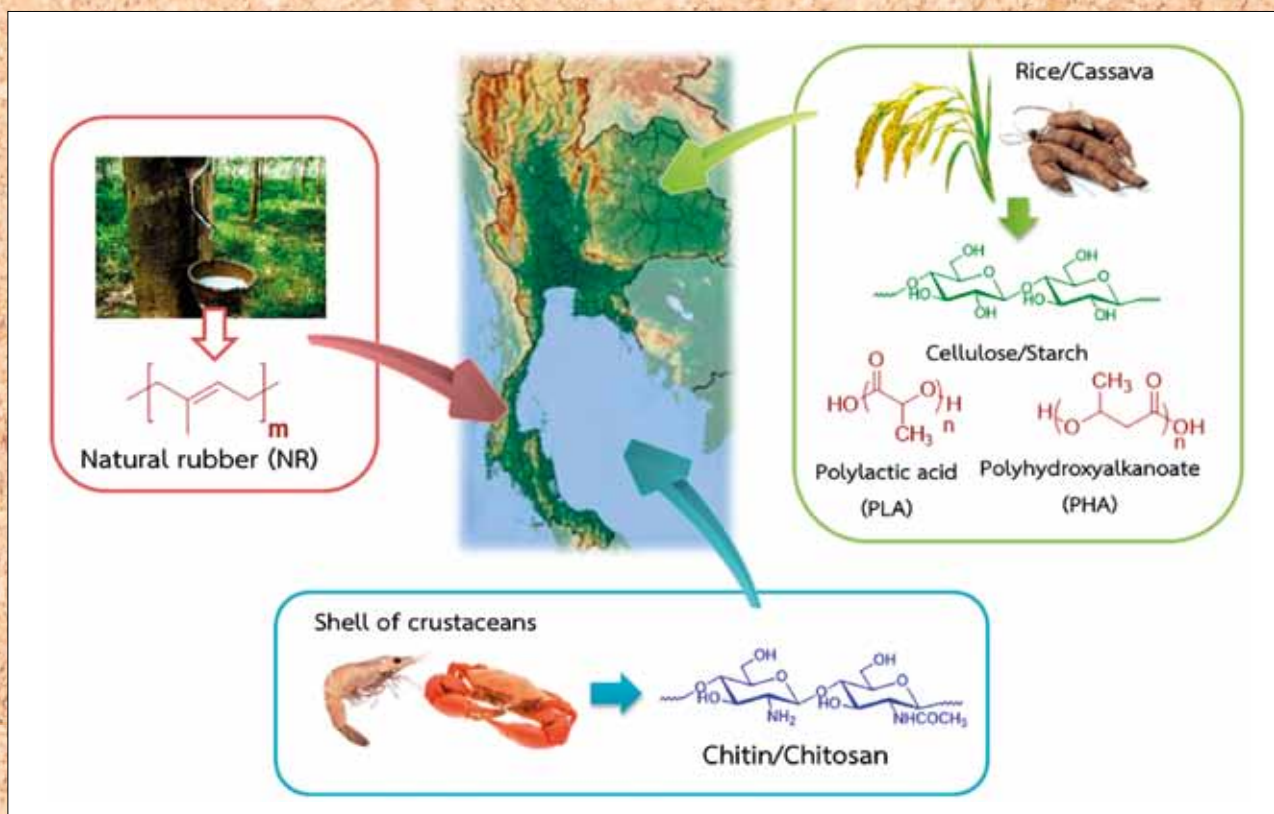


Figure 1 Natural resources for bio-based polymeric materials in Thailand.
Source: Chirachanchai, designed in December 2015

The important point is that after using the biodegradable plastic products, the waste can be degraded by microbes (enzymatic degradation) leading to the fertilizer back to the soil. Comparing the cycle of renewable resource-based plastic with that of petroleum-based one, it is clear that the use of biodegradable plastics is the sustainable way to avoid the environmental problems, i.e. green-house effect, air pollution, acid rain, etc., since the plastic wastes can be solved.

The concept of the present research

Based on the polymers and/or plastics with the concerns on environmental issue, the present project focuses on the development of plastics to provide clean, safe and prolonging for food and water. The project involves with unique ideas to develop bio-based polymeric materials for prototype products under the concrete research focuses.

This project is divided into three sub-projects as follows;

1) *Biodegradable polymer foam for water filtration system.* The project aims to develop filter which is a main component in a water filtration system to separate sewage, heavy metals or bacteria to get water purified. In this project, biodegradable polymer, i.e. polylactic acid is applied for preparing porous foam. The specific properties related to the hydrophobicity and hydrophilicity are fine-tuned by modifying polylactic acid with the hydrophobic and/or hydrophilic functional groups. At the same time, the porosity is tuned by developing the molecules in branching structure, i.e. star- shape, multi-branched. The cross linked network of those branching not only brings in the network but also the variety of porous density.

2) *Nano magnetic microbe test kits.* The project focuses on the rapid and accurate examination to identify the contamination of microbes in food and water. Nano-meter size of magnetic particles are surface modified with bio-based polymer chains to



Figure 2 Cycles of non-renewable resource and renewable resource products.
Source: Chirachanchai, designed in December 2015

prevent the aggregation. The polymer chains on the surface of magnetic nanoparticles are further conjugated with antibody to bring in the specific interaction of antigen-antibody. In this work, the biopolymers such as chitosan which contains reactive amine is good candidate. The magnetic nanoparticles obtained are well dispersed in water, buffer, and the media whereas they show biocompatibility as well as the specific interaction with antibody. (Denkbaş et al., 2002; Xu et al., 2001) The conjugation with specific antibody leads to the selective antigen interaction to result in the sensing function to be used in the test kits.

3) *Flexible biodegradable wrapping film.* Polylactic acid (PLA) has some limitations related to the brittleness as it is in the helical structure which consumes the time for crystallization. In addition, its glass transition temperature (T_g) is also as high as 60 °C leading to the short shelf life. Therefore, PLA is difficult to replace commodity plastics as it is lacking

of flexibility and endurance. The additives to improve the mechanical properties of PLA also bring in the opaqueness to PLA and this also limits the uses in packaging due to the loss of clarity. (Auras, Harte, and Selke, 2004; Saeidlou et al., 2012) The research aims to develop food packaging PLA to replace petroleum-based polymer packaging. There, the key point of the work is to develop the additive with the functions of improvement of PLA plasticity and toughness in combination with PLA compatibility. In the past, we already succeeded in demonstrating the effect of multi-branched PLA on enhancing the crystallization as well as providing the amorphous phase to result in the PLA toughness. At that time, we already proved that the branching PLA also plays an important role for the compatibility.

Conclusion

The present project focuses on biodegradable polymers which are polylactic acid and chitosan for

