สมุนไพรสำหรับโรคสตรีที่ใช้โดยหมอพื้นบ้านในจังหวัดนครนายก
The Use of Medicinal Plants for Gynecologic Ailments by Thai Traditional Folk Healers in Nakhonnayok Province

นิพนธ์ต้นฉบับ

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บทคัดย่อ

วัตถุประสงค์: เพื่อระบุสมุนไพรที่หมอพื้นบ้านในจังหวัดนครนายกใช้รักษาโรคสตรีในกลุ่มอาการไข้ทับระดู ปวดประจำเดือน ประจำเดือนมาไม่ปกติ และตกขาว และศึกษาความสัมพันธ์ของสรรพคุณสมุนไพรกับผลการศึกษาฤทธิ์ทางเภสัชวิทยาที่มีรายงานไว้ **วิธีการศึกษา:** การวิจัยเชิงคุณภาพนี้เก็บข้อมูลโดยการสัมภาษณ์หมอพื้นบ้านที่ใช้สมุนไพรรักษาโรคสตรีจำนวน 9 คน การคัดเลือกกลุ่มตัวอย่างใช้การคัดเลือกแบบเจาะจงโดยงานแพทย์แผนไทย สำนักงานสาธารณสุขจังหวัดนครนายก ใช้การสัมภาษณ์เดี่ยวแบบไม่มีโครงสร้าง จากนั้นสืบค้นข้อมูลผลการศึกษาฤทธิ์ทางเภสัชวิทยาเพื่อเชื่อมโยงสรรพคุณสมุนไพรตามองค์ความรู้ของหมอพื้นบ้านกับผลการศึกษาในเชิงวิทยาศาสตร์ **ผลการศึกษา:** ยาสมุนไพรที่หมอพื้นบ้านในจังหวัดนครนายกใช้ในโรคสตรีมีสมุนไพรเดี่ยว 2 ชนิด คือ ช้าครามและไพล และตำรับยาสมุนไพรรวมทั้งสิ้น 9 ตำรับ สมุนไพรที่ใช้มีทั้งที่ซื้อจากร้านยาในจังหวัดนครนายก สมุนไพรที่ปลูกเอง และเก็บสมุนไพรจากที่มีอยู่ในชุมชน การปรุงยาส่วนใหญ่ใช้วิธีต้ม (ร้อยละ 66.66) ผลการสืบค้นข้อมูลฤทธิ์ทางเภสัชวิทยาพบว่าสมุนไพรแก้ไข้ทับระดูจำนวนร้อยละ 62.5 มีฤทธิ์แก้อักเสบ และร้อยละ 12.5 มีฤทธิ์ต่อสมดุลย์ของฮอร์โมนเพศหญิง สมุนไพรที่ใช้แก้ปวดประจำเดือนร้อยละ 63.7 มีฤทธิ์แก้อักเสบ มีสมุนไพร 1 ชนิดคือขิงที่มีการศึกษาทางคลีนิกว่าสามารถแก้ปวดประจำเดือน สมุนไพรแก้ประจำเดือนมาไม่ปกติร้อยละ 45.5 มีฤทธิ์ต่อสมดุลย์ของฮอร์โมนเพศหญิง สมุนไพรแก้ตกขาวร้อยละ 44.4 มีฤทธิ์แก้อักเสบ และร้อยละ 22.2 มีฤทธิ์ขับปัสสาวะ **สรุป:** การสำรวจการใช้สมุนไพรและการสืบค้นฤทธิ์ของสมุนไพร ทำให้ได้ข้อมูลเบื้องต้นเกี่ยวกับสมุนไพรสำหรับโรคสตรี โดยสมุนไพรที่ใช้ตามภูมิปัญญาดั้งเดิมเป็นสมุนไพรที่มีฤทธิ์แก้อักเสบและมีผลต่อสมดุลย์ของฮอร์โมนเพศหญิง

คำสำคัญ: โรคสตรี, สมุนไพร, หมอพื้นบ้าน, จังหวัดนครนายก

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Original Article

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Abstract

Objective: To determine medicinal plants used by folk healers in Nakhonnayok province for gynecological ailments including pelvic inflammatory disease (menstrual fever), dysmenorrhea, oligomenorrhea and leucorrhea. Relations of healing properties and reported pharmacological activities of the herbs was also determined. **Method:** In this qualitative study, nine folk healers prescribing medicinal plants for gynecological ailments were selected by a purposive sampling. The information was obtained by unstructured interview on individual folk healers. Pharmacological activities of the plants were studied from literature to establish relations of the local wisdom with scientific evidence. **Results:** Two single plants and nine formulas were used for healing gynecological ailments. The plants were obtained by cultivation, collection from the wilds, and purchase from herb stores. Decoction (66.66%) was the most used preparation method. Studies of pharmacological activities revealed that 62.5% of the plants used for menstrual fever exhibited anti-inflammatory activity and 12.5% for female hormone balance. In addition, 63.7% of the plants for dysmenorrhea were reported to possess anti-inflammatory activity and ginger was reported to relieve dysmenorrhea by clinical study. It was found that 45.5% of the plants for oligomenorrhea were reported to balance female hormones. Finally, the results showed that 44.4% and 22.2% of the plants for leucorrhea were reported to possess anti-inflammatory activity and diuretic property, respectively. **Conclusion:** The study provided basic information of the plants used for gynecological ailments by folk healers. These plants possessed mainly anti-inflammatory and female hormone balancing activities.

Keywords: gynecological ailment, medicinal plants, folk healers, Nakhonnayok province

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Introduction

Common gynecologic ailments could be menstrual period related and non-related including pelvic inflammatory disease (commonly known as menstrual / periodic fever) , dysmenorrhea, oligomenorrhea, and leucorrhea. In addition to their impairment on quality of life, these symptoms could cause more severe diseases and complications. To treat these gynecologic ailments, not only modern medicines but Thai traditional and herbal medicines have also been popular therapeutic remedies. Specifically, Thai traditional gynecologic medicines have been widely used with the highest sale volume in the herbal medicine market. [1] In terms of prescription, the use of herbs including these Thai traditional gynecologic medicines has long been directed by Thai folk healers.

