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RESEARCH ARTICLE

Wisdom of utilizing Zingiberaceae plants by traditional healers in Nakhon Si Thammarat Province, Thailand

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Abstract

Plants in the ginger family are globally utilized in diverse ways, varying from region to region. This study aims to compile the uses of ginger family plants by traditional healers in five districts of Nakhon Si Thammarat Province. These districts include Thung Song, Na Bon, Lan Saka, Chang Klang and Ron Phibun, which have not been previously studied. Ten traditional healers were selected based on specific criteria. This qualitative research was conducted through semi-structured interviews combined with observations. The data were analyzed descriptively, including frequency, fidelity level (FL) and use value (UV). The study found that traditional healers use 16 species of ginger family plants, including *Curcuma longa* L., *Zingiber ligulatum* Roxb., *Boesenbergia rotunda* (L.) Mansf., *Zingiber cassumunar* Roxb., *Amomum testaceum* Ridl., *Zingiber officinale* Roscoe, *Alpinia galanga* (L.) Willd., *Curcuma zedoaria* (Christm.) Roscoe, *Curcuma comosa* Roxb., *Zingiber zerumbet* (L.) Roscoe ex Sm., *Kaempferia galanga* L., *Kaempferia parviflora* Wall. Ex Baker, *Amomum biflorum* Jack, *Curcuma mangga* Valeton & Zijp, *Alpinia purpurata* (Vieill.) K.Schum. and *Etlingera coccinea* (Blume) S.Sakai & Nagam. The highest FL values (100%) were found for four species, including *Amomum biflorum* Jack, *Curcuma mangga* Valeton & Zijp, *Alpinia purpurata* (Vieill.) K.Schum. and *Etlingera coccinea* (Blume) S.Sakai & Nagam. The highest UV value was found for *Zingiber officinale* Roscoe (0.4). Scientific evidence has identified 14 pharmacological activities, including anti-inflammatory, antifungal, gastroprotective, anthelmintic, anti-emetic, anti-platelet, antioxidant, analgesic, neuroprotective, renoprotective, aphrodisiac, anti-ulcer, antipyretic and anti-asthma properties. These activities support the therapeutic effects used by traditional healers. Traditional healers use these ginger family plants as ingredients in polyherbal and monoherbal medicinal formulas. Ginger family plants play a crucial role in community healthcare and are employed in various ways. This constitutes a cultural heritage worthy of preservation and documentation for the benefit of global healthcare.

Keywords

ginger family; herbal; plants; survey; traditional healers; Zingiberaceae

Introduction

Ginger family plants (Zingiberaceae) are herbaceous, many years old, with underground rhizomes and beautiful flowers that are unique to each genus. They have a unique smell and all plant parts contain essential oils. Ginger family plants are distributed worldwide, comprising about 50 genera and 1,500 species. They thrive in tropical regions, especially in Southeast Asia. In Thailand, there are approximately 30 genera and 300 species of ginger (1). They are classified as biologically diverse plants and have been used since ancient times. Some species,

such as *Zingiber officinale* Roscoe and *Alpinia galanga* (L.) Willd, are used for food. Other species, such as *Boesenbergia rotunda* (L.) Mansf., are used as medicines to treat flatulence and stomach aches. Some species are used as ornamental plants for their beauty, such as *Etlingera elatior* (Jack) R.M.Sm., which has red flowers that create a fresh appearance. Additionally, some species can produce dyes, such as *Curcuma longa* L., which yields a yellow dye (2).

Some plants in the ginger family are used for medicinal purposes. Traditional healers have long played a role in community health. Even today, with modern medicine flourishing, some patients still value and receive treatment from traditional healers or other alternative medicine. According to survey results on the utilization of Thai traditional medicinal services in 2019 and 2020, the ratio of outpatients receiving Thai traditional medicine services was 19.8 and 20% in these respective years, which is a slightly increasing trend. It shows that patients place importance on Thai traditional medicine (3). Traditional healers have different expertise, such as Thai massage, postpartum care and herbal medicine. Traditional healers treat patients with both monoherbal and polyherbal formulas. Polyherbal formulas contain herbs that are effective in treating patient symptoms. Plants in the ginger family can be used to treat various diseases. Thailand's policy outlined in the 13th National Economic and Social Development Plan on human capital growth for the future focuses on high-value medical and healthcare, encouraging people to engage in lifelong learning and to preserve their health (4). Therefore, recognizing the importance of various types of ginger family plants in treating diseases by traditional healers is crucial. This study aims to compile the ginger family plant species used by traditional healers in Nakhon Si Thammarat Province to promote increased utilization of ginger family plants for healthcare, both as food and medicine, to mitigate the risk factors for various diseases. Therefore, it is important to study the use of various types of ginger family plants in treating diseases by traditional healers in Nakhon Si Thammarat Province, as it shows the value of ginger family plants in maintaining health and reducing risk factors for various diseases.

Materials and Methods

Study area

Nakhon Si Thammarat Province is in the eastern part of the south of Thailand at approximately 8°25′7″N latitude and 99°57′49″E longitude. The study was conducted in five districts in Nakhon Si Thammarat Province, including Thung Song, Na Bon, Lan Saka, Chang Klang and Ron Phibun (Fig. 1). The study area is near Nam Tok Yong National Park. A complex mountainous terrain and numerous water sources characterize this area. It is part of the Nakhon Si Thammarat Mountain range that runs continuously north-south along the southern part of the Khao Luang Mountain range. This area is rich in diverse natural plants, suitable for medicinal purposes (5). From a survey on the diversity of plant species used by ten traditional healers, 162 species were found, 16 of which belonged to the ginger family.

