Original Research

Promoting rational herb-drug use through pharmacy-led advice and home visits in NCD patients

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Abstract

Introduction: There has been a considerable increase in the concurrent use of prescribed medicines and herbal products, but most users do not have any information about drug-herb interactions. Objective: Therefore, this study aimed to investigate the effects of pharmacological advice by community pharmacists on promoting the rational use of prescribed medicines together with herbal products. **Methods:** The study was one group pretest-posttest experimental design, performed on a sample of 32 people who met the following criteria: aged ≥18 years, lived in an urbanized area, have NCDs such as diabetes, hypertension, dyslipidemia, or cardiovascular disease, and have used prescribed medicines and herbal products concurrently. The participants were informed and practically advised on the rational use of herbal products simultaneously with prescribed medicines, the possibility of drug-herb interactions, and self-monitoring of possible adverse effects. **Results:** After implementing pharmacological advice, the participants showed a significant increase in knowledge of rational drug-herb use: from 5.8±1.8 to 8.4±1.6 out of a total of 10 (p<0.001), and their score in terms of appropriate behavior rose from 21.7±2.9 to 24.4±3.1 out of a total of 30 (p<0.001). Additionally, the number of patients with herb-drug interaction risk decreased statistically significantly (37.5% and 25.0%, p=0.031). **Conclusion:** Pharmacy-led advice on rational use of herbal products with prescribed NCD medicines is effective in terms of promoting increases in knowledge and appropriate behavior in these matters. This is a strategy for risk management of herb-drug interactions in NCD patients.

Keywords: medicine; herb; chronic disease; herb-drug interaction; knowledge; behavior

INTRODUCTION

Nowadays, chronic diseases have become a significant problem for Thailand and other countries around the world. More people tend to suffer from these chronic diseases or called non-communicable diseases (NCDs) which lead to hospitalization and even death in some cases. Each year, around 41 million people were global deaths.[1] According to WHO, in 2019, seven of the top ten causes of death are NCDs and they were accounted for 74% of all death in the world. There is also an upward trend of the Burden of Disease towards 60%.[2] In South East Asia, NCDs such as cardiovascular diseases, chronic respiratory diseases, diabetes and cancer are top diseases,

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estimated around 8.5 million patient each year.[3] Patients with such diseases need continuous and long-term treatment, some of them therefore seek alternative medicines in addition to or before having conventional medicine that they should be given.[4,5] Examples include herbal medicine, herbal and dietary supplement, complementary and alternative medicine (CAM), Chinese medicine, and herbs. They have become more popular and demand for herbs in healthcare is therefore expanding.

Herbs for medical use in Thailand are promoted to use. They are supported by inclusion in the National List of Essential Medicines (NLEM), in the part of list of Herbal Medicines.[6] They are encouraged to prescribe and dispense by the health professionals with the evidence-based efficacy and safety. Due to abundance of Thai herbs, herbal products are produced as the dietary supplements that are sold in both the public and private sectors. Some of these herbal products can be bought by consumers without needing a prescription, also known as 'over-the-counter' (OTC) herbs, in accordance with the Drugs Act B.E. 2510[7] of Thailand. These herbs are also believed to be safe and effective for consumers to pick and choose as they wish. They can be bought from general shops (non-pharmacy stores), and are also available through other forms of distribution (such as direct delivery, the postal service, and medicine trucks). Management of herbal products is now dealt with under a new legislation in Thailand called the Herbal Product Act B.E. 2562.

Information on the dangers of and adverse product reactions (APR) that can result from using health products are recorded on the database on the use of health products, which was

created by the Health Product Vigilance Centre (HPVC) under Thailand's Food and Drug Administration (Thai FDA).[8] It was found that, between 2000-2018, only 3,583 from a total of 761,921 reports, or 0.47%, were on problems relating to the use of herbal products. 20.2% of these involved severe adverse reactions.[9] The top ten most popular herbs in terms of the quantities that are used are: turmeric, cinnamon (19%), heart-leaved moonseed (18%), garlic (17%), mixed botanical preparations (13%), ginseng (13%), lingzhi mushroom (12%), kariyat (11%), and black ginger (11%).[10]

According to the risk management guidelines and the potential interactions between herbal products and modern medicine,[11-13] a frequent risk factor is that the patient, during their visit to the doctor, neglects to tell the doctor that they are using herbal products. As a result, it is recommended that doctors and medical personnel should always ask their patients whether they are using any herbal products. They should also learn more about herbal products in order to give useful advice to their patients. Doctors and medical personnel need to realize the possible severity of interactions between herbal products and modern medicines. They need to create a strategic plan for risk management and ensure there is a continuous and frequent assessment of the plan's effectiveness.