In Nakhonnayok province, folk healers have long and yet been accepted for primary or basic treatment. A survey study

on the treatment folk healers in Ongkharak district, Nakhonnayok province found that communities in Ongkharak district somewhat relied on local folk healers.[2] It was also found that these folk healers were rather old since it took a long time to acquire knowledge and skill. They also had no successors since strict professional and ethical conduct was required such as strictly holding Buddhism precepts and alcohol abstinence.[2] In addition, with the tradition of more memorizing than writing, knowledge and skill of these folk healing remedies, as well as the preparation of the herb materials and medicinal products had not been fully collected in the durable and retrieval media.[2]

Nakhonnayok province consists of four districts namely Muang, Ongkharak, Banna and Pakpli. Based on the survey in 2016, there were a total of 258,276 people with the majority in agriculture (37%).[3] In 2016, of the total of 125 folk healers registered with the Nakhonnayok Provincial Public Health Office, there were nine of them specialized in gynecologic illnesses with active practice.[3] Understanding the folk healing on gynecologic ailments could be augmented by scientific evidence; however, there has been a lack of studies on the healing properties of theses herbal folk medicines.

With a concern on the need to understand on the use of herbal folk medicines for gynecologic illnesses, this study aimed to determine the herb components in the traditional medicines for gynecologic illnesses of these folk healers. We also identified pharmacological actions of the components to establish a scientific rationale on their use. In addition, the preparations of the herbs and related traditional medicines were also obtained from these healers. Therefore, the extracts of these traditional medicines as guided by these healers could be prepared at a laboratory scale and their pharmacological actions could be studied in the future. This study was qualitative in design employing an interview method. The findings could be useful for identifying active compounds and developing herbal products for gynecologic symptoms such as menstrual fever, dysmenorrhea, oligomenorrhea, and leucorrhea, at a manufacturing scale.

Methods

In this qualitative study, the interview method was used to collect data from a purposive sample of all nine active folk healers specialized in gynecologic ailments registered with the Nakhonnayok Provincial Public Health Office in 2016. Unstructured interview was carried out by the investigators for a duration of 10 months, from March to December 2017. Individual interview for each healer was conducted at the healer's residence; hence dosage forms, preparations, and sources and plantations of herbs, if available, could be observed. The interview was sound-recorded for later verification if needed. All transcript information was proved by each of these Thai traditional medicine healers themselves.

Scientific names of the herbal plants were based on Thailand's Department of National Park Wildlife and Plant Conservation (www.dnp.go.th/botany/mplant/searchlocalname.aspx) and the Herb Information Center, Faculty of Pharmacy, Mahidol University (www.medplant.mahidol.ac.th). Plant specimens were identified with the official databases and experts. Specifically, Cha-kram or Kram-yai in Thai (*Indigofera suffruticosa*) (other common names: Guatemalan indigo, small-leaved indigo (Sierra Leone) was identified with the Invasive Species Compendium (Wallingford, UK, CAB International, at www.cabi.org/isc), Tongtaek (*Aliospermum montanum* Muell. Arg.) with Prosea (http://uses.plantnet-project.org/en/Baliospermum_montanum_(PROSEA), and Pai-jued with the Herb Information Center of Chaophraya Abhaibhubejhr Hospital (www.abhaiherb.com). All specimens were further verified with the data from the two herb information centers namely the Flora of China (www.eFloras.org) and the Plants of the World Online (www.plantsoftheworldonline.org).

Pharmacological actions of the compounds reportedly found in herb components of these Thai traditional medicines were searched from literature review on original research papers, books, textbooks, and Google Scholars with the keywords of scientific names, synonyms, and certain related terms (medicinal use, bioactivity, pharmacological activity, anti-inflammatory activity, antipyretic activity, diuretic activity, estrogen, dysmenorrhea, oligomenorrhea, hypomenorrhea, menorrhagia, menstrual hemagogue and leucorrhea).

Results

Among nine folk healers registered with the Nakhonnayok Public Health Administration Office, six of them were from the districts of Muang and Banna (three each), two from Pakpli and one from Ongkharak. Of these nine informants, five were men and most of them were farmers. They learned Thai traditional treatment and medicines from their ancestors while

a few men learned additional subjects while in their monkhood.

For the source of medicinal plants used in their remedy, some were from home-grown cultivation, collection from the local wilds, and store-bought herb products commercially available at stores in Nakhonnayok province (Table 1). For a given medicine, formula and preparation were different among healers (Table 2). Dosage form prescribed could be the finished products such as pills and crude drug of medicinal plants for concoction by the patient. Certain finished formulas that needed the healer's recital of an incantation over were prepared by the healers themselves.

Remedies and medicinal plants

Four kinds of remedies for gynecologic illnesses were found, specifically, menstrual fever (2 formulas with a total of 8 herbs), dysmenorrhea (2 formulas with 11 herbs), oligomenorrhea (2 formulas with 11 herbs), and leucorrhea (3 formulas with 9 herbs) (Table 1).

Herb harvest and medicine preparation

In harvesting the medicinal plants, the healers prayed for blessing and therapeutic success as their regular ritual. Specific rituals were found in harvesting Cha-kram (*Indigofera suffruticosa* Mill.) and butterfly pea vine (*Clitoria ternatea* L.). For Cha-kram, the healers held the breath while picking 3 span-length shoots (a span is the length from the tip of the thumb to the tip of the little finger). While picking, the healers prayed in silence for permission from their master or teacher to use the knowledge on the medicinal plant, and the treatment success. To achieve a therapeutic success from butterfly pea vine, it was not supposed to be cut by knife, but rather pulling the vine until broken; the longer the vine length obtained, the better.