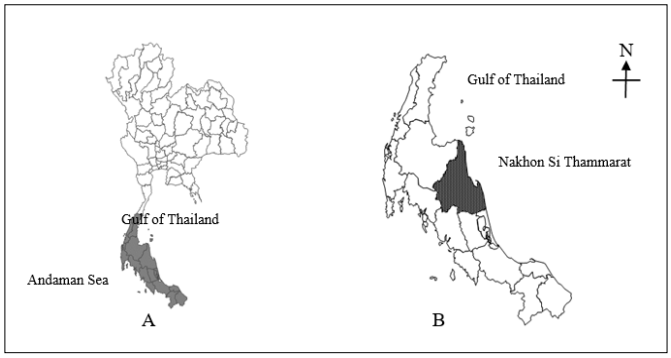

Fig. 1. The study area: (A) Southern Thailand (B) Nakhon Si Thammarat Province.

Informants

Ten traditional healers who met the following selection criteria were interviewed. They were traditional healers with more than ten years of experience, had utilized ginger plant species, were accepted by the local community and were willing to provide information (6).

Research design and instruments

The current work is a qualitative research study that utilizes surveys through semi-structured interviews to gather information. The interview form for traditional healers was developed based on a literature review and checked by experts. The questions ask for general information, knowledge and information on traditional healers' uses of ginger family plants in treating diseases. These questions are selected from the certification data of traditional healers from the Department of Thai Traditional and Alternative Medicine, Ministry of Public Health, Thailand (7). They are open-ended questions to stimulate conversation and encourage traditional healers to share their personal experiences openly. Researchers observed participatory interactions during the interviews, with permission to take notes, record audio and capture photographs. These interactions involved face-to-face engagement with the interviewees, fostering open exchanges of opinions and ideas.

Ethical approval

This research project was certified by the Human Research Ethics Committee, Walailak University, Certificate Number WUEC -19-208-01. Before participating in the research project, traditional healers received an explanation of the research objectives and signed consent forms to participate in the study. Afterwards, traditional healers underwent interviews according to the interview form. During the interviews, note-taking, photographs and audio recordings were made. Permission was sought from the traditional healers before recording images and audio in each instance.

Data collection

Ethical approval for human research and a list of traditional healers obtained from the Provincial Health Office of Nakhon Si Thammarat Province were requested. After that, traditional healers were selected based on predefined criteria. Their consent for data collection was obtained. Interviews with traditional healers began using the interview form, with the project leader as the interviewer. Each informant was interviewed approximately three times. The first interview was done to establish rapport with the traditional healers and gather preliminary data. The second interview involved collecting additional data until the interview provided no new information, after which medicinal plants were

surveyed. The third interview confirmed the accuracy of the data obtained from traditional healers. Each interview lasted 90-120 minutes, depending on the cooperation of the traditional healers. Plant specimens were collected (Fig. 2) and prepared according to standard methods (8). Scientific names were identified following the principles of plant taxonomy using the Flora of Thailand. The accepted names were then verified against The Plant List (9). Voucher specimens were obtained for reference and deposited at the herbarium of the Department of Traditional Thai Medicine, Faculty of Science and Technology, Rajamangala University of Technology Srivijaya.

Data analysis

The collected data was analyzed descriptively, frequencies were determined, scientific names were identified, parts were used, use patterns were identified and plants belonging to the ginger family were utilized. Analyzed fidelity level (FL) was used to determine which species were most popular for treating particular diseases. FL values near 100% were found for plants where almost all use reports refer to identical usage, whereas low FL values were found in plants used for various purposes. FL is calculated as:

$$FL\ (\%) = (Np/N)*100 \qquad \text{(Eqn.1)}$$

Np is the number of use reports cited for a given species for treating a particular disease.

N is the total number of use reports cited for any given species.

Analyzed use value (UV) was employed to estimate the maximum utilization of each plant. A UV value near zero showed that a plant's medicinal use was limited. UV was calculated as:

$$UV = (\sum U)/n \qquad \text{(Eqn.2)}$$

$\sum U$ is the number of use reports of a given herbal plant.

n is the number of all informants in the study (10).

Fig. 2. Zingiberaceae plants: (A) *Curcuma longa* L. (B) *Zingiber ligulatum* Roxb. (C) *Boesenbergia rotunda* (L.) Mansf. (D) *Zingiber cassumunar* Roxb. (E) *Amomum testaceum* Ridl. (F) *Zingiber officinale* Roscoe (G) *Alpinia galanga* (L.) Willd. (H) *Curcuma zedoaria* (Christm.) Roscoe (I) *Curcuma comosa* Roxb. (J) *Zingiber zerumbet* (L.) Roscoe ex Sm. (K) *Kaempferia galanga* L. (L) *Kaempferia parviflora* Wall. Ex Baker (M) *Amomum biflorum* Jack (N) *Curcuma mangga* Valeton & Zijp (O) *Etlingera coccinea* (Blume) S.Sakai & Nagam. (P) *Alpinia purpurata* (Vieill.) K.Schum.

Results

Among the ten traditional healers in Nakhon Si Thammarat Province, Thailand, who used Zingiberaceae plants, five were male and five were female, aged 51-90 years. All traditional healers were Buddhists residing in Thung Song, Na Bon, Lan Saka, Chang Klang and Ron Phibun districts. Most traditional healers graduated from primary school and use herbal medicine to treat diseases. Their experience in treating diseases ranges from 11-50 years. Traditional healers commonly obtained their knowledge from their elders. All traditional healers diagnose disease by asking about symptoms, checking the affected area and looking at the patient's lesions. Herbs that traditional healers use to treat patients are grown around the house, bought from herbal drug stores, or obtained from evergreen forests (Table 1).

Traditional healers shared similar knowledge about the ginger family plants. These plants have underground rhizomes, a spicy and hot taste with a hint of sweetness. Ginger species are differentiated by observing the characteristics of their stems, leaves, flowers and rhizomes, including their shapes, colors, odors and flavors. They typically have a lifespan of several years and are harvested when the stems become dry.