Food and Water

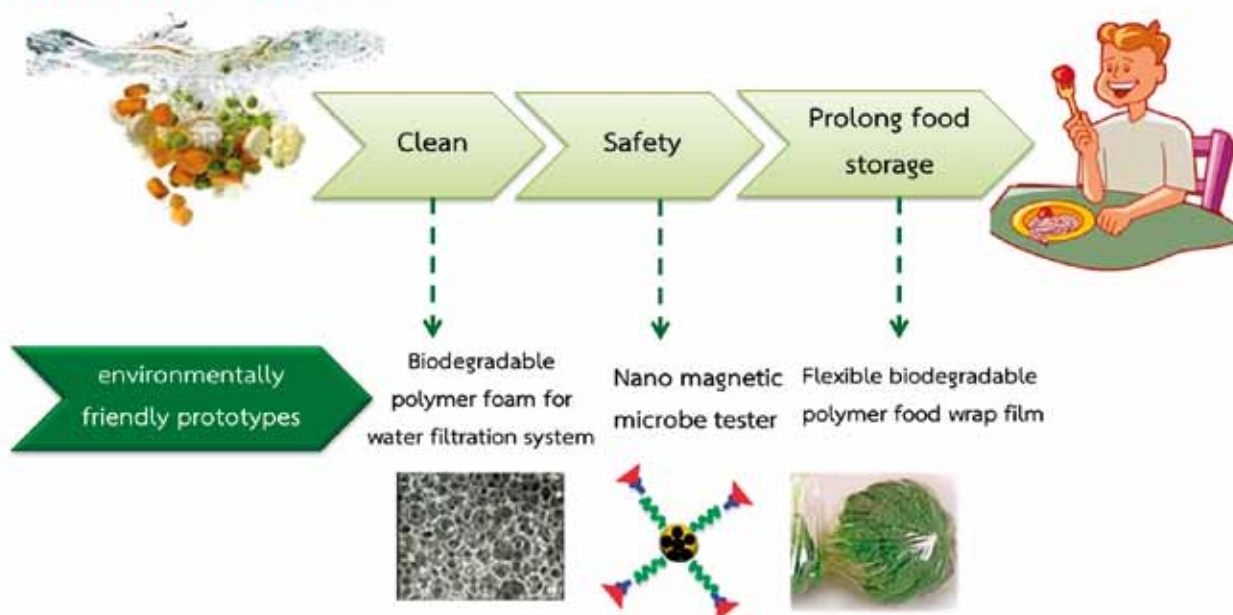


Figure 3 Three subprojects for clean water, safety food, and food shelf-life, i.e., (i) biodegradable polymeric foam for water purification system, (ii) nano-magnetic microbe test kits, and (iii) flexible biodegradable polymer food wrap film.

Source: Chirachanchai, designed in December 2015

quality of water and food. The subproject 1 is the way to obtain filtration system for water based on the use of PLA network. The subproject 2 is the development of microbes test kits by modifying the surface of magnetic nanoparticles with biodegradable polymer, especially chitosan. The rich of functional groups of chitosan leads to not only the conjugating with magnetic nanoparticles but also with the antibody to result in the function of sensor. The subproject 3 is the development of biodegradable PLA packaging which the controls of toughness and compatibility are possible. The use of star, including the multi-branched core molecules modified with

PLA brings in the compatibility as well as the crystallization and nucleation. The work to the development of engineering, technology, innovation and production and is essential for the development of a comprehensive and sustainable for Thailand.

Acknowledgment

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Polymorphism at base pairs -29 and 2039 (rs6166 and rs1394205) of the follicle stimulating hormone receptor gene in osteoporosis

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Introduction

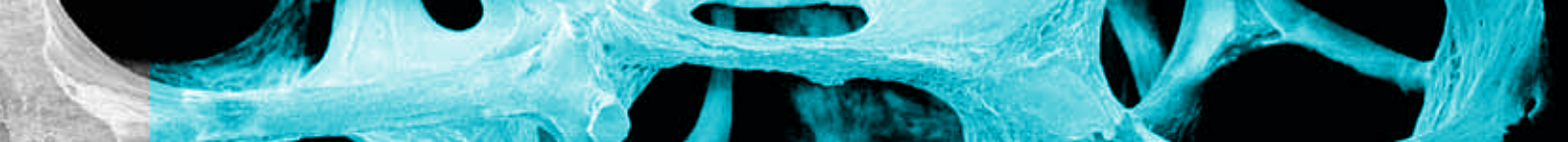
Osteoporosis is a condition that involves the loss of bone mineral density together with the degeneration of the bone structure, and so the bones become fragile with an increased risk of fracture or collapse. Osteoporosis is age-related and especially to reduced estrogen levels and so is most commonly found in elderly or postmenopausal women.

With advances in health care, nutrition and housing, the average life expectancy of humans has increased globally over the last century and accordingly the number of elderly people in the worldwide population, including in Thailand, has increased rapidly and with it the number of people diagnosed with osteoporosis and broken bones has increased. Previous studies have shown that bone fractures caused by osteoporosis are more common in females (30–50%) than in males (15–30%) (Randell et al., 1995). The causes of osteoporosis in females are the reduced estrogen levels following menopause, malnutrition (such as a low calcium or vitamin D diet), genetics, race, lack of exercise, other chronic diseases (such as diabetes) and the long-term use of certain medications, such as steroids, (Pongchaikul, 1999).

It is important to understand the origin of osteoporosis in order to find ways to prevent this disease and improve the quality of life, especially for menopausal and postmenopausal women.

Osteoporosis occurs when there is an imbalance between bone formation (osteogenesis) and bone resorption. Proteins related to the bone formation and resorption processes are encoded from highly diverse genes and their incorrect expression could cause different levels of osteoporosis in postmenopausal women. These include the vitamin D receptor (*VDR*), which is the gene normally used to study the relationship between the genetic diversity of the population/individual and the risk of osteoporosis, with several polymorphisms in the *VDR*, including the *BsmI* and *FokI* sites, being linked to changes in the bone mineral density, peak bone mass and frequency of fractures. For example, Thakkinstian et al. (2004) reported that the *BsmI* polymorphism in the *VDR* was related to the spine bone mineral density but not the hip, while a relationship between polymorphism at the *FokI* site and bone mineral density and risk of osteoporosis has been reported (Gross et al., 1996).





Polymorphisms in the follicle stimulating hormone receptor (FSHR) gene in osteoporosis

DNA polymorphisms, different sequences at the same loci in each individual, can lead to different expression levels or amino acid sequences of the encoded protein and so different phenotypes, and these can be inherited.

This research studied the polymorphism at two loci in the follicle stimulating hormone receptor (*FSHR*) gene located at chromosome 2p21-p16. These were the G-29A polymorphic substitution near the promoter (single nucleotide polymorphism (SNP) rs1394205 in the NCBI DNA data base) and the G2039A polymorphic substitution located in exon 10 (SNP rs6166 in the NCBI DNA data base). The polymorphisms in these two loci have been differentially linked to the risk of osteoporosis in elderly postmenopausal Italian women (Rendina et al., 2010). Follicle stimulating hormone (FSH) is produced in the anterior pituitary gland, located at the forebrain, and regulates the production of sex hormones in both males and females, including estrogen, by working together with luteinizing hormone (LH). Sun et al. (2006) reported that FSH has a direct effect on bone resorption.

However, there has been no study on the polymorphism of the *FSHR* gene at the G-29A and G2039A SNPs (rs1394205 and rs6166, respectively) in osteoporosis in Thai women. Therefore, this study evaluated the polymorphism (as genotypes) at these two SNP loci in a sample set of the Thai population with the hypothesis that polymorphism at these two SNP loci in the *FSHR* gene were linked to osteoporosis.

If so, then the detection of these polymorphisms could help in risk assessment of osteoporosis and forewarn patients prior to osteoporosis onset to allow them to change their lifestyle and diet, such as avoiding activities that could risk bone injuries and the consumption of food supplements to strengthen the bones, such as Vitamin D and calcium enhanced diets.

In this research, the extraction of blood and the subsequent use of DNA for research were authorized according to the Research Ethics Committee, Faculty of Medicine, Thammasat University Hospital. A total of 210 postmenopausal (at least 6 months) Thai women were selected and were divided into the two groups of those who had osteoporosis (104 samples; osteoporosis group) and those who do not (106 samples; control (healthy) group). You should state

Table 1 Primers used for the PCR-HRM genotyping at the two *FSHR* SNP loci

<i>FSHR</i> SNP locus	Primer sequence (5' to 3")	Amplicon size (bp)
rs6166	F: TGCTCTTCAGCTCCCAGA F _{seq} : TCTTCACTGACTTCCTCTGC R: TCCAATTACATACTTGTC	real time PCR = 50 sequence = 331
rs1394205	F: GCTTCTGAGATCTGTGGAG F _{seq} : TTGAATGCAACCCAGAAGGG R: CAGGTGGATGGATGCATAAT	real time PCR = 67 sequence = 479

F stands for forward, R stands for reverse, and F_{seq} stands for the forward primer used for sequencing

Source: Imngen (2014)