In terms of dosage form preparations, water concoction (boiling), alcohol concoction, alcohol maceration, grinding and pill-rolling, and extracting and pill-rolling (Table 2). Most dosage forms were prepared by water concoction with water volume equal to that of the plant. It was recommended that the three-round chant to the Buddha was recited before boiling the herb. Once boiled, the concoct was taken either until tasteless or bland, or the symptoms resolved. For Cha-kram, the plant was tied into three knots and boiled with three glasses of water till a glass of the final concoct was obtained.

The administration method of Cha-kram was special. On the first day of treatment, the three knots of Cha-kram are boiled with 3 glasses of water to a glassful of concoct. The patient drinks the whole glassful. On the second day, one of the knot is untied, and 3 glasses of water are added and boiled to a glassful. Again, the whole glassful is taken. On the third day, the second knot is untied and the process is repeated. Once 3 glasses on 3 consecutive days are taken, the plant is discarded off the concoction pot and the glass is turned upside down.

Pharmacological actions of the medicinal plants from literature search

A) Medicinal plants for pelvic inflammatory disease (menstrual/periodic fever)

Based on the Thai dictionary of traditional medical terms and pharmacy, menstrual fever is the fever during or right after menstruation. Menstrual fever could be mild to life-threatening. On the other hand, fever-acquired menstruation is the symptom of abnormal, heavy menstruation accompanying the fever which is generally less severe than menstrual fever, but could be life-threatening as well.

During menstruation period, female hormones are changed and the immunity is decreased. In addition, since the cervix is opened during the period, the infection with subsequent complications are more likely. In the uterus and fallopian tube, the infection and subsequent inflammation could lead to fever. The cure of herbs on menstrual fever could be attributable to their anti-inflammatory and female hormone balancing actions.

Medicinal plants used by folk healers with anti-inflammatory actions included rhizome of Plai (*Zingiber cassumunar* Roxb.), whole plant of Cha-kram, rhizome of Zedoary or Roscoe (*Curcuma zedoaria* (Christm.) Roscoe), leaf of jackfruit (*Artocarpus heterophyllus* Lam.), and leaf of kaffir lime (*Citrus hystrix* DC.). As reported by the healers, Plai rhizome was macerated in alcohol for the treatment of menstrual fever. Plai rhizome has been widely used for inflammation with the active compound of *(E)*-1-(3,4-dimethoxyphenyl) butadiene (DMPBD).[5] The extraction of active compounds from Plai rhizome is alcohol-based with ethanol or methanol; thus the method reported by the healers were seemingly effective in releasing the active anti-inflammatory compounds.

Table 1 Medicinal plants for gynecologic ailments in Nakhonnayok province.

	Medicinal plants (parts used)	Botanical name (Family)	Sources*	Pharmacological activity				Reference number
				Anti-inflammation	Relief of dysmenorrhea	Female hormone balance	Diuresis	
Medicinal plants for pelvic inflammatory disease (menstrual/periodic fever)								
1.	Cha-kram (whole plant, shoot)	*Indigofera suffruticosa* Mill.[a] (Fabaceae)	3	✓				6
2.	Jackfruit (leaf)	*Artocarpus heterophyllus* Lam. (Moraceae)	1	✓				8
3.	Kaffir lime (leaf)	*Citrus hystrix* DC. (Rutaceae)	1	✓				10
4.	Lime (leaf)	*Citrus aurantifolia* (Christm.) Swingle (Rutaceae)	1					
5.	Maga (leaf)	*Bridelia ovata* Decne. (Phyllanthaceae)	2					
6.	Plai (rhizome)	*Zingiber montanum* (J. Koenig) Link ex A. Dietr. [syn. *Zingiber cassumunar* Roxb.] (Zingiberaceae)	1	✓				5
7.	Samo Di Ngu or Terminalia (fruit)	*Terminalia citrina* (Gaertn.) Roxb. ex Fleming (Combretaceae)	2					
8.	Zedoary or Roscoe (rhizome)	*Curcuma zedoaria* (Christm.) Roscoe (Zingiberaceae)	2	✓		✓		7, 27
Medicinal plants for dysmenorrhea								
1.	Eleutherine (bulb)	*Eleutherine americana* (Aubl.) Merr. ex K. Heyne (Iridaceae)	2					
2.	Fingerroot (rhizome)	*Boesenbergia rotunda* (L.) Mansf. (Zingiberaceae)	1	✓				19
3.	Garlic clove (bulb)	*Allium sativum* L. (Amaryllidaceae)	2	✓				7
4.	Ginger (rhizome)	*Zingiber officinale* Roscoe (Zingiberaceae)	2	✓	✓			21
5.	Khing haeng (rhizome)	*Zingiber ligulatum* Roxb.[b] or *Z. kerrii* Craib[c] (Zingiberaceae)	2					
6.	Mytle grass or Sweet flag (rhizome)	*Acorus calamus* L. (Acoraceae)	2	✓				7
7.	Nutmeg (seed)	*Myristica fragrans* Houtt (Myristicaceae)	2	✓				17
8.	Pai-jued (aerial part)	*Pogonatherum paniceum* (Lamk) Hack[d] (Poaceae)	1					
9.	Plai (rhizome)	*Zingiber montanum* (J. Koenig) Link ex A. Dietr. [syn *Zingiber cassumunar Roxb.*] (Zingiberaceae)	1	✓				5
10.	Teak (wood)	*Tectonia grandis* L. (Lamiaceae)	2					
11.	Zedoary or Roscoe (rhizome)	*Curcuma zedoaria* (Christm.) Roscoe (Zingiberaceae)	2	✓		✓		7, 27
Medicinal plants for irregular menstruation								
1.	Cavendish banana (stalk)	*Musa xparadisica* L. (Musaceae)	1			✓		28
2.	Golden shower (pod)	*Cassia fistula* L. (Fabaceae)	3			✓		34
3.	Hogcreeper (aerial part)	*Derris scandens* (Roxb.) Benth (Fabaceae)	3					
4.	joint-whip ginger (rhizome)	*Alpinia conchigera* Griff.[c] (Zingiberaceae)	2	✓				35
5.	Maga (leaf)	*Bridelia ovata* Decne. (Phyllanthaceae)	2					
6.	Sappan (wood)	*Caesalpinia sappan* L. (Fabacea)	2					
7.	Som-poi (leaf)	*Senegalia rugata* (Lam.) Britton & Rose [syn *Acacia concinna* (Willd.) DC.] (Fabaceae)	2			✓		33
8.	Som-siao (leaf)	*Bauhinia malabarica* Roxb (Fabaceae)	2			✓		31
9.	Tamarind (leaf)	*Tamarindus indica* L. (Fabaceae)	1					
10.	Tongtaek (root)	*Baliospermum solanifolium* (Burm.) Suresh [syn *Baliospermum montanum* (Willd.) Müll. Arg.[e]] (Euphorbiacea)	1					
11.	Zedoary or Roscoe (rhizome)	*Curcuma zedoaria* (Christm.) Roscoe (Zingiberaceae)	2	✓		✓		7, 27
Medicinal plants for leucorrhea								
1.	Butterfly pea (aerial part)	*Clitoria ternatea* L. (Fabaceae)	1	✓				43
2.	Globe amaranth (aerial part)	*Gomphrena globosa* L. (Amaranthaceae)	1	✓				42
3.	Indian shot (rhizome)	*Canna indica* L. (Cannaceae)	1					
4.	kaffir lime (fruit)	*Citrus hystrix* DC. (Rutaceae)	1	✓				47
5.	Kao-yen-tai (rhizome)	*Smilax glabra* Roxb. (Smilacaceae)	2					
6.	Kao-yen-nueh (rhizome)	*Smilax china* L. or *Smilax corbularia* Kunth (Smilacaceae)	2	✓				45, 46
7.	Kidney tea plant (aerial part)	*Orthosiphon aristatus* (Blume) Miq. (Lamiaceae)	1				✓	48
8.	Nom-maew (root)	*Uvaria siamensis* (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders [syn *Melodorum siamense* (Scheff.) Bân, Rauwenhoffia siamensis Scheff.[f]] (Annonaceae)	2					
9.	Radish (root)	*Raphanus sativus* L. [syn: *Raphanus raphanistrum* subsp. *sativus* (L.) Domin[g]] (Brassicaceae)	2				✓	49