Traditional healers use ginger family plants in medicinal formulations to treat nine disease groups. Ginger plants are predominantly used for gastrointestinal, musculoskeletal, gynecological, pediatric, respiratory, urinary tract, neurological, skin and hormonal disorders. The ginger species most commonly used by traditional healers are *Curcuma longa* L. and *Zingiber ligulatum* Roxb., followed by *Boesenbergia rotunda* (L.) Mansf., *Zingiber cassumunar* Roxb., *Amomum testaceum* Ridl., *Zingiber officinale* Roscoe, *Alpinia galanga* (L.) Willd., *Curcuma zedoaria* (Christm.) Roscoe, *Curcuma comosa* Roxb., *Zingiber zerumbet* (L.) Roscoe ex Sm., *Kaempferia galanga* L., *Kaempferia parviflora* Wall. Ex Baker, *Amomum biflorum* Jack, *Curcuma mangga* Valeton & Zijp, *Etlingera coccinea* (Blume) S.Sakai & Nagam. and *Alpinia purpurata* (Vieill.) K.Schum. Traditional healers utilize the rhizomes of these plants for medicine preparation. For *Alpinia galanga* (L.) Willd., the leaves are also used. In the case of *Amomum testaceum* Ridl., both the fruit and the leaves are utilized. Fidelity level showed the highest value, 100%, when *Amomum biflorum* Jack was used to treat muscle pain, *Curcuma mangga* Valeton & Zijp as a blood tonic, *Alpinia purpurata* (Vieill.) K.Schum. and *Etlingera coccinea* (Blume) S.Sakai & Nagam. were employed to treat patients for intestinal parasites (Table 2).

Traditional healers often use ginger family plants as monoherbal formulations. *Zingiber officinale* Roscoe is the most used (UV=0.4), followed by *Zingiber zerumbet* (L.) Roscoe ex Sm., *Kaempferia galanga* L., *Zingiber cassumunar* Roxb., *Boesenbergia rotunda* (L.) Mansf. and *Curcuma longa* L. These plants are usually cut into small pieces, boiled for drinking, or cut into small pieces, dried in the sun, ground into powder and brewed for consumption. They help relieve ailments such as flatulence, nausea-vomiting, colds, nasal stuffiness and expulsion of lochia, among others (Table 3).

Table 1. Demographic data of traditional healers in the Nakhon Si Thammarat Province, Thailand

Demographic data	Value	Frequency (n=10)
Gender	Male	5
	Female	5
Age (years)	51-60	3
	61-70	3
	71-80	2
	81-90	2
Religion	Buddhism	10
Location (District)	Thung Song	2
	Na Bon	2
	Lan Saka	2
	Chang Klang	2
	Ron Phibun	2
Education level	Primary school	7
	Secondary school	2
	Vocational diploma	1
Type of experience	Herbal medicine	7
	Herbal medicine and Thai massage	3
Years of experience	11-20	5
	21-30	2
	31-40	0
	41-50	3
Source knowledge	Elders	8
	Self-study	6
	Institutions	7
Practice	Pay respect to ancestors/ teachers	3
	Making merit	2
	Observe Buddhist precepts	3
Diagnosis	History taking and physical examination	10
Sources herbs	Grow or buy	10
	Evergreen forest	1

Discussion

The demographics of the ten traditional healers in Nakhon Si Thammarat province who utilize ginger family plants are similar to those presented in previous studies. These male and female traditional healers are over 50 years old, practice Buddhism and live in different areas. Most have completed primary school education and prefer using herbal medicine to treat illnesses (6, 11). They have been practising for over ten years (12), with the majority gaining knowledge from their elders (11). The traditional healers follow similar practices. These include respecting ancestors/teachers, making merit and observing Buddhist precepts, which exemplify appropriate conduct for healers and earn patients' trust (13). All the traditional healers similarly diagnose illnesses through history taking and physical examination (14). The traditional healers use herbs grown around their homes since some are common garden plants that are easy to grow, making it convenient to harvest them for treating patients. Some plants are purchased from herbal pharmacies, while others are sourced from evergreen forests where they grow naturally. The healers collect these herbs and process them into dried herbal remedies for medicinal use (15). Knowledge about ginger family plants among the ten traditional healers is similar, which aligns with theory (1).

Traditional healers use ginger family plants as ingredients in medicinal polyherbal formulas to treat nine disease groups and employ them in monoherbal therapies.

Table 2. Diseases treated by traditional healers using ginger family plants (polyherbal)