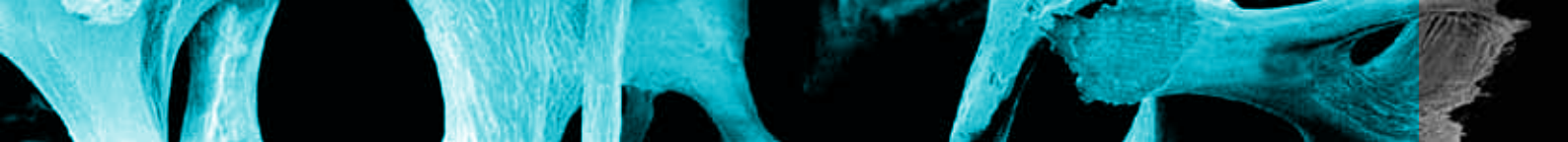


Table 2 The increase of DNA in each polymorph by real time PCR-HRM

PCR	rs6166		rs1394205	
Initial denaturation	98 °C, 30 s		98 °C, 30 s	
Denaturation	98 °C, 2 s	40 cycle	98 °C, 2 s	40 cycle
Annealing	54.2 °C, 30 s		58 °C, 10 s	
Extension	72 °C, 30 s		72 °C, 30 s	
Denaturation	98 °C, 30 s		98 °C, 30 s	
Renaturation	60 °C, 30 s		60 °C, 30 s	
DNA melting	increasing the temperature from 60 to 90 °C at 0.2 °C/s		increasing the temperature from 60 to 90 °C at 0.2 °C/s	

Source: Imngen (2014)

if women were screened for other diseases known to affect bone metabolism other than osteoporosis and excluded if positive, or not and what the age range and average age was in each of the two groups.

Blood (3 ml) was removed from each patient and DNA was isolated from the blood by the standard phenol/chloroform extraction and then used to evaluate the genotype at the two selected *FSHR* SNP loci (rs1394205 and rs6166) by PCR amplification and high resolution melting (HRM) using the primer pairs shown in Table 1.

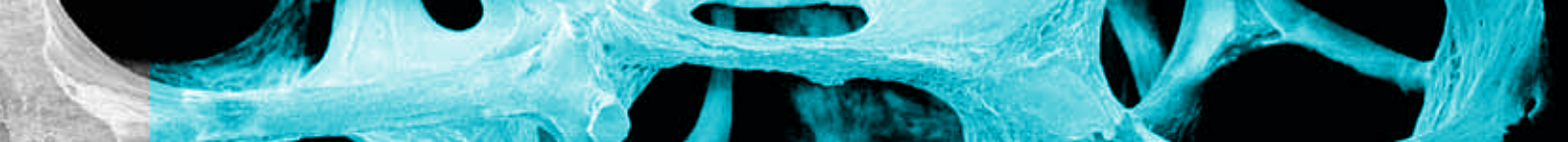
All extracted DNA samples were genotyped at the two SNP loci by PCR-HRM (The protocol of PCR mixture was followed by BIO-RAD, CA, USA) shown in Table 2.

The results were then statistically analyzed using the Statcalc (AcaStat Software, Leesburge, VA, USA) software to find the odd ration (OR). The OR is used to find the relationships between two variables, where each categorical variable is dichotomous, and in this case was used to compare whether each SNP was related to the morbidity or not and by how much. The OR is categorized as: OR = 1, the morbidity is not related to the studied SNP; OR > 1, the morbidity is related to the studied SNP compared to a healthy person; and OR < 1, the risk factor is not related to the morbidity. Confident intervals were used at 95% and statistical significance was accepted at $P < 0.05$.

Table 3 Percentage of each genotype found at the rs6166 and rs1394295 SNP loci

Genotype	Number of individuals			
	rs6166		rs1394205	
	Control group	Osteoporosis group	Control group	Osteoporosis group
AA	54	33	23	19
AG	37	53	45	56
GG	15	18	38	29

Source: Imngen (2014)



Genotypic results for the *FSHR* rs6166 and rs1394205 SNP loci in postmenopausal Thai women

The genotypes of the *FSHR* rs6166 and rs1394295 SNP loci and their frequency in the control (healthy person) and the experimental (osteoporosis patients) groups are shown in Table 3.

The G allele was found more frequently at SNP locus rs6166 in patients with osteoporosis than in the control group, and so was possibly related to the occurrence of osteoporosis. Therefore, genotype GG was selected as the reference genotype. From the study, the OR (95% CI) of individuals with genotypes GG vs. AA was 1.96 (0.873–4.417), meaning individuals with genotype GG had a 1.96-fold higher risk of osteoporosis than individuals with genotype AA, but this was not significant (95% CI of over 1 and $p = 0.147$). Comparing between individuals with genotype GG and AG, the OR (95% CI) was 0.84 (0.375–1.871), giving genotype GG a 0.84-fold higher risk of osteoporosis, but this was also not significant (95% CI over 1 and $p = 0.685$).

With respect to locus rs1394205, the hypothesis was that allele A should be related to the occurrence of osteoporosis, and so genotype AA was selected as the reference genotype. The results showed that the OR (95% CI) of individuals with genotypes AA vs. GG was 1.08 (0.498–2.353) with $p = 0.846$, and so

individuals with genotype AA had no significant increased risk of osteoporosis than individuals with genotype AA. Comparing between individuals with genotype AA and AG, the OR (95% CI) was 0.66 (0.322–1.368) with $p = 0.277$, and so individuals with genotype AA had a lower (0.66-fold) risk of osteoporosis than individuals with genotype AG but this was not significant. (Table 4)

Relationship between allele frequency and osteoporosis

Allele frequency is the relative frequency of an allele at a particular locus in the gene pool. From this study, at locus rs6166 both the osteoporosis and healthy groups had three genotypes (GG, GA and AA). In the healthy group, the allele frequency of A and G was 0.68 and 0.32, respectively, while in the osteoporosis group it was 0.57 and 0.43, respectively. In previous studies, the allele frequency G was normally higher in osteoporosis patients than in healthy ones, leading to the hypothesis that allele G is correlated to the occurrence of osteoporosis. The results of this study on Thai postmenopausal women showed that the OR (95% CI) of allele G was 1.61 (1.08–2.41) with a P -value of 0.02, and so individuals with allele G have a 1.61-fold higher and statistically significant risk of osteoporosis than individuals without allele G.

Table 4 The relationship between osteoporosis and patterns of inheritance in each genotype.

<i>FSHR</i> SNP locus	Genotype	OR (95% CI)	<i>P</i> -value
rs6166	GG vs. AA	1.96 (0.873-4.417)	0.147
	GG vs. AG	0.84 (0.375-1.871)	0.685
rs1394205	AA vs. GG	1.08 (0.498-2.353)	0.846
	AA vs. AG	0.66 (0.322-1.368)	0.277

Source: Imnngen (2014)

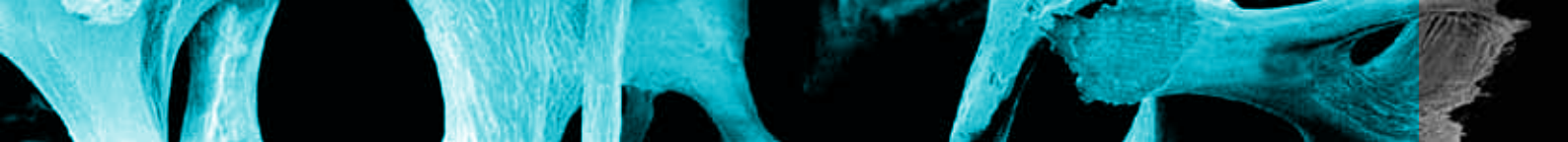


Table 5 The relationship between osteoporosis and pattern alleles in the *FSHR* SNP locus.

<i>FSHR</i> SNP locus	allele	OR (95% CI)	P-value
rs6166	G vs. A	1.61 (1.08–2.41)	0.02
rs1394205	A vs. G	1.09 (0.74–1.61)	0.69

Source: Imngen (2014)

For locus rs1394205, both the osteoporosis and healthy groups had three genotypes (AA, GA and GG). In the healthy group, the allele frequency of A and G was 0.43 and 0.57, respectively, while in the osteoporosis group it was 0.45 and 0.55, respectively. Since the allele frequency of A in the osteoporosis patients was slightly higher than in the healthy group, then the hypothesis was that allele A is associated with the occurrence of osteoporosis. The OR (95% CI) of allele A was 1.09 (0.74–1.61) with *P*-value = 0.69, and so there was no significant increased risk of osteoporosis in individuals with the A allele over those with the G allele.