* Sources of the plants: 1-cultivation, 2-purchase from herb stores, and 3-collection from the wilds.

Note: The scientific names were from Thai plant names (http://www.dnp.go.th/botany/mplant/searchlocalname.aspx) except the items superscripted with a-d and the synonyms were obtained from reference e-g.

[a] Invasive Species Compendium. Wallingford, UK: CAB International. (https://www.cabi.org/isc/datasheet/28611)

[b] Reference number 24 in the reference list.

[c] PHARM database (http://medplant.mahidol.ac.th/pharm/botanic.asp? bc=0111&kw=%A2%D4%A7%E1%A4%C5%A7)

[d] Abhaibhubejhr (www.abhaiherb.com)

[e] Prosea (http://uses.plantnet-project.org/en/Baliospermum_montanum_(PROSEA))

[f] Kew Science Plants of the World Online (http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77101199-1)

[g] Reference number 49 in the reference list.

Table 2 Preparation methods for each ailment.

Ailments	Number (%) of preparation methods for each ailment			
	water concoction	alcohol concoction/ alcohol maceration	grinding and pill-rolling	extracting and pill-rolling
Pelvic inflammatory disease (menstrual /periodic fever) (5)	3* (60.00)	2** (40.00)	-	-
Dysmenorrhea (2)	1 (50.00)	-	1 (50.00)	-
Irregular menstruation (2)	2 (100.00)	-	-	-
Leucorrhea (3)	2 (66.67)	-	-	1 (33.33)
Total	8 (66.67)	2 (16.67)	1 (8.33)	1 (8.33)

* One dosage form contained single herb (*Indigofera suffruticosa* Mill.).

** Both dosage forms consisted of single herb: one of *Indigofera suffruticosa* Mill., another of *Zingiber montanum* (J. Koenig) Link ex A. Dietr.

Table 3 Summary of pharmacological actions of the medicinal plants from literature search.

Ailments	Number of plants (%)			
	Anti-inflammation	Relief dysmenorrhea	Female hormone balance	Diuresis
Pelvic inflammatory disease (menstrual fever) (8)	5 (62.5)	0	1 (12.5)	0
Dysmenorrhea (11)	7 (63.7)	1 (9.1)	1 (9.1)	0
Irregular menstruation (11)	2 (18.18)	0	5 (45.5)	0
Leucorrhea (9)	4 (44.4)	0	0	2 (22.2)

Cha-kram (*Indigofera suffruticosa* Mill.) was reportedly used by the healers as a single herb and in combination with other herbs such as curcuma rhizome, sugarcane (*Saccharum officinarum* L.), jackfruit leaf (*Artocarpus heterophyllus* Lam.), fruit of Samo Di Ngu or Terminalia (*Terminalia citrine* (Gaertn.) Roxb. ex Fleming), leaf of Maga (*Bridelia ovata* Decne), lime leaf (*Citrus aurantifolia* (Christm & Panz) Swingle.), and kaffir lime leaf (*Citrus hystrix* DC). In terms of its habitat, Cha-kram was found abundant on the rice field around the healer's residence area.