Disease	Parts used	Use method	Diseases treated	FL %
Gastrointestinal disease				
Curcuma longa L.	Rhizome	Bolus	Dyspepsia	12.50
Zingiber ligulatum Roxb.	Rhizome	Decoction, Infusion	Gastroesophageal Reflux Disease, Hemorrhoids	28.57
Boesenbergia rotunda (L.) Mansf.	Rhizome	Decoction, Bolus, Capsule	Gastroesophageal Reflux Disease, Hemorrhoid, Dyspepsia, Canker Sores	44.44
Zingiber cassumunar Roxb.	Rhizome	Decoction	Gastroesophageal Reflux Disease	10.00
Amomum testaceum Ridl.	Rhizome	Decoction	Gastroesophageal Reflux Disease	16.67
Zingiber officinale Roscoe	Rhizome	Decoction, Bolus	Gastroesophageal Reflux Disease, Hemorrhoids	40.00
Alpinia galanga (L.) Willd.	Rhizome	Decoction	Gastroesophageal Reflux Disease	20.00
Curcuma zedoaria (Christm.) Roscoe	Rhizome	Bolus	Gastroesophageal Reflux Disease	25.00
Curcuma comosa Roxb.	Rhizome	Decoction	Hemorrhoids	33.33
Musculoskeletal diseases				
Curcuma longa L.	Rhizome	Compress, Ointment, Herbal steam	Muscle pain, Office Syndrome	37.50
Zingiber ligulatum Roxb.	Rhizome	Infusion	Tendon and bone injury	14.28
Zingiber cassumunar Roxb.	Rhizome	Compress, Ointment, Herbal steam, Poultice	Swelling, Muscle pain, Office Syndrome	50.00
Amomum testaceum Ridl.	Fruit, Leaf	Infusion	Tendon and bone injury	16.67
Alpinia galanga (L.) Willd.	Rhizome, Leaf	Compress, Ointment, Herbal steam	Swelling, Muscle pain	60.00
Zingiber zerumbet (L.) Roscoe ex Sm.	Rhizome	Ointment	Muscle pain	50.00
Amomum biflorum Jack	Rhizome	Compress	Muscle pain	100.00
Gynecological diseases				
Boesenbergia rotunda (L.) Mansf.	Rhizome	Decoction, Capsule	Blood tonic	22.22
Zingiber cassumunar Roxb.	Rhizome	Decoction, Herbal liquor, Capsule	Blood tonic, Expel lochia after giving birth, Subinvolution	20.00
Amomum testaceum Ridl.	Fruit	Decoction, Herbal liquor	Blood tonic	50.00
Zingiber officinale Roscoe	Rhizome	Decoction	Blood tonic	20.00
Curcuma mangga Valeton & Zijp	Rhizome	Decoction	Blood tonic	100.00
Curcuma comosa Roxb.	Rhizome	Decoction, Capsule	Blood tonic	66.67
Curcuma zedoaria (Christm.) Roscoe	Rhizome	Capsule	Blood tonic	25.00
Kaempferia parviflora (Vieill.) K.Schum.	Rhizome	Capsule	Blood tonic	50.00
Pediatric diseases				
Curcuma longa L.	Rhizome	Pill	Intestinal parasites	12.50
Zingiber ligulatum Roxb.	Rhizome	Infusion	Intestinal parasites	14.28
Boesenbergia rotunda (L.) Mansf.	Rhizome	Pill	Intestinal parasites	11.11
Zingiber cassumunar Roxb.	Rhizome	Ya Kwat (grinding to keep in mouth), Pill	Laryngitis in children, Intestinal parasites	20.00
Amomum testaceum Ridl.	Rhizome	Infusion	Intestinal parasites	16.67
Zingiber officinale Roscoe	Rhizome	Ya Kwat	Laryngitis in children, Intestinal parasites	40.00
Alpinia galanga (L.) Willd.	Rhizome	Pill	Intestinal parasites	20.00
Zingiber zerumbet (L.) Roscoe ex Sm.	Rhizome	Pill	Intestinal parasites	50.00
Kaempferia galanga L.	Rhizome	Ya Kwat, Pill	Laryngitis in children, Intestinal parasites	66.67
Curcuma zedoaria (Christm.) Roscoe	Rhizome	Decoction, Pill	Intestinal parasites	50.00
Alpinia purpurata (Vieill.) K.Schum.	Rhizome	Pill	Intestinal parasites	100.00
Etlingera coccinea (Blume) S.Sakai & Nagam.	Rhizome	Pill	Intestinal parasites	100.00
Respiratory disease				
Curcuma longa L.	Rhizome	Decoction	Lung tonic	12.50
Zingiber ligulatum Roxb.	Rhizome	Decoction	Cough, Asthma	14.28
Urinary tract disease				
Curcuma longa L.	Rhizome	Pill, Decoction	Kidney disease	12.50
Zingiber ligulatum Roxb.	Rhizome	Infusion	Urinary disorder	14.28
Kaempferia galanga L.	Rhizome	Infusion	Urinary disorder	33.33
Neurological disease				
Zingiber ligulatum Roxb.	Rhizome	Bolus	Numbness	14.28
Boesenbergia rotunda (L.) Mansf.	Rhizome	Bolus	Numbness	11.11
Kaempferia parviflora Wall. Ex Baker	Rhizome	Bolus	Numbness	50.00
Skin disease				
Curcuma longa L.	Rhizome	Ointment	Itching rash, *Tinea Capitis*	12.50
Hormonal system				
Boesenbergia rotunda (L.) Mansf.	Rhizome	Smoothie and drink	Balancing hormones	11.11

Table 3. Utilization of ginger family plants by traditional healers (monoherbal)

Scientific Name	Parts used	Preparation & Use method	Utilization	UV
Zingiber officinale Roscoe	Rhizome	Boiling or crushing to drink	Flatulence, phlegm, nausea-vomiting, gastroesophageal reflux disease	0.4
Zingiber zerumbet (L.) Roscoe ex Sm.	Rhizome	Crushing to drink or grilling and juicing clear lime water to drink	Flatulence, bloody mucus stool	0.3
Kaempferia galanga L.	Whole	Crushing to drink, Boiling to drink and shower, crushing to paste on anterior fontanelle	Flatulence, colds, nasal stuffiness, runny nose, sneezing	0.3
Zingiber cassumunar Roxb.	Rhizome	Boiling or crushing to drink, crushing to paste on anterior fontanelle	Flatulence, colds, nasal stuffiness, breathe easily, flows easily lochia	0.3
Boesenbergia rotunda (L.) Mansf.	Rhizome	Boiling or crushing to drink	Flatulence, energy, myalgia	0.2
Curcuma longa L.	Rhizome	Crushing to drink	Dyspepsia	0.1