Conclusion

From this study of polymorphism in the rs6166 and rs1394205 SNP loci in the *FSHR* gene in Thai

postmenopausal women, allele G at locus rs6166 is potentially related to an increased risk of osteoporosis but locus rs1394205 either carries a low (allele A over G) or no risk association. More studies should be performed to increase the sample size and so resolution, especially for locus rs1394205.

Acknowledgements

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Professor Suchinda Malaivijitnond, Ph.D.

White Kwao Krua...endemic Thai herb for curing osteoporosis



Professor Suchinda Malaivijitnond is an expert in zoology, physiology and primatology. Much of her research is well-known at national and international levels, and she was recently awarded a second runner-up DMSc Award 2016 from the Department of Medical Sciences, Ministry of Public Health regarding her excellent research work in medical sciences that helps to promote the public health. This aspect of her research was on the topic of “Comprehensive research for the development of *Pueraria mirifica* Thai herb as anti-osteoporosis drug”, and the paper talked about the potential use of *white Kwao Krua* for treating osteoporosis in elderly communities.

Botanical and physical characteristics of white kwao krua

“...white Kwao Krua is an endemic Thai herb that contains bioactive phytoestrogens which have a similar effect as female estrogen...”

Kwao Krua has been known as biologically active herb for several decades and four types of Kwao Kruas (white, red, black and dull grey) were recorded. They are named by the colour of their dissected tuburous roots. However, these four types of Kwao Krua are actually different and unrelated plant species. The white (*Pueraria mirifica*), red (*Butea superba*) and black (*Mucuna collettii*) Kwao Krua plants, according to the traditional pharmacopoeia, have been used as a rejuvenating herb to promote youthfulness, with bright eyes, black and thick hair, soft skin, energetic, and to enhance sexual performance. Therefore, they are popularly used among Thai people.

White Kwao Krua is a hard wood vine that lives for several years and is classified in the same family with legumes. Its tuber is grown underground, rather round, and when cut open it exudes a whitish latex like milk. The tuber texture is similar to that of water chestnut, brittle with many viens. White Kwao Krua is endemic to Thailand and can be found in the forests, especially the deciduous forests, from north to south of Thailand. At present, white Kwao Krua can be cultivated commercially. The flowers are in bloom during February-March each year, and after three years the tuberous root, which is the beneficial part of the plant, then has a high enough phytoestrogen content to be used as a pharmaceutical product. White Kwao Krua is used to substitute the state of estrogen (one of the female hormones) deprivation in menopausal women.

Origin of the white Kwao Krua research as an anti-osteoporotic agent

“...to answer, apart from promoting the reproductive system, how does white Kwao Krua affect osteoporosis?...”

Previously, white Kwao Krua has long been used as a medicinal herb for rejuvenation in women, but without any scientific research to support its efficacy. However, since 1999, the research team has been developed after the Associate Professor Dr. Vichai Cherdcheevasart's work. Dr. Vichai is an expert in botany and is the first Thai scientist who tested the estrogenic activity of white Kwao Krua in the cell lines. However, the *in vitro* cell line studies could not completely answer how white Kwao Krua affects the whole body of the organisms. Once a person intakes white Kwao Krua, a biotransformation of that active compound in the body occurs. That is, after ingesting into the gut, the active compound is absorbed into the blood circulation, transported into some metabolic organs, for example, the liver or kidney which can be transformed to a less or a more active compound before reaching target organs. These pharmaceutical mechanisms could not be seen if the test is carried on in cell or tissue culture.



The research team first focused on the effect of white Kwao Krua on the reproductive organs. Since white Kwao Krua contains at least 17 phytoestrogenic compounds, plant derived hormones which have a similar structure and function to human estrogens, it then can elicit estrogenic activity. In a simple dogma, once the ligand binds with its respective receptors at the target organs, the response to that ligand would be initiated. Therefore, if phytoestrogens from white Kwao Krua are able to bind with the estrogen receptors on the target organs, such as breast, womb, heart or even bone, then estrogenic effects of the phytoestrogens on those organs should be observed. After the intensive research of white Kwao Krua on the reproductive system has been performed for several years, the next research question in relation to the estrogenic activity of white Kwao Krua and other organs, that is bone, was thought? Bone was a next candidate for white Kwao Krua research because both male and female bone cells express estrogenic receptors and the low estrogen level during menopausal period in women is a major cause of osteoporosis. To answer this question, the research team started the experiments in both male and female rats.

Research method and goal

“...the research team studies the mechanisms of actions of white Kwao Krua on osteoblasts and osteoclasts. The goal of this research is to develop an anti-osteoporotic drug from white Kwao Krua...”

The research team fed 10, 100 and 1,000 mg/kg (body weight) of white Kwao Krua to both castrated male and female rats for 90 days. The gonads of rats were removed first aiming with the development of sex steroid hormones depleted state in the animals as representatives of menopausal women and andropausal men. It was found that white Kwao Krua could prevent bone loss in both female and male rats and the response was in the same degree with no differences between the gender. Later, the mechanisms of actions of white Kwao Krua on bone forming (osteoblast) cells and bone resorping (osteoclast) cells were verified. Studies of the effect of white Kwao Krua on osteoblasts were performed in rat as well as monkey cell lines. The results showed that white Kwao Krua stimulated proliferation and differentiation of osteoblasts and then increase bone mass, and so had a positive effect on bone strength. Determining the effect of white Kwao Krua on osteoclast cells revealed that it reduced the proliferation and differentiation of preosteoclasts into mature osteoclasts, but promoted osteoclast cell death. This in part explains the positive effect of white Kwao Krua on osteoporosis. The combined effect of white Kwao Krua on the stimulation of osteoblasts and suppression of osteoclasts helps increase the bone mass. However, because rats have different bone structures and remodeling and sex hormone profiles from those of humans, and they do not have a menstrual cycle, the results gained from rat study cannot be directly transferred to humans. Subsequently, the research on cynomolgus macaques was performed. Cynomolgus macaques were used to fulfill this gap, because their physiological and anatomical characters are quite similar to the humans. They are non seasonal breeder so that they can be fertile throughout the year. The female's menstrual cycle is approximately 30 days, with 3-5 bleeding days. They also have menopausal period. The results of these studies showed that white Kwao Krua can retain the bone mass in postmenopausal monkeys at the onset of the treatment.