To treat menstrual fever, the whole plant of Cha-kram was boiled in water with or without ethanol. There has been reported by a study that water and ethanol extracts of Cha-kram has anti- inflammatory action based on the lipopolysaccharide- induced inflammatory responses in cell culture. The extracts could reduce cellular nitric oxide and suppress the expression of genes controlling the synthesis of inflammatory substances and enzymes such as nitric oxide synthase, tumor necrosis factor-α and pro-interleukin-1β.[6]

For the rhizome of Zedoary or Roscoe, its anti-inflammatory compounds include sesquiterpene, furanodiene and furanodienone. In addition, curdione could inhibit the secretion of inflammatory substances in a cell culture study.[7] In our present study, rhizome of Zedoary was reportedly used in the formulas for abnormal menstruation and dysmenorrhea, in addition to that for menstrual fever.

Leaf of jackfruit has been used for fever in traditional folk healing throughout south- east Asia. Jackfruit leaf has been reported to contain sapogenins, cycloartenone, cycloartenol, β- sitosterol and tannins.[8] It has also been tested for anti-inflammatory effects both in animal and cell culture by the leaf extract. Even though no individual compounds could be identified for the anti-inflammatory effects from the leaf extract, it has been by a study that artocarpesin, a compound found in the fruit of jackfruit exerts an anti-inflammatory effect.[9]

It has been reported that kaffir lime leaf contains coumarin compounds such as bergamottin, oxypeucedanin and psoralen which have an anti- inflammatory effect. This action is mediated through inhibiting nitric oxide synthesis which is stimulated by lipopolysaccharide and interferon.[10] For the leaf of Samo Di Ngu or Terminalia, furofuran lignan glucosides which have anti-estrogenic effect was found when tested in cell cultures of MCF- 7 and T47D estrogen- responsive human breast cancer cell lines.[11] Unlike the leaf, the fruit of Samo Di Ngu has not been studied. In Bangladesh, Samo Di Ngu is used for dysmenorrhea but the used parts of the plant have not been specified.[12]

After an exhaustive search, we found no information about the anti- inflammatory and analgesic effects, and actions on female hormone systems of the leaf of lime and Maga. However, an anti- inflammatory effect was found in the fruit of lime.[13] In the leaf of lime, however, various flavonoids such as apigenin, rutin, quercetin, kaempferol and nobiletin have been found.[14] These flavonoids have been known to possess anti-inflammatory effects by means of various mechanisms. For the leaf of Maga, no active compounds have been reported.

B) Medicinal plants for dysmenorrhea

Dysmenorrhea is associated with the increase in inflammation causing the uterus and vascular muscle to contract more intensely and the subsequent pain. In addition, since estrogen level drops immensely during menstruation, arachidonic acid, an inflammation related substance, is secreted as a response.[7] Since dysmenorrhea is related with inflammation related substances, herbs for dysmenorrhea is expected to inhibit inflammation process and abdominal muscle spasm during menstruation.

Seven medicinal plants prescribed for dysmenorrhea by the healers and reported to have anti- inflammation effects

included rhizome of Myrtle grass or Sweet flag (*Acorus calamus* L.), seed of nutmeg (*Myristica fragrans* Houtt), rhizome of fingerroot (*Boesenbergia rotunda* (L.) Mansf.), rhizome of Plai (*Zingiber cassumunar* Roxb.), rhizome of Zedoary (*Curcuma zedoaria* (Christm.) Roscoe), garlic clove (*Allium sativum* L.), and rhizome of ginger (*Zingiber officinale* Roscoe.).

Rhizome of Myrtle grass or Sweet flag has been used with other herbs in various traditional formulas. It has been reported that α-asarone and asaraldehyde could slow down the inflammation process by inhibiting cyclooxygenase-1 and cyclooxygenase-2 enzymes.[7] Volatile oils of terpenoid compounds are found in the rhizome. The overdose of Myrtle grass rhizome could induce vomiting. β-asarone, a carcinogenic and hepatotoxic agent, is also found in Myrtle grass rhizome.[15] The Council of Europe Committee of Experts on Flavouring Substances recommends that β-asarone, as a favoring agent in foods and drinks not to exceed 0.1 mg/kg and allows for 1 mg/kg or less in foods and drinks.[16] To assure the safety of these Thai traditional formulas, the amount of β-asarone needs to be quantified and the amount of the herbs used in the formula should also be controlled. Based on the Thai traditional medicine wisdom, herbs with agonistic and antagonistic actions are usually balanced in the formula to ensure the safety. The formulas found in our study could have had such herb(s) antagonistic to Myrtle grass rhizome; even though specific herbs could not be verified.

Nutmeg, the seed of the fruit of *Myristica fragrans* Houtt, has been used in the formula for dysmenorrhea remedy according to Ayurvedic medicine. Volatile oil in nutmeg with a dose of 20 mg/kg of mice could exert the action similar to non-steroidal anti-inflammatory drugs (NSAIDs) including the relief of pain and inflammation, and the adverse effect such as gastric ulcer.[17] The formula containing nutmeg for dysmenorrhea was patented in China. Specifically, this formula consisted of nutmeg (10 - 30 gm), licorice (*Glycyrrhiza glabra* L.) (10 – 30 gm), Rehmannia (*Rehmannia glutinosa* Libosch.) (2 – 10 gm), membranous milkvetch root (5 – 15 gm) Chinese thorowax root (5 – 15 gm) fried atractylodes (8 – 20 gm) Chinese angelica (2 – 10 gm) and *Ligusticum wallichii* Franch. (1 – 10 gm).[18]

Fingerroot has been used for dysmenorrhea in China, Vietnam, Cambodia and Thailand. From literature search, no dysmenorrhea remedy of fingerroot was found but its good anti-inflammatory effect on cell culture has been reported.[19]