There are 16 species of ginger family plants. Previous studies in Nakhon Nayok Province, Central Thailand, found the ginger family plants were most frequently used to treat gastrointestinal diseases. Species used for this purpose included *Curcuma longa* L., *Boesenbergia rotunda* (L.) Mansf., *Zingiber officinale* Roscoe, *Alpinia galanga* (L.) Willd., *Curcuma zedoaria* (Christm.) Roscoe and *Curcuma comosa* Roxb. are similar to the findings in this study. Additionally, *Curcuma longa* L. and *Alpinia galanga* (L.) Willd. were used to treat musculoskeletal diseases. *Boesenbergia rotunda* (L.) Mansf., *Curcuma comosa* Roxb., *Curcuma longa* L. and *Kaempferia galanga* L. were used to treat gynecological and urinary tract diseases. *Curcuma longa* L. was used for respiratory and skin diseases, while *Boesenbergia rotunda* (L.) Mansf., *Zingiber officinale* Roscoe and *Kaempferia parviflora* Wall. ex Baker were used to treat nutritional and blood -related conditions, which supports this study, indicating that its use follows a similar trend (16). In Bueng Kan Province, Northeastern Thailand, *Zingiber ligulatum* Roxb. treats gastrointestinal diseases, serving as a laxative and relieving stomach aches (17). In the neighbouring country of Central Sulawesi, Indonesia, *Alpinia purpurata* (Vieill.) K. Schum. is used to treat stomach aches. At the same time, *Zingiber zerumbet* (L.) Roscoe ex Sm. is applied for neck issues, such as neck pain. Additionally, *Curcuma mangga* Valeton & Zijp is used to relieve menstrual irregularities (18), similar to the findings in this study where traditional healers use *Curcuma mangga* Valeton & Zijp as a blood tonic for gynecological diseases.

The highest FL value, 100%, was for four most popular species for treating a particular disease. This includes *Amomum biflorum* Jack to treat muscle pain. The essential oils of *Amomum biflorum* Jack contain compounds such as camphor (17.6%), α-bisabolol (16.0%), camphene (8.2%) and α-humulene (5.1%), which have anti-inflammatory and antioxidant properties (19). These properties help alleviate patient symptoms and improve their condition. *Curcuma mangga* Valeton & Zijp is used in blood tonic formulations. Scientific evidence indicates that extracts from *Curcuma mangga* Valeton & Zijp, when prepared using gold nanoparticles, are blood-compatible, causing less than 10% hemolysis with no aggregation of erythrocytes. This can be used to improve blood circulation (20). *Alpinia purpurata* (Vieill.) K. Schum. and *Etlingera coccinea* (Blume) S. Sakai & Nagam. treat patients for intestinal parasites, although the exact mechanism of action is poorly understood. Extracts from the rhizomes of *Alpinia purpurata* (Vieill.) K. Schum. contain phenols, which have disease-resistant and pest-resistant properties. These characteristics suggest that phenols might be applicable for anthelmintic purposes (21). *Etlingera coccinea* (Blume) S. Sakai & Nagam. is used to treat patients with intestinal parasites, relieving stomach pain that frequently occurs in this group of diseases. It has been found that indigenous communities in Sabah, Malaysia, use it to treat patients with stomachache, food poisoning and gastric problems. *Etlingera coccinea* (Blume) S.Sakai & Nagam. exhibits antioxidant activities that contribute to maintaining patient health (22). Therefore, these two species are particularly interesting for future studies of their anthelmintic activities.

The highest UV value was for *Zingiber officinale* Roscoe. Traditional healers use *Zingiber officinale* Roscoe and *Zingiber ligulatum* Roxb. to treat flatulence, gastroesophageal reflux disease and hemorrhoids. These species have gastroprotective activities, which are vital in ulcer prevention by increasing mucin secretion. They are also used to treat patients who have intestinal parasites. Aqueous extracts of *Zingiber officinale* Roscoe rhizomes show anthelmintic activity against earthworms. Due to its anti-emetic activity, *Zingiber officinale* Roscoe is used to treat nausea and vomiting in patients. It is commonly employed for morning sickness in pregnant women and promotes blood health, with anti-platelet aggregation activity, which aids in blood circulation.

Additionally, it can be used to treat phlegm and laryngitis by leveraging the plant's immune-system-boosting properties (23). *Zingiber ligulatum* Roxb., possesses anti-inflammatory and antioxidant activities that help maintain health. The antioxidant properties of *Zingiber ligulatum* Roxb. enhance the body's immune system, countering free radicals that can damage cells (24). Treatment of tendon and bone injuries is possible due to its analgesic activity. It also treats numbness with its neuroprotective activity, potentially due to phenolic and flavonoid compounds and urinary disorders through its renoprotective activity (23, 25). Other species have further pharmacological activities.

Curcuma longa L. contains the active compound curcumin. In Chinese and Indian medicine, it is an anti-inflammatory medication to treat wounds and can reduce fungal growth by 90% This is why traditional healers use it to treat itching rash and *Tinea capitis*. Consuming curcumin helps manage diabetes and may effectively address urinary issues, cancer, gastrointestinal diseases and neurological disorders. Its anti-inflammatory properties help reduce irritation in patients with respiratory problems, improving lung function. No side

effects have been observed, leading traditional healers to choose it for treatment (26, 27).

Boesenbergia rotunda (L.) Mansf. is traditionally used to treat gastrointestinal disorders. Scientific evidence has shown that *Boesenbergia rotunda* (L.) Mansf. can be used to treat inflammatory conditions such as canker sores, muscle pain and numbness. It also serves as an antiparasitic agent to eliminate worms or roundworms in the human intestine and has aphrodisiac effects in men (28, 29). However, this study found that traditional healers use *Boesenbergia rotunda* (L.) Mansf. to balance hormones and tonics for women's blood through medicinal formulations.