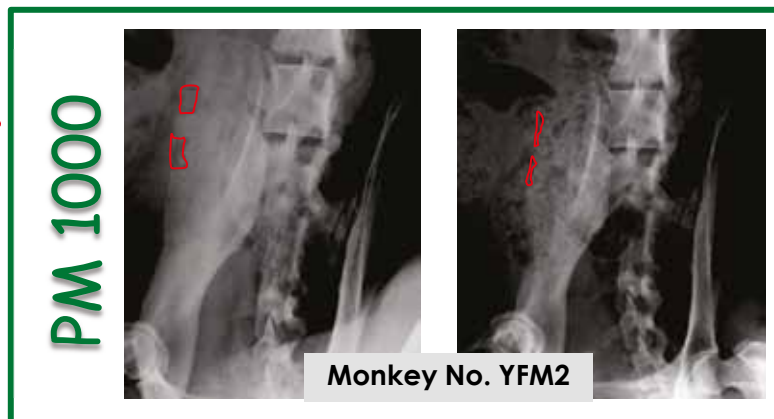
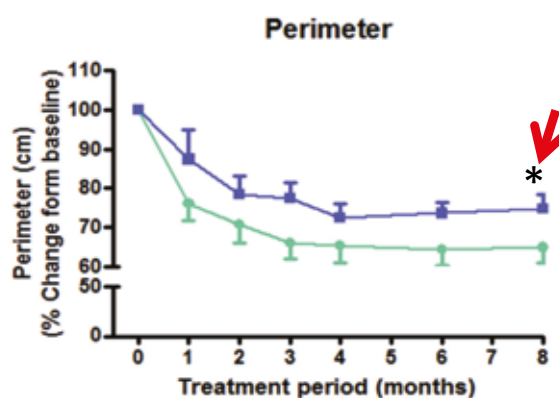
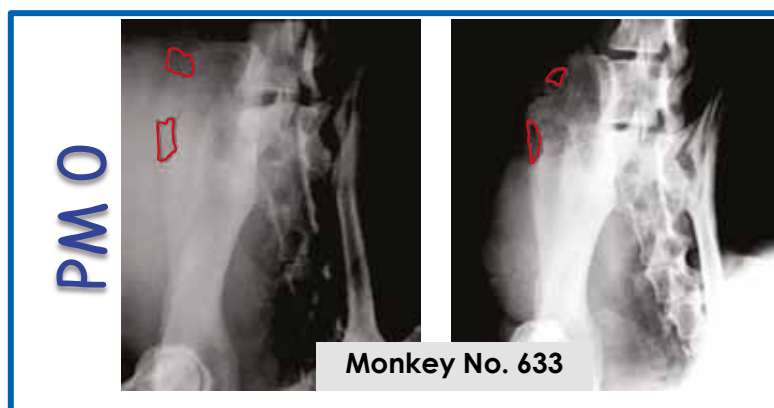
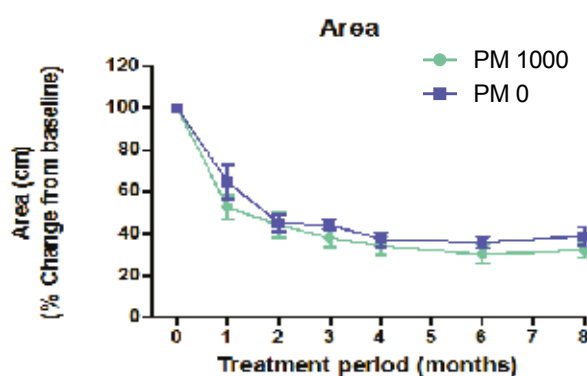
Results and potential use of white Kwao Krua as a medicine

“...white Kwao Krua has high potential for prevention and treatment of osteoporosis. It can be used in both males and females without undesirable side effects, and this herb is rather cheap for Thais...”

Normally, brittle bones in elderly or menopausal women occur principally at the long bones, which are the humerus, radius, femur, tibia and ilium. The inner part of these bones are spongy and highly vascular, while the outer part is hard and compact. The study showed that white Kwao Krua could prevent the compact bone loss in menopausal monkeys which implies that it can abate bone fracture in elderly and menopausal women. Drilling out the ilium bone in cynomolgus macaques, the bone healing was observed afterwards. The bones of cynomolgus macaques given Kwao Krua were healed faster than those were not given. Thus, apart from the increase in bone mass, white Kwao Krua can also reduce the chance of bone fracture, which is beyond what the research team expected. The comprehensive studies of white Kwao Krua in small to large animals and in cellular to molecular level led to the conclusion that white Kwao Krua has high potential to be developed as anti-osteoporotic drug. Compared with other medicines, it has a high potential to prevent bone loss, and can be used in both males and females with no adverse side effects, such as on breast cancer, as found in the estrogen replacement therapy. On the other hand, research has verified that white Kwao Krua can reduce the growth and number of breast tumors in rats which supports the safety of use of white Kwao Krua in humans. Since white Kwao Krua is endemic to Thailand, it is not difficult to cultivate

0 months

8 months



PM & Bone healing in monkeys: X - ray

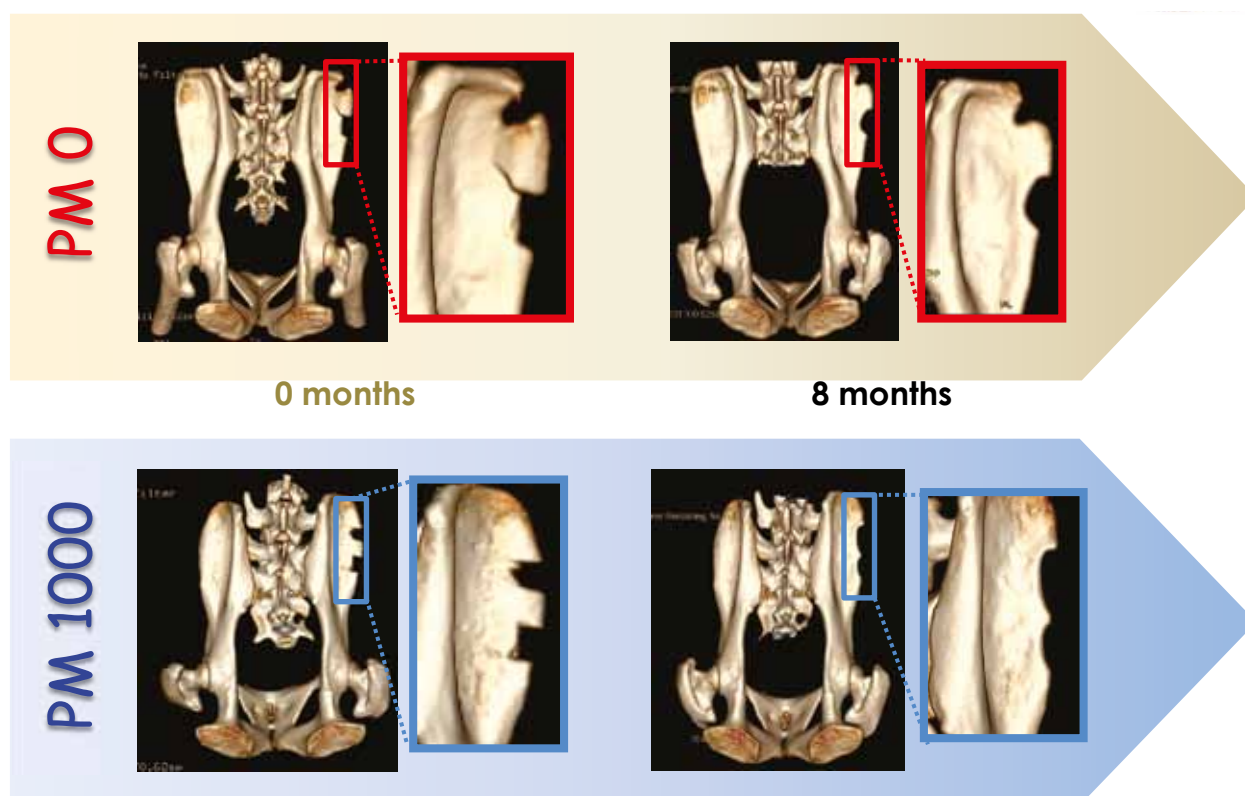
which allows the quality control of the product and cultivar selection, and making it relatively cheap and accessible for Thais. This study also added the value to the plant for socioeconomic approach.

At present, the research team is interested in the effect of white Kwao Krua on the coordination between osteoblasts and osteoclasts in keeping the homeostasis of bone mass. So far, the results from this research topic are undertaken and the team keeps working on in human cell lines.

Chance and possibility to use white Kwao Krua as an anti-osteoporosis medicine

“...chance of using white Kwao Krua as a medicine is very high, however, there is still no connection between the researcher and the private sector. This is going to be beneficial to the medical professions in treating osteoporosis in Thai elderly people...”

As we all know, osteoporosis occurs in every elderly person, but it is faster in some than in others, and seems to depend on many factors. This disease is asymptomatic, causing only the thinning and fragile of the bones that can be problematic only when the bone breaks. This can be an economic burden to look after the patients. At present, the anti-osteoporotic drugs are imported from abroad and are quite expensive, yet the patients need to take the medication continuously for a long time. Therefore, only the rich can afford to take these medications. So, if the knowledge from the white Kwao Krua research could be used to develop an anti-osteoporosis medicine, it would likely be affordable and accessible for all Thais. It also would be of great benefit to the medical profession with a high business and economical value compared to, for example, supplementary foods that are focused mainly on the beauty. In addition, this could help to solve some problems in the aging Thai society which is growing day by day.