Rhizome of Plai, rhizome of Zedoary, garlic clove and Eleutherine bulb (*Eleutherine americana* (Aubl.) Merr. ex K. Heyne) were reported by the healers to be used for irregular menstruation and oligomenorrhea. These herbs were also found in Prasaplai formula both in Thai traditional medicine formulary and the Thai national list of essential medicines indicating for irregular menstruation, oligomenorrhea, dysmenorrhea, and post-delivery discontinuation of amniotic fluid.[20] Rhizomes of Zedoary and Plai were found from the literature to treat these ailments. There is a study reporting that garlic clove extract reduced the inflammation process by inhibiting 1) the stimulation of nuclear factor-ΚB, 2) cyclooxygenase-2 and 3) nitric oxide synthase.[7] It has not been found that Eleutherine bulb has anti-inflammatory action; however, it has vasodilation effect which could improve blood circulation.[7]

Based on a systematic literature review of six studies, one medicinal plant with the indication of dysmenorrhea was ginger rhizome.[21] Another study reported that ginger rhizome was as efficacious as mefenamic acid in relieving dysmenorrhea.[22] In addition, gingerol, the major compound in ginger rhizome was found to have analgesic and antipyretic effects through vanilloid receptor when injected with a dose of 10 microgram into mice bone marrow.[23]

Ginger rhizome was used instead of Khing haeng (*Zingiber ligulatum* Roxb.) Even though it was recommended in a large number of formulas in the Thai traditional medicine, the Khing haeng rhizome was not adequately available. The substitution of Khing haeng rhizome with ginger rhizome is widely practiced.[24] Main compounds found in Khing haeng rhizome include kaempferol and quercetin which are also found in ginger rhizome.[25] Unlike ginger rhizome, no benefit on dysmenorrhea was found with Khing haeng rhizome.

The healers in our study reported the use of teak wood and the aerial part of Pai-jued (*Pogonatherum crinitum* (Thunb ex Murr.) Kunth.) for the formula to treat dysmenorrhea. However, no studies on pharmacological actions of teak wood regarding anti-inflammation, analgesic, muscle spasm, and female hormone system have been found. There has been a study reporting the analgesic and anti-inflammatory action of the extract of teak leaf in the rat with caragenan-induced swollen paws.[26] In Ayurvedic medicine, the acrid taste of teak wood could lessen the uterus muscle contraction to prevent pre-mature labor. Folk healers in the Philippines used concoct both of dried and fresh teak leaf for irregular menstruation and

hypermenorrhea. In Thailand, Pai-jued is grown densely in Prachinburi province. It has been known that it is used as an antidote potion and for menstrual fever. No pharmacological studies of Pai-jued have been found.

C) Medicinal plants for irregular menstruation

Abnormal menstruation could refer to hypermenorrhea, hypomenorrhea (oligomenorrhea), or irregular menstruation. Irregular menstruation could be caused by various etiologies such as abnormal hormones in ovary and endometrium, infection in the uterus, stress and medications. Hence, the relief of irregular menstruation is expected to be by balancing female hormone system by the herb.

In our study, medicinal plants reported by the healers to treat irregular menstruation and had been reported to have benefit the female hormone balance included rhizome of Zedoary, stalk of Cavendish banana (*Musa xparadisica* L.), leaf of Som-siao (*Bauhinia malabarica* Roxb.), leaf of Som-poi (*Senegalia rugata* (Lam.) Britton & Rose.), and fruit pod of Golden shower (Indian laburnum, Pudding-pine tree, or Purging Cassia) (*Cassia fistula* L.).

From the literature, rhizome of Zedoary has been used in crude drug for the treatment of menstrual fever, dysmenorrhea, and irregular menstruation. In traditional medicine formularies of China and Vietnam, rhizome of Zedoary has been used for menstrual hemagogue. It has been reported that the ethanol extract of Zedoary rhizome with a dose of 15 gm/kg given to mice during 1 to 5 days post fertilization resulted in a non-embedding of the blastocyst into the uterine lining; if given during 6 – 1 days post fertilization, pregnancy was terminated.[27]

In India, seed, stalk and root of Cavendish banana have been used for contraception. The ethanol extract of Cavendish banana stalk inhibited ovulation in female albino rat by expanding the diestrous phase of the uterine.[28] However, studies on effects of hormones and menstrual hemagogue by Cavendish banana have not been found.

Regarding Som-siao (*Bauhinia malabarica* Roxb.), its leaf has been used as menstrual hemagogue and antipyretic in Thailand, Indonesia, and India.[29] The leaf of Som-siao contains various flavonoids such as 6,8-di-*C*-methylkaempferol 3-methyl ether, kaempferol, afzelin, quercetin, isoquercitrin, quercitrin and hyperoside.[30] In a study on estrogenic effect on estrogen receptors generated in the genetically modified yeast, ethanol extract of Som-siao leaf had a poor affinity with the estrogen receptor.[31]

For Som-poi (*Senegalia rugata* (Lam.) Britton & Rose), its leaf and fruit pod contains saponin terpinoids.[32] Saponin from Som-poi for contraception has been patented based on its effects on follicle stimulating hormone, luteinizing hormone and estrogen.[33] The extract of the fruit pod of Golden shower (*Cassia fistula* L.) was found to have a slight stimulation effect on estrogen receptors; however, it exerted an anti-estrogenic effect once the body was hyperestrogenic.[34]

Other medicinal plants reported with the use in our study but have not been found to have benefits for irregular menstruation included rhizome of joint-whip ginger (*Alpinia conchigera* Griff.), leaf of Maga, leaf of tamarind, wood of Sappan (*Caesalpinia sappan* L.), Hogcreeper (*Derris scandens* (Roxb.) Benth), and root of Tongtaek (*Baliospermum solanifolium* (Burm.) Suresh). These herbs have been used throughout most regions of Thailand for gynecological ailments and others as follows.