Zingiber cassumunar Roxb. possesses anti-inflammatory properties, enabling traditional healers to use it for the treatment of laryngitis and to improve patient symptoms. It is also used to treat respiratory issues such as colds and nasal stuffiness and to help patients breathe more easily. Scientific evidence has found that *Zingiber cassumunar* Roxb. has antipyretic, anti-asthma and antioxidant properties, helping to reduce fever and strengthen the body. In addition to these effects, it also has analgesic and neuroprotective properties, supporting traditional healers' use in relieving pain caused by musculoskeletal or gastrointestinal disorders. Interestingly, traditional healers use *Zingiber cassumunar* Roxb. to care for postpartum mothers, commonly employing it in herbal steam and postpartum baths to increase blood circulation. Additionally, it is used as an oral medication to help expel lochia and facilitate uterine contraction, leveraging the plant's anti-inflammatory and antioxidant properties (30, 31).

Amomum testaceum Ridl. contains polyphenols and its oils primarily consist of 1,8-cineole (20-60%) and α-terpinyl acetate (20-55%) as key constituents. It is used to treat indigestion, including symptoms of gastroesophageal reflux disease. Due to its antioxidant and anti-inflammatory properties, it supports traditional healers in aiding patient recovery from tendon and bone injuries. Additionally, its antioxidant effects help to increase blood flow (32). The current research also found that traditional healers use *Amomum testaceum* Ridl. to treat patients with intestinal parasites, although no clear pharmacological evidence supports this use.

Alpinia galanga (L.) Willd. is used by traditional healers to treat gastroesophageal reflux disease by reducing digestive acids and alleviating the burning sensation in the epigastric region. It has anti-ulcer properties that reduce gastrointestinal damage and anti-inflammatory and antioxidant effects that help reduce swelling and muscle pain (33). Additionally, it is employed to treat patients who have intestinal parasites. Tannins in *Alpinia galanga* (L.) Willd. bind with free proteins in the gastrointestinal tracts of earthworms. This mechanism is responsible for anthelmintic activity and leads to their death (34).

Traditional healers use *Curcuma zedoaria* (Christm.) Roscoe to treat gastroesophageal reflux disease due to its anti-ulcerogenic activity, which helps reduce the burning pain in the epigastric region. It also has anti-inflammatory and antioxidant properties that support traditional treatments. Additionally, it is used in a blood tonic, leveraging its anti-platelet activity to improve blood circulation (35). *Curcuma zedoaria* (Christm.) Roscoe has antiparasitic effects enabling treatment of patients with intestinal parasites. Its essential oils, including curzerenone (28.6%), 1,8- cineole (21.3%) and delta-3- carene (10.6%) have been shown to significantly reduce the viability of *Giardia lamblia* both *in vitro* and *in vivo* (36).

Curcuma comosa Roxb. is used by traditional healers to treat haemorrhoids by alleviating pain from inflamed hemorrhoidal tissues and promoting the reduction of their size. This is attributed to its anti-inflammatory and antioxidant properties (37). Additionally, it is used in medicinal formulas for women as a blood tonic, leveraging its ability to inhibit platelet aggregation, which helps improve blood circulation (38).

Zingiber zerumbet (L.) Roscoe ex Sm. is used by traditional healers to treat muscle pain. Scientific evidence shows that it has analgesic and anti-inflammatory activities that inhibit the release of prostaglandins, thus improving patient symptoms. Its alcohol extracts demonstrate anthelmintic activity, effectively inhibiting *Ascaris lumbricoides in vitro*, supporting traditional healers' use of these formulations in treating patients with intestinal parasites. Additionally, it is employed to treat patients with flatulence and bloody mucus in their stools. Zerumbone in *Zingiber zerumbet* (L.) Roscoe ex Sm. has antiulcer activity, contributing to its gastroprotective effects (39).

Kaempferia parviflora Wall. Ex Baker is used by traditional healers as a blood tonic and to treat numbness. It is a vascular relaxant with cardioprotective and neuroprotective activities, which improve blood circulation and help reduce numbness (40).

Kaempferia galanga L. is employed by local tribes in Northeast and South India to treat flatulence, tongue blisters in babies, mouth sores and sore throats, similar to laryngitis symptoms. This traditional use is supported by its anti-inflammatory and analgesic activities (41). Its 50 and 100 mg/mL brine extracts cause paralysis and death of *Pheretima posthuma* earthworms, demonstrating anthelmintic activity (42) and supporting their value in treating patients with intestinal parasites. Additionally, *Kaempferia galanga* L. is used to treat urinary tract disorders, with reports indicating its diuretic properties, as it helps increase urine volume as well as the levels of sodium and potassium in urine (43). For colds, nasal stuffiness, runny nose and sneezing, the essential oils from the rhizomes of *Kaempferia galanga* L. exhibit antipyretic activity, helping to improve patient symptoms (41).

Conclusion

Based on the study of traditional knowledge in the use of ginger family plants by traditional healers in Nakhon Si Thammarat Province, it was found that the healers use 16 species of ginger family plants. The highest FL values were for *Amomum biflorum* Jack, *Curcuma mangga* Valeton & Zijp, *Alpinia purpurata* (Vieill.) K. Schum. and *Etlingera coccinea* (Blume) S.Sakai & Nagam. The highest UV value was for *Zingiber officinale* Roscoe. Scientific research has identified 14 pharmacological activities of ginger. Traditional healers use ginger family plants as polyherbal and monoherbal medicinal formula ingredients. However, the current work is only a partial study. A comprehensive study conducted throughout Nakhon Si Thammarat Province may

reveal a wider variety of uses of ginger family plants by traditional healers, which would greatly interest future research.

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Authors' Contributions

SJ and SL designed the study concept. SJ, SL, KY, WH, AC and TR performed data collection. SJ and SL analyzed the data and prepared the manuscript. All authors read and approved the final manuscript.

Compliance with Ethical Standards

Conflict of interest: Authors do not have any conflict of interest to declare.