PM & Bone healing in monkeys: CT-scan

Even though there is a very high possibility that white Kwao Krua could be developed as a medicine, to do so it requires a very high investment and so far no private sector takes this opportunity. Also the drug development process is rather complicated comparing to the production of the supplementary foods. To use a herb as medicine, the key bioactive ingredients need to be extracted and the exact quantity of them in the formulation must be known. The problems of using white Kwao Krua as a medicine are that it has many substances, with at least 17 known phytoestrogens, but only two (puerarin and miroestrol) are of major interests. Puerarin is found at quite high amount in white Kwao Krua but it possesses only weak estrogenic activity, while miroestrol constituent is rather low but it has high bioactivity. Besides miroestrol is not stable once isolated and is difficult to synthesize chemically. Therefore, it is difficult to standardize and quantify the activity of each preparation. Moreover, sometimes when each phytoestrogen has been isolated, its activity is reduced suggesting that mixed compounds are better. So for now the best way is to use the crude extract of white Kwao Krua and quantify the key compound in each preparation.

Apart from the complication on drug development process, the criteria to obtain the approval of osteoporotic drug from the Food and Drug Administration (FDA) is also rather complicated, and this could be another reason why no company is currently interested in white Kwao Krua investment. As a consequence, the results of this research have not been transferred into a commercial product. It would be excellent if there is a department that connects valuable scientific knowledge on white Kwao Krua to the industrial sector and fosters a collaboration among researchers, academics and private sectors. The use of white Kwao Krua would also increase the economic value and interest in Thai medicinal plants.



Professor Suchinda Malaivijitnond, Ph.D.

Professor Suchinda graduated B.Sc. (second class honour) from the Faculty of Science, Khon Kaen University. She obtained her M.Sc. (Zoology) and Ph.D. (Biological Sciences) from the Department of Biology, Faculty of Science, Chulalongkorn University and then did a post doctoral fellowship at the Tsukuba Primate Research Center, Japan. She is now the director of the National Primate Research Center of Thailand, Chulalongkorn University; deputy head of the Department on Research and Academic Services; head of the Primate Research Unit, Faculty of Science, Chulalongkorn University; and president of the Comparative Endocrinology and Molecular Evolution Society of Thailand. She also serves as the council member of three international societies: Asia and Oceania Society of Comparative Endocrinology (AOSCE), International Federation of Comparative Endocrinological Societies (IFCES) and Federation of the Asia and Oceanian of Physiological Societies (FAOPS).



Primary Health Care for Thailand



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Despite Thailand's growing problems in public health, the quality of service delivery is higher than that seen in neighboring countries. Responsible authorities at all levels are trying to make basic health services available equally to all; however, factors such as insufficient budget, personnel shortages, distance from Bangkok and other factors exacerbate inequality of access, and thus must be resolved urgently.

Provision of primary health care is an important fundamental for societies to achieve health equality for people of all age groups and socio-economic strata. Such a policy is vital not only for social welfare and stability, but also for sustainable economic development.

The World Health Organization (WHO) defines 8 essential elements of primary health care, on which Thailand based its own approach in successive National Economic and Social Development Plans (4th 5th and 6th). Thailand's scope for primary health care has been expanded from the original 8 elements defined by WHO to cover the following 14 elements

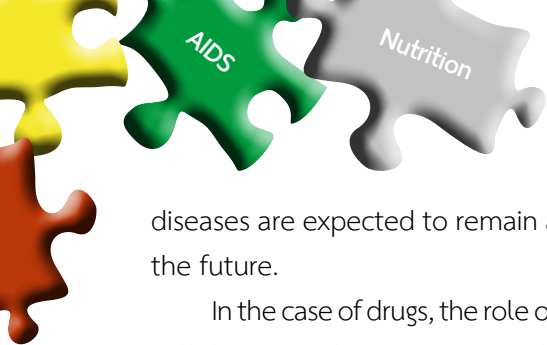
1. Health Education
2. Nutrition
3. Water Supply and Sanitation
4. Surveillance for Local Disease Control
5. Immunization
6. Maternal Child Health and Family Planning
7. Simple Treatment
8. Essential Drugs
9. Mental Health
10. Dental Health
11. Environmental Health
12. Consumer Protection
13. Accidents and Non-communicable Disease Control
14. Prevention and Control of AIDS

Drug abuse is the country's most prevalent and widespread public health issue in every province, while outbreaks of re-emerging infectious diseases such as tuberculosis and malaria is increasingly frequent in border areas as a result of cross-border labor mobility. Control and treatment of these



The Declaration of Alma-Ata, which is the result of the historic International Conference on Primary Health Care held in Alma – Ata, Soviet Union in 1978, stated: “ *Primary health care is essential health care based on practical, scientifically sound and socially acceptable methods and technology, made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process.* ”





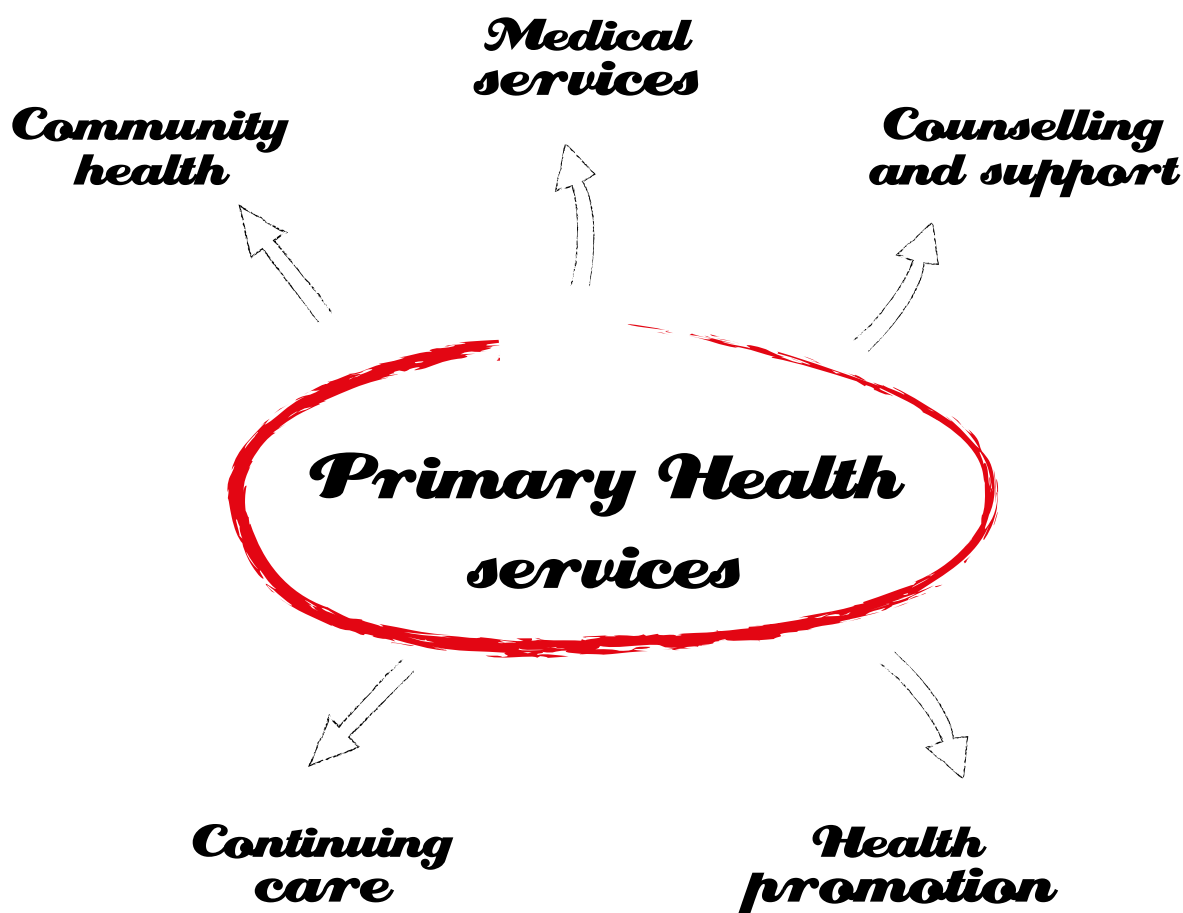
diseases are expected to remain a major problem in the future.