Rhizome of joint-whip ginger (*Alpinia conchigera* Griff.) has been found in most forests of Thailand. With its acrid taste, joint-whip ginger is used for flatulence, bloating, and stomach discomfort; but usually not for cooking. There has been a study reporting the anti-inflammatory action of the extract of joint-whip ginger rhizome with doses of 30, 100 and 300 mg/kg in the rat with caragenan-induced swollen paws.[35]

The leaf of Maga and tamarind has been a component in formula for irregular menstruation as found in the report of a survey on herbs for gynecological ailments in local folk healers in the provinces of Krabi and Songkhla. It was found that the leaf of Maga was in a formula for leucorrhea and the Thai traditional medicine stated that Maga leaf, with a bitter and acrid taste, was used as a mild laxative.[36] In our study, we found the use of Maga leaf for irregular menstruation and menstrual fever but not for leucorrhea. It has been no studies on the use of tamarind leaf for irregular menstruation. However, in the remote area of Tripura state, India, the fruit of tamarind was used to induce uterine bleeding in an attempt of abortion by drinking the water concoct.[37]

Based on Ayurvedic medicine, the wood of Sappan (*Caesalpinia sappan* L.) stimulates Pitta Dosha element (i.e., the element that controls digestion, metabolism, and energy production), relieve rash and itch, heartburn, gastric ulcer, and indigestion. Countries in south-east Asia including Thailand, the Philippines, and Indonesia used the water concoct of

Sappan wood to stimulate uterine bleeding and menstrual hemagogue. In Chinese traditional medicine, Sappan wood is also used for uterine bleeding stimulation. It is also used for homeostasis balance and circulation stimulation. Pharmacological effects of Sappan wood was based on homoisoflavonoid compounds.[38]

The vine of Hogcreeper (*Derris scandens* (Roxb.) Benth) contains various flavonoids[39] including genistein. These flavonoids were reported to have estrogenic effects. The root of Tongtaek (*Baliospermum solanifolium* (Burm.) Suresh) has been used as anti-asthmatic, anthelmintic, diuretic, and tonic; but as a remedy for irregular menstruation has not been reported.[40]

D) Medicinal plants for leucorrhea

Leucorrhea is an odorless vaginal secretion of mucus with clear or white-yellowish color. This mucus is produced from the cervix, ovary and fallopian tube. The mucus is beneficial since it moistens the vagina. Once abnormal, the mucus turns greenish or yellowish with odor and usually vaginal itching. Some cases also suffer from abdominal pain and uterine inflammation. Leucorrhea could be attributable to infections of bacteria, yeast, and virus on the cervix resulting in mucus with pus. Leucorrhea could be originated from infection on vagina with fungi such as *Candida albicans* and protozoa like *Trichomonas vaginalis*. Based on Thai traditional medicine, leucorrhea could also cause burning sensation in the vagina in addition to thick or pus-like mucus with odor. Some women reported vaginal pain and itching, and body ache, and weakness.[4] It was postulated that herbs to cure leucorrhea are those with anti-bacterial, analgesic and diuretic actions.

In our study, the folk healers reported the use of 4 herbs with proven benefits on leucorrhea. These included the aerial part of the white-flowered cultivar of Globe amaranth (i.e., Pearly everlasting, Bachelor's button, and Button agagas) (*Gomphrena globosa* L.), the aerial part of Butterfly pea (*Clitoria ternatea* L.), the rhizome of Kao-yen-nueh (*Smilax china* L. or *Smilax corbularia* Kunth), and the fruit of kaffir lime (*Citrus hystrix* L.).

It has been reported that the white-flowered Globe amaranth (*Gomphrena globosa* L.) contains quercetin-3-*O*-rutinoside as the major active substance. The water-ethanol extract of the flowers of white-flowered Globe amaranth was found to have effects against inflammation and free-radicals; but with a lesser extent that the cultivars with pink and red flowers. No toxicity of the three cultivars of Globe amaranth.[41]was reported. A survey on the folk traditional medicines of Trinidad found that Globe amaranth flower was used for uterine inflammation.[42]

The flower of butterfly pea contains flavonoids and phenolic compounds with anti-oxidant activities both *in vitro* and *in vivo*. The extract of Butterfly pea aerial part, both water and ethanol, had analgesic, anti-inflammatory, and antipyretic effects in animals. In India and south Asia, the vine of Butterfly pea is used to treat inflammation; while in Cuba, its root is used to stimulate uterine bleeding.[43,44]

In our study, the folk healers used rhizome of the two Smilax species consisting of Kao-yen-nueh (*Smilax china* L. or *Smilax corbularia* Kunth) and Kao-yen-tai (*Smilax glabra* Roxb.) for leucorrhea. Kao-yen-nueh was reported to have anti-inflammation action with sieboldogenin, a saponin compound.[45,46]

The fruit of kaffir lime contains various compounds such as terpenoids and phenylpropanoids in its volatile oil, and flavonoids and alkaloids in the fruit skin. As a result, the fruit of kaffir lime possesses a wide range of pharmacological properties including antibacterial, antifungal, and anti-inflammatory actions[47] which could eliminate microorganisms and reduce the pain and inflammation symptoms of the leucorrhea.

Two medicinal plants reported to have diuretic action are the aerial part of Kidney tea plant or Java tea (*Orthosiphon aristatus* (Blume) Miq.) and radish root (*Raphanus sativus* L.). In Thailand, the national list of herbs promoted the use of infusion of Kidney tea plant as a substitute for diuretic drugs, if appropriate. In addition to diuretic effect, water-ethanol extract of Kidney tea leaf where the concentrations of 100 and 200 mcg/mL could inhibit the growth of *Candida albicans* about half of that by nystatin 10 mcg/mL. No studies indicating gynecological benefits of Kidney tea plant have been found.[48]

The extract of radish root was reported to dissolve kidney stone in animal test. Radish root contains various flavonoids with anti-oxidant activities. Isothiocyanates with pungent and/or rooty odor possess anti-microorganisms. No toxicity was found from the extract of radish root. In Chinese traditional medicine, radish root was used to treat pain and stone in urinary tract, and as diuretic.[49] No pharmacological studies of rhizome of Indian shot (*Canna indica* L.) and root of Nom-maew (*Uvaria siamensis* (Scheff.) L. L. Zhou, Y. C. F. Su & R. M. K. Saunders).