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References

1. Larsen K, Larsen SS. Gingers of Thailand. Chiang Mai: Queen sirikit botanic garden; 2006
2. Peng W, Li P, Ling R, Wang Z, Feng X, Liu J, et al. Diversity of volatile compounds in ten varieties of Zingiberaceae. Molecules. 2022;27 (2):565. https://doi.org/10.3390/molecules27020565
3. Limcharoen P, Sattayasomboon Y, Kongsin S, Sillabutra J. The use of Thai traditional medicine services among type 2 diabetes mellitus patients in community hospitals, Pathum Thani Province, Thailand. J Health Sci. 2022;31(6):975-83.
4. Thailand. Office of the national economic and social development council. The thirteenth national economic and social development plan (2023-2027) [Internet]. Bangkok: The Office; 2023 [cited 2023 Nov 11]. Available from: https://www.nesdc.go.th/article_attach/article_file_20230615134223.pdf
5. Kamchansuppasin A, Nounmusig J, Saengkrajang, Kaewsuwan W. Diversity and ethno-utilization of indigenous plants at Krung Ching Sub District in Nopphitam District, Nakhon Si Thammarat Province. Wichcha J NSTRU. 2015;34(2):52-63.
6. Saising J, Maneenoon K, Sakulkeo O, Limsuwan S, Gotz F, Voravuthikunchai SP. Ethnomedicinal plants in herbal remedies used for treatment of skin diseases by traditional healers in Songkhla Province, Thailand. Plants. 2022;11(7):880. https://doi.org/10.3390/plants11070880
7. Thailand. Department of Thai traditional and alternative medicine, ministry of public health. Request for proposal of a list of traditional healers [Internet]. Nonthaburi: The department; 2020 [Cited 2019 Nov 11]. Available from: https://indi.dtam.moph.go.th/images/4.1_MHO_4.1.pdf
8. Bridson D, Forman L. The herbarium handbook. UK: Royal botanic gardens, Kew; 1992
9. The Plant List. A working list of all plant species [Internet]. The plant list online; 2013 [cited 2021 May 20]. Available from: http://www.theplantlist.org/
10. Srithi K, Balslev H, Wangpakapattanawong P, Srisanga P, Trisonthia C. Medicinal plant knowledge and its erosion among the Mien (Yao) in northern Thailand. J Ethnopharmacol. 2009;123(2):335-42. https://doi.org/10.1016/j.jep.2009.02.035
11. Laohaprapanon S, Jitjum S, Panitset KYT, Sukmak N. Traditional healing practices and folk medicines in Thailand: A case study of Huai Yot District, Trang Province. Trop J Nat Prod Res. 2024;8 (3):6537-43. https://doi.org/10.26538/tjnpr/v8i3.10
12. Krongyut O, Wansuthaand S, Udonsan P. A study the wisdom of Thai herbs utilization of folk healers: A case study of a folk healer in Nam Mong sub-district, Tha Bo district, Nong Khai province. UDRU Journal of humanities and social science. 2021;10(2):17-37.
13. Puritatto W, Kantidharo D, Southivongsa S. The analytical studies of traditional medicine wisdom's concepts in Mekong basins. Pa~n~na Panithan Journal. 2021;6(1):81-94.
14. Jitjum S, Laohaprapanon S, Songsang R, Keawjara T. Knowledge and asthma herbal recipes of folk healer: A case study Mr.Thawee Manmad. JTT Med Res. 2021;7(2):75-91.
15. Yincharoen K, Laohaprapanon S, Jitjum J, Chookeaw S. Herbal formula used for menstrual disorders: Case study of folk healers in Nakhon Si Thammarat, Phatthalung and Trang province. J Med Health Sci. 2020;27(1):82-95.
16. Boonma T, Saensouk S, Saensouk P. Diversity and traditional utilization of the Zingiberaceae plants in Nakhon Nayok Province, Central Thailand. Diversity. 2023;15(8): 904. https://doi.org/10.3390/d15080904
17. Ragsasilp A, Saensouk P, Saensouk S. Ginger family from Bueng Kan Province, Thailand: Diversity, conservation status and traditional uses. Biodiversitas. 2022;23(5):2739-52. https://doi.org/10.13057/biodiv/d230556
18. Pitopang R, Damry, Rusdi, Hamzah B, Zubair MS, Amar AL, et al. Diversity of Zingiberaceae and traditional uses by three indigenous groups at Lore Lindu National Park, Central Sulawesi, Indonesia. In: Journal of Physics: Conference Series. Vol. 1242. Proceedings of the International Seminar on Science and Technology 2018; 2018 Jul 25 -26; Palu, Central Sulawesi, Indonesia. Bristol: IOP Publishing; 2018. https://doi.org/10.1088/1742-6596/1242/1/012039
19. Singtothong C, Gagnon MJ, Legault J. Chemical composition and biological activity of the essential oil of *Amomum biflorum*. Nat Prod Commun. 2013;8(2):265-7.
20. Foo YY, Periasamy V, Kiew LV, Kumar GG, Malek SNA. *Curcuma mangga*-mediated synthesis of gold nanoparticles: Characterization, stability, cytotoxicity and blood compatibility. Nanomater. 2017;7(6):123. https://doi.org/10.3390/nano7060123
21. Subramanian V, Suja S. Evaluation of antioxidant activity of *Alpinia purpurata* rhizome (Vieill). Int J Res Pharm Sci. 2011;2(4):601-7.
22. Mendez NP. Phenolic content and antioxidant activity of leaves and rhizomes of *Etlingera coccinea* (Blume) S. Sakai and Nagam. (Zingiberaceae). J Trop Biol Conserv. 2023;20:81-95. https://doi.org/10.51200/jtbc.v20i.4648
23. Dhanik J, Arya N, Nand V. A Review on *Zingiber officinale*. J Pharmacogn Phytochem. 2017;6(3):174-84.
24. Rahaman MM, Hossain R, Herrera-Bravo J, Islam MT, Atolani O, Adeyemi OS, et al. Natural antioxidants from some fruits, seeds, foods, natural products and associated health benefits: An update. Food Sci Nutr. 2023;11(4):1657-70. https://doi.org/10.1002/fsn3.3217
25. Phuaklee P, Sakpakdeejaroen I, Itharat A. Cytotoxic and antioxidant activities of two species of ginger extracts. Thai J Pharmacol. 2010;32(1):82-5.
26. Jyotirmayee B, Mahalik G. A review on selected pharmacological activities of *Curcuma longa* L. Int J Food Prop. 2022;25(1):1377-98. https://doi.org/10.1080/10942912.2022.2082464