In the case of drugs, the role of local communities will be crucial in managing these problems in cooperation with local officials. However, it has to be acknowledged that the problem is complex and intractable, so that primary health care alone can only address some elements. Only through closely coordinated collaboration among concerned agencies and the community can progress be accomplished in prevention, control, enforcement and rehabilitation.

The issue of contagious diseases resulting from cross-border migration from neighboring countries needs urgent resolution, and requires inter-agency cooperation. For example, tuberculosis, elephantiasis and lymphatic filariasis are increasingly prevalent, despite their eradication from Thailand over many

years. Poverty and unrest have led to increasing cross-border migration into Thailand, leading to outbreaks of these re-emerging infectious diseases; a lack of medical personnel and public health services in these area make control especially difficult and imposes an increasing burden on local health authorities, especially at community level.

Re-emerging diseases pose threats beyond the border areas through legal and illegal migration into urban areas. Because of the risk that these people may be carriers of re-emerging infectious diseases, workers are required to undergo a medical check before starting work. However, in practice, current medical checks may not be sufficiently rigorous to identify carriers. As the result, outbreaks of re-emerging infectious diseases can occur in populations who may not be aware of the risks or symptoms, and are





unprepared to respond. It is often challenging even to identify the exact source(s). The increasing liberalization of labour movement makes control, treatment and surveillance an even more challenging task. The relevant authorities need to accelerate action in various fields, including the design of new regulatory measures to manage problems that may arise as a result of labour movement, such as requirements for more stringent and comprehensive health checks in all areas, especially in the case of travelers from areas with known outbreaks.

Likewise, to ensure universal access to basic health services, inter-agency cooperation will be required among public and private sector agencies, as well as communities. The success of such initiatives will depend on four factors:

1. People participation or community involvement.
2. Appropriate technology.
3. Reoriented basic health service.
4. Inter-sectoral collaboration.

Operations in any areas require strong community participation, especially in remote areas that might

require close surveillance for re-emerging diseases. Communities need to be educated in basic healthcare issues, including basic steps for prevention, preparedness and control, and what cooperation and assistance can be sought from concerned agencies. In the event of an outbreak, communities must have a basic understanding of modes of transmission, and how to prevent the disease from spreading further.

Education in the basic principles of public health at community level is therefore of critical importance in the control and prevention of medical problems. Implementation of activities to support all 14 elements listed above to support basic primary health care is a necessary and essential measure to enhance well-being and quality of life, as well as ensuing equality of access. The role of the community as a front-line in addressing public health problems has been inadequately recognized; we therefore need to encourage communities to become more pro-active in responding public health issues, rather than simply waiting for assistance from government agencies.

'*Pasteurella Multocida*' Autogenous Vaccine for Control of pneumonic pasteurellosis in piglets

Pornchalit Assavacheep, D.V.M., M.Sc., Ph.D.

Nowaday, diseases of pigs reared in commercial swine farms in Thailand are often severe and some outbreaks may last longer than ever, unless swine farmers can implement effective prevention, control and treatment measures, combined with good farm management.

Respiratory infections caused by common found bacteria cause major economic losses to Thai swine industry. In particular, '*Pasteurella multocida*' is one of important bacteria in respiratory tract of pig, a causative agent of '*Pneumonic pasteurellosis*' disease devastating pig health, and is mostly found in nursery and fattening pig farms located in intensive pig producing regions, especially in the Central, East and West of Thailand. For disease control and prevention, many swine farms require antimicrobials as a tool to reduce disease severity including clinical symptoms and mortality rates, but sometimes prove ineffective. Researchers have therefore proposed the use of bacterin vaccine in combination with antimicrobials as an alternative tool together with biosecurity and other managements to offer effective disease control and prevention on farm. Vaccines prepared from certain known infected farms are found to be more effective in controlling disease outbreaks.

Therefore, this study was aimed to investigate the effects of '*Pasteurella multocida*' autogenous vaccine for control of pneumonic pasteurellosis in piglets. The data obtained from this investigation were deliberated to be used as a basis for further in-depth study to increase





effectiveness of disease prevention and control in swine farms, as well as to propose plans for development of an autogenous vaccine to prevent bacterial diseases. The researchers were able to control swine disease by first identifying diagnostically confirmed infections of blood, and organs from recent dead pigs. The bacteria '*Pasteurella multocida*' was purified, carefully examined, and multiplied under laboratory conditions and researcher supervision, before being inactivated and tested for sterility. This killed vaccine was then injected into swine and the incidence of disease symptoms were subsequently monitored after vaccination.

The principle of bacterial selection for vaccine production demanded disease situation of sick pigs in certain farm. Other health and production related data were needed to be collected. Apart from pathological finding under gross lesion inspection in the first instance of disease investigation in pig farm, organ samples and swabs must be taken for laboratory examination by two main methods: 1) microbiological examination for *Pasteurella multocida*; 2) identification using polymerase chain reaction (PCR). The outcome of the study were then analyzed by evaluating clinical symptoms, number of sick pigs and deaths in the group receiving the vaccine, and the increased production performance of the pigs including growth rates, and amount of feed consumed.

All clinical samples in the study were collected from dead pigs. Animal euthanasia is designed to cause minimal pain and distress, and the process is under the supervision and authorized by the Committee for the Guidance, Care and Use of Laboratory Animals, Faculty of Veterinary Science, Chulalongkorn University. The study methodology is therefore considered not to pose ethical problems for humans and animals. The use of bacterin vaccine together with proper antimicrobials and strict biosecurity measures to control and prevent the disease outbreak especially respiratory bacterial infections such like this project better our understanding of the effectiveness of bacterin vaccine, and improve our ability to prevent and control outbreaks in real situations. The results of this study will contribute to the body of knowledge on prevention and control of swine disease using vaccines prepared under laboratory conditions. Moreover, the data from the study can be used for teaching purposes in both undergraduate and graduate levels.

NBTC with Chula Unisearch organizes communication cables for security purposes; supporting expansion of Thailand's telecommunication networks



The Office of the National Broadcasting and Telecommunications Commission (NBTC) together with **Chula Unisearch** held an opening ceremony for a project to test the feasibility of operating communication cables along electricity poles of the Metropolitan Electricity Authority (MEA) and Provincial Electricity Authority (PEA). The project would upgrade

technical standards and contribute to a safer and more attractive urban landscape. The project will also support the rapid expansion of the telecommunications network, and its capacity to deliver a comprehensive range of services reliably, and at high speeds. Under the project, MEA will install communication cables in two areas on Ngam Wong Wan Road and Rama IV Road in Bangkok, while PEA will install communication cables in two areas including Hua Hin District, Prachuap Khiri Khan and Thalang District, Phuket Province. In all, the installations cover 200 electricity poles in these areas.

It is hoped that the pilot will result in the technique being used more widely elsewhere across the country.

CU Eco-Products Exhibition in EPIF 2016

Senior executives from **Chula Unisearch**, including Saowanee Wijitkosum, Ph.D. and Supichai Tangjaitrong, Ph.D., Deputy Managing Director, Chula Unisearch and Sornnate Areesophonpichet, Ph.D., Manager of Coordinate Academic and Industry Collaboration Office, recently presented CU Eco-Products developed by academics and researchers at Chulalongkorn University at the **10th Eco-Products International Fair 2016 (EPIF2016)**.