Discussions and Conclusion

In our study on folk healers in Nakhonnayok province, two formulas for gynecological ailments were found to use two single individual herbs, i.e., Cha-kram and Plai; while multiple herbs were found in 9 formulas. Four medicinal plants were used for more than one gynecological illness, specifically Plai rhizome in the formulas for menstrual fever and dysmenorrhea, Maga leaf for menstrual fever and irregular menstruation, Zedoary rhizome for menstrual fever, dysmenorrhea and irregular menstruation, leaf of kaffir lime for menstrual fever and its fruit for leucorrhea.

In terms of source of the herb, they were store-bought from Nakhonnayok area, cultivated by the healer, and collected from the local wilds. To obtain certain plants, specific rituals, such as praying, were performed. Most herbs were prepared for use by concoction (66.66%); while the rest by pills. Some formulas needed special ritual chanting before use.

In our study, more than one plant was used in the formulas according the Thai traditional herbal medicine which aimed not only to cure the ailments but to improve health as well. In a given formula, certain herbs offer a cure specific to the ailment while the rest could offer other overall health-promoting effects such as laxative, anti-flatulent, and appetite stimulant.

Our survey and the literature review indicated 5 herbal medicine formulas for menstrual fever (62.5%) including rhizome of Plai, Cha-kram aerial part, rhizome of Zedoary, jackfruit leaf, and kaffir lime fruit (Table 3). These 5 medicinal plants possessed anti-inflammation action which was consistent with the menstrual fever's inflammation etiology. It has also been a research reporting benefit for menstrual fever of Chan-lee-la, a well-known Thai traditional medicine antipyretic formula.[20] Most formulas were found to have anti-inflammation both *in vitro* and *in vivo*.[50]

Our study found 7 formulas for dysmenorrhea (63.7%) including rhizome of Myrtle grass or Sweet flag (*Acorus calamus* L.), seed of nutmeg (*Myristica fragrans* Houtt), rhizome of fingerroot (*Boesenbergia rotunda* (L.) Mansf.), rhizome of Plai (*Zingiber cassumunar* Roxb.), rhizome of Zedoary (*Curcuma zedoaria* (Christm.) Roscoe), garlic clove, and rhizome of ginger (*Zingiber officinale* Roscoe) (Table 3). These medicinal plants have anti-inflammation effect. In the Pra-sa-plai formula for dysmenorrhea, most plants in the formula exerted an anti-inflammatory action which is consistent with the etiology of dysmenorrhea where it is originated from the inflammation in the uterine.[7]

For medicinal plants in the formulas to treat irregular menstruation, 5 herbs affecting female hormone system were found (45.5%) including rhizome of Zedoary, stalk of Cavendish banana (*Musa xparadisica* L.), leaf of Som-siao (*Bauhinia malabarica* Roxb.), leaf of Som-poi (*Senegalia rugata* (Lam.) Britton & Rose) and fruit pod of Golden shower (Indian laburnum, Pudding-pine tree, or Purging Cassia) (*Cassia fistula* L.) (Table 3). Balancing hormone system could better regulate menstruation.

For formulas for leucorrhea, 4 herbs were found to have an anti-inflammation effect (44.4%) including aerial part of the white-flowered cultivar of Globe amaranth (i.e., Pearly everlasting, Bachelor's button, and Button agagas) (*Gomphrena globosa* L.), the aerial part of Butterfly pea (*Clitoria ternatea* L.), the rhizome of Kao-yen-nueh (*Smilax china* L. or *Smilax corbularia* Kunth), and the fruit of kaffir lime (*Citrus hystrix* L.) (Table 3). In addition, kaffir lime fruit also has an anti-microorganism effect. Two herbs with diuretic effect were found (22.2%), specifically Kidney tea plant or Java tea (*Orthosiphon aristatus* (Blume) Miq.) and radish root (*Raphanus sativus* L.). Since leucorrhea is usually accompanied with difficulty urinating, diuretic effect of these herbs could therefore be beneficial.

In our survey, there were some other plants with no studies to demonstrate their related benefits. They however were used by and documented in the formulary of folk healers participating in our study. For example, formulas for leucorrhea in Nakhonnayok province and that of Suk monk were found to use white-flowered Globe amaranth and the combination of Kao-yen-nueh and Kao-yen-tai. Wood of Sappan (*Caesalpinia sappan* L.) has been used for irregular menstruation in the Philippines, Indonesia and China.

Ultimately, our survey on the local folk healer wisdom and literature review on the medicinal plants for gynecological ailments indicated that these herbs affected female hormone system and most of them possessed anti-inflammation action. As expected, certain well-known herbs were those with extensive laboratory and clinical studies with established therapeutic benefits. For example, ginger rhizome in the formula for dysmenorrhea is as clinically efficacious as mefenamic acid. In addition, Cha-kram was found to have a potential for further development. It was widely grown and

known among local folk healers in Nakhonnayok province. Cha-kram was used as a single herb or in combinations of traditional formulas. People in Ongkharak district area used Cha-kram for menstrual fever[2] and laboratory test indicted its anti-inflammatory effect.[6] In conclusion, Cha-kram should be studied for its antipyretic and immunological modulation effects in addition to the well-known anti-inflammation. If the immune system could be strengthened by Cha-kram, menstrual fever could then be prevented.

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