27. Marni M, Firdaus I, Wahyuningsih, Soares D, Raharja MLT, Savitri DNS. Effectiveness of honey, curcuma and turmeric for child health: A literature review. In: Proceedings of the 4th International Conference of Health, Science and Technology; 2023 Sep 23; Surakarta, Indonesia. Surakarta; 2023. p. 444-50.

28. Rosdianto AM, Puspitasari IM, Lesmana R, Levita J. Bioactive compounds of *Boesenbergia* sp. and their anti-inflammatory mechanism: A review. J Appl Pharm Sci. 2020;10(7):116-26. https://doi.org/10.7324/JAPS.2020.10715

29. Eng-Chong T, Yean-Kee L, Chin-Fei C, Choon-Han H, Sher-Ming W, Li-Ping CT, et al. *Boesenbergia rotunda*: From ethnomedicine to drug discovery. Evid Based Complement Alternat Med. 2012;2012:473637. https://doi.org/10.1155/2012/473637

30. Han A-R, Kim H, Piao D, Jung C-H, Seo EK. Phytochemicals and bioactivities of *Zingiber cassumunar* Roxb. Molecules. 2021;26 (8):2377. https://doi.org/10.3390/molecules26082377

31. Jaroenngarmsamer P, Ounprasertsuk J, Krutchangthong P, Dumklieng W. Herbal, postpartum care in Thai traditional medicine. International academic multidisciplinary research conference in London 2019; 2019 Mar 7-8; London, United Kingdom. p. 292-7.

32. Kaewkaen P. Antioxidative effect of *Amomum testaceum* Ridl. extract for protecting against *Vascular Dementia*. Int J Food Sci. 2022;2022(1): 1572527. https://doi.org/10.1155/2022/1572527

33. Khairullah AR, Solikhah TI, Ansori ANM, Fadholly A, Ramandinianto SC, Anshariet R, et al. A Review of an important medicinal plant: *Alpinia galanga* (L.) Willd. Sys Rev Pharm. 2020;11(10):387-95.

34. Babu ND, Moulika V, Krishna BM, Anitha S, Mounika B, Satyanarayana T. Phytochemical and anthelmintic activity of *Alpinia galanga* Linn. J Pharmacogn Phytochem. 2017;6(4):2049-51.

35. Gharge S, Hiremath SI, Kagawad P, Jivaje K, Palled MS, Suryawanshi SS. *Curcuma zedoaria* Rosc (Zingiberaceae): A review on its chemical, pharmacological and biological activities. Futur J Pharm Sci. 2021;7:166. https://doi.org/10.1186/s43094-021-00316-1

36. Albalawi AE, Alanazi AD. Chemical composition, *in vitro* and *in vivo* antiparasitic effects of *Curcuma zedoaria* rhizome essential oil against *Giardia lamblia*. Pharmacogn Mag. 2023;19(2):418-26. https://doi.org/10.1177/09731296231166055

37. Petchuay P, Kitiyanant Y, Tuchinda P, Hongeng S, Sa-Ngiamsuntorn K, Keeratinijakal V, et al. Effects of *Curcuma comosa* Roxb. extract on the expression of CYP450s in immortalized hepatocyte-like cells (imHC). Walailak J Sci Tech. 2021;18(2):6704. https://doi.org/10.48048/wjst.2021.6704

38. Sophonsritsuk A, Wongkanha L, Ochareun A, Vallibhakara SAO, Vallibhakara O, Pinpradap K, et al. Effect of *Curcuma comosa* on uterine smooth muscle contraction in women with adenomyosis. J Med Assoc Thai. 2018;101(5):659-65.

39. Chaudhuri A, Sharma SC, Khan F. An Overview on the advances of *Zingiber zerumbet*. UK J Pharm Biosci. 2018;6(5):24-7. https://doi.org/10.20510/ukjpb/6/i5/177346

40. Chen D, Li H, Li W, Feng S, Deng D. *Kaempferia parviflora* and its methoxyflavones: Chemistry and biological activities. Evid Based Complement Alternat Med. 2018;2018(1):4057456. https://doi.org/10.1155/2018/4057456

41. Khairullah AR, Solikhah TI, Ansori ANM, Hanisia RH, Puspitarani GA, Fadholly A, et al. Medicinal importance of *Kaempferia galanga* L. (Zingiberaceae): A comprehensive review. J Herbmed Pharmacol. 2021;10(3):281-8. http://doi:10.34172/jhp.2021.32

42. Dash PR, Mou KM, Erina IN, Ripa FA, Al Masud KN, Ali MS. Study of anthelmintic and insecticidal activities of different extracts of *Kaempferia galanga*. Int J Pharm Sci Res. 2017;8(2): 729-33. https://doi.org/10.13040/IJPSR.0975-8232.8(2).729-33

43. Wang S-Y, Zhao H, Xu H-T, Han X-D, Wu Y-S, Xu F-F, et al. *Kaempferia galanga* L.: Progresses in phytochemistry, pharmacology, toxicology and ethnomedicinal uses. Front Pharmacol. 2021;12:675350. https://doi.org/10.3389/fphar.2021.675350