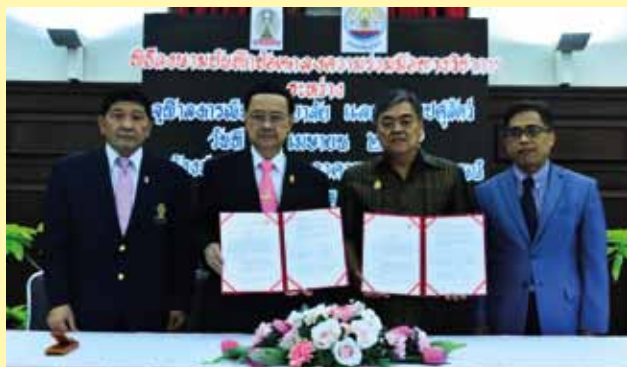
Examples of eco-products research at Chulalongkorn University include the following: **NU-PPC plasma chemical technology laboratory** (Assoc. Prof. Ratana Rujiravanit, Ph.D.) **Nature Care Cups** (Assoc. Prof. Rathanawan Magaraphan, Ph.D., of the Petroleum and Petrochemical College) **Micro-weather station UAV application** (Asst. Prof. Sanphet Chunithipaisan, Ph.D., Faculty of Engineering) **Flexible thin film zinc-air battery** (Assoc. Prof. Soorathep Kheawhom, Ph.D., Faculty of Engineering) **Micro-nano wax particles from agricultural wastes** (Asst. Prof. Sorada Kanokpanont, Ph.D., Faculty of Engineering) **Enzyme Technology** (Asst. Prof. Rath Pichyangkura, Ph.D., Faculty of Science) **Concentrate Thai snail mantle secretion filtrate for premium cosmeceutical products** (Prof. Somsak Panha, Ph.D., Faculty of Science)

In addition, the exhibition featured research from **Chula Unisearch** together with the Environment Research Institute (ERIC), Chulalongkorn University. This included **Biochar: Research for the Community** by Assoc. Prof. Thavivongse Sriburi, Ph.D. and Saowanee Wijitkosum, Ph.D.

The 10th Eco-Products International Fair 2016 (EPIF2016) was organized by the Federation of Thai Industries, Thailand Productivity Institute and the Asian Productivity Organization (APO) from 8-11 June 2016 at the Bangkok International Trade and Exhibition Centre (BITEC). The Chulalongkorn University booth attracted many private sector entrepreneurs, students and the general public interested in the University's diverse contributions to real-world problems.



Signing ceremony for MOU with Department of Livestock for Development of Autogenous Vaccine



On Friday 8 April, 2016, Chulalongkorn University President Prof. Pirom Kamolrattanakul, M.D., and the Director of the Department of Livestock, Mr. Ayut Harintranon signed a MOU establishing a 4-year cooperation programme in R&D and innovation for the development of an autogenous vaccine to control bacterial and viral diseases in pig farming. The collaboration will focus on research at the University and Department of Livestock to benefit livestock farmers directly, as well as exchange knowledge among R&D researchers at the two

institutions. **Chula Unisearch** will coordinate the cooperation between the institutions, as part of its stewardship of the successful “*CU Industrial Linkage Partners in Progress*”. This initiative was established to foster university-industry collaboration in research for innovation, including development of network cooperation of education and empirical research.

The signing ceremony was witnessed by Mr. Sorawit Thaneto, Deputy Director General of the Livestock Department, Prof. Mongkol Techakumphu, DVM. (Vice President for Research of Chulalongkorn University), Assoc. Prof. Thavivongse Sriburi, Ph.D. (Managing Director of Chula Unisearch), Saowanee Wijitkosum, Ph.D., Supichai Tangjaitrong, Ph.D. (Deputy Managing Director, Chula Unisearch), Suphot Wattanaphansak, DVM., MS., Ph.D., Pornchalit Assavacheep, DVM., M.Sc., Ph.D., and Rachod Tantilertcharoen, DVM., MS. from the Department of Veterinary Medicine.

Special Lectures to Develop Chulalongkorn into a World Class University

On Monday 18 April, 2016, the Administrative Board of **Chula Unisearch** established a Working Group to study and propel the university into a World Class University under the framework of operations of “*CU strategic: World Class National University*”. The Working Group included Prof. Mongkol Techakumphu, DVM. (President of the Administrative Board, Chula Unisearch), Assoc. Prof. Thavivongse Sriburi, Ph.D. (Managing Director, Chula Unisearch), Saowanee Wijitkosum, Ph.D., Supichai Tangjaitrong, Ph.D.,



Assoc. Prof. Suchana Chavanich, Ph.D. (Deputy Managing Directors, Chula Unisearch) and Sornnate Areesophonpichet, Ph.D. (Manager of Coordinate Academic and Industry Collaboration Office). The Working Group attended a special lecture on the topic “*Internationalization at National University of Singapore*” and “*NUS as a World*

Class University” delivered by Assoc. Prof. Anne Pakir, Director, International Relations Office, National University of Singapore (NUS). The lecture, organized by the Office of International Affairs and Global Network, Chulalongkorn University, provided opportunities for university staff to gain insights into the strategies and operations of NUS, including its research and teaching experience in diverse fields. The growth in cooperation in international trade is a key driver for the establishment of world-class universities.

Commemoration of the Statue of King Chulalongkorn and King Vajiravudh

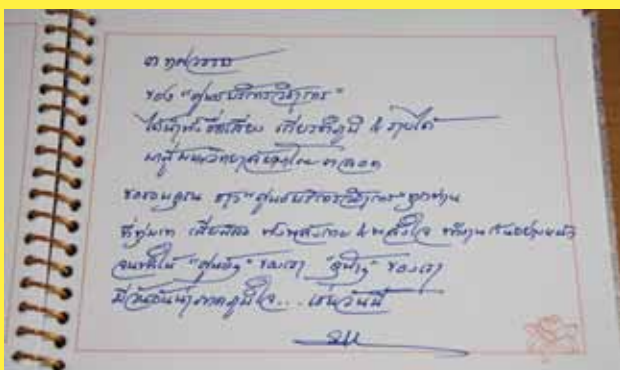


The **Chula Unisearch** Executive Board and staff participated in a special New Year merit-making ceremony held to commemorate King Chulalongkorn and King Vajiravudh. Many university staff and students joined the ceremony on the occasion of the beginning of the 2016 New Year, held in front of Chamchuri 4 Building.



30th Anniversary Established of Chula Unisearch

Chula Unisearch celebrated the 30th Anniversary of its establishment on Monday 15 February, 2016 at the Chulalongkorn University Research Building. On this occasion Prof. Pirom Kamolratanakul, M.D., President of Chulalongkorn University, together with the Vice President, Deans and directors of the University's Institutes, Centres and Offices joined the celebration. Alms were also given to monks at a special morning merit-making ceremony, and in the afternoon, representatives of **Chula Unisearch** visited and gave flowers to patients at the War Veterans Hospital.



Presentation of book: “Princess Flora at Sra Prathum Palace”



Chula Unisearch presented a copy of a book: “*Princess Flora at Sra Prathum Palace*” to HRH Princess Maha Chakri Sirindhorn, by Prof. Emeritus Khunying Suchada Kiranandana, Ph.D., Chairperson of Chulalongkorn University Council on the occasion of the 99th foundation anniversary of Chulalongkorn University on Saturday 26 March, 2016 at Maha Chulalongkorn Building.

The book was inspired by the initiative of Her Royal Highness, and provided a record of the many flowering and ornamental plants in Sra Prathum Palace. **Chula Unisearch** was granted Royal permission to collect photographs of various plants and flowers at Sra Pathum Palace in order to compile the book, which provides detailed information on family name, scientific name, common name as well as local names and characteristics of the diverse range of plants found in Sra Pathum Palace which can be used as a reference.

Representatives from KU & RMUTI Visit Chula Unisearch



Assoc. Prof. Thavivongse Sriburi, Ph.D., Managing Director of Chula Unisearch welcomed representatives from Kasetsart University (KU) and Rajamangala University of Technology Isan (RMUTI) upon their visit to **Chula Unisearch** for discussions on research and academic research for use as a guideline for KU and RMUTI in developing future academic collaboration.



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