From studying the interaction between herbal products and modern medicine, it was found that the modern medicines that have the highest rates of interaction with herbal products are usually those prescribed for the treatment of cardiovascular diseases, diabetes, hypertension, and dyslipidemia.[14] The researchers were therefore especially interested in this group of diseases and the patients that suffer from them. Research into recommendations on the utilization of herbal products along with medicines that are used to treat NCD is still relatively rare. Most of it was done abroad, and may therefore have involved different herbs from those employed in Thailand. As well as to learn more about the potential interactions between such health products and prescribed modern medicines. It is also intended that knowledge and recommendations on the correct and proper use of herbal products with modern medication can be passed on to patients in the community by a pharmacist. This is so that the patients learn more about rational use of herbal medicines.

RESEARCH METHODS

The study was a quasi-experimental study, one group with pretest-posttest experimental design. There are the assessment forms on the correct and proper use of herbal products and modern medicines to be filled in before and after receiving pharmacy-led advice and home visits from a community pharmacist.

Population and samples

The population are patients who are ≥ 18 years old, have been diagnosed with at least one of the following NCDs: Diabetes, Hypertension, cardiovascular disease, and Dyslipidemia. They currently use modern medicines to treat their chronic diseases and live in the Nakwichai Community, Muang Districts, Maha Sarakham Province.

The sample group consists of people who concurrent use herbal products with modern medicines to treat their NCDs. They must be able to identify the types/names of the products and be willing to participate in the study, and meet the study inclusion criteria.

Calculation of the sample group using the formula of comparing MEAN between pair-groups

From the research of Sutthiluk[15] on the effectiveness of a support programme on herbal use behaviors for the promotion of healthcare for the elderly in Natai District, Baan Na Derm Sub district, Surat Thani where 30 elderly people participated in the study, it was found that on average, the behavioural scores for herbal use before and after the study were at 2.37±0.55 and 4.59±0.21 points, with the following formula $n = (Z_\alpha + Z_\beta)^2 \sigma^2 / \Delta^2 = (2.32+1.64)^2 1.4054 / 1^2 = 22.09$

A sample group of 23 persons was needed. An adjustment needed to be made in order to reduce the potential for loss of data by 30%. This meant that n=32.

Criteria for the selection of participants for the study (Inclusion criteria) were those who:

Were aged ≥18, who have been diagnosed with at least one of the following chronic illnesses or NCD: diabetes, Hypertension, cardiovascular disease, and dyslipidemia, and are using modern medicines to treat such diseases.

Were presently using herbal products, the types and names of which could be identified.

Could communicate well or have relatives/care givers who could communicate well.

Consented to participate in the study.

Criteria for excluding a sample group from the study (Exclusion criteria) are those:

Whose information could not be collected, such as those who have relocated or died;

Who no longer wished to participate in the research.

Research tools

Consent form to participate in the research.

Record of information form for each NCD patient. The information was acquired from a home interview on the patient's use of herbal products alongside modern medicines, and from their medical record from Burapha Community Medical Centre, consisting of their diseases and medicine use, as well as from pharmacy-led advice and recommendation plans on the proper use of herbal products with modern medicine by a pharmacist. Information on possible interaction between the herbal products and modern medicine in each patient was also recorded, with reference to a drug interaction fact textbook and an online database: micromedex®[16] and Rxlist®[17].

A 10-item questionnaire on the patient's knowledge of the use of herbal products and modern medicines.

A 10-item assessment of the proper behavior on herbal products and modern medicines use, with 3-rating scales on the behavioral assessment which were never (1), sometimes (2), and often (3).

A pamphlet on herbal products and their potential interaction with modern medicine, recommendations on the proper use of herbal products.

Validity and reliability of research tools

The tools have been examined for the content validity by 3 experts in herbal products and tool development. A reliability test has also been done on 20 patients from another district hospital who are using herbal products with NCD medicine, applying the Cronbach's Coefficient Alpha formula, with results of 0.705-0.720.

Pharmacy-led interventions

Advice and recommendation plan by a pharmacist and two trained sixth year PharmD students on the proper use of herbal products together with NCD medicines shall be done after the lists of patients' names from the Burapha Community Medical Centre is received and they have passed the inclusion criteria. Four home visits were provided for each patient. Each home visit had taken 45-60 minutes/person. Figure 1 shows the flow chart of Pharmacy-led intervention.

Statistical analysis

Paired t-test is used to compare average score on knowledge and score on how to properly use the herbal products and modern medicine before and after recommendations and advice are received. A Wilcoxon Signed Ranks Test is used in order to analyze the levels of knowledge and proper use of herbal products and modern medicine. Chi-square with $p < 0.05$ is used to compare the numbers of members of the sample group who use herbal products which have the potential to cause effects that are connected with drug interaction, before and after recommendations and advice were given.

RESULTS

The sample group of this research consisted of 32 individuals whose information was collected in an urbanized community. The results of the data analysis are divided into the following 4 parts including patients' characteristics and health information, herbal product use, risk of herb-drug interaction, and the effects of pharmacy-led intervention on herbal use.

Part 1: Patients' characteristics and health information

32 participants of the sample group from an urbanized community had their general characteristics recorded: gender, age, levels of education, health insurance, average income, and occupation, as shown in Table 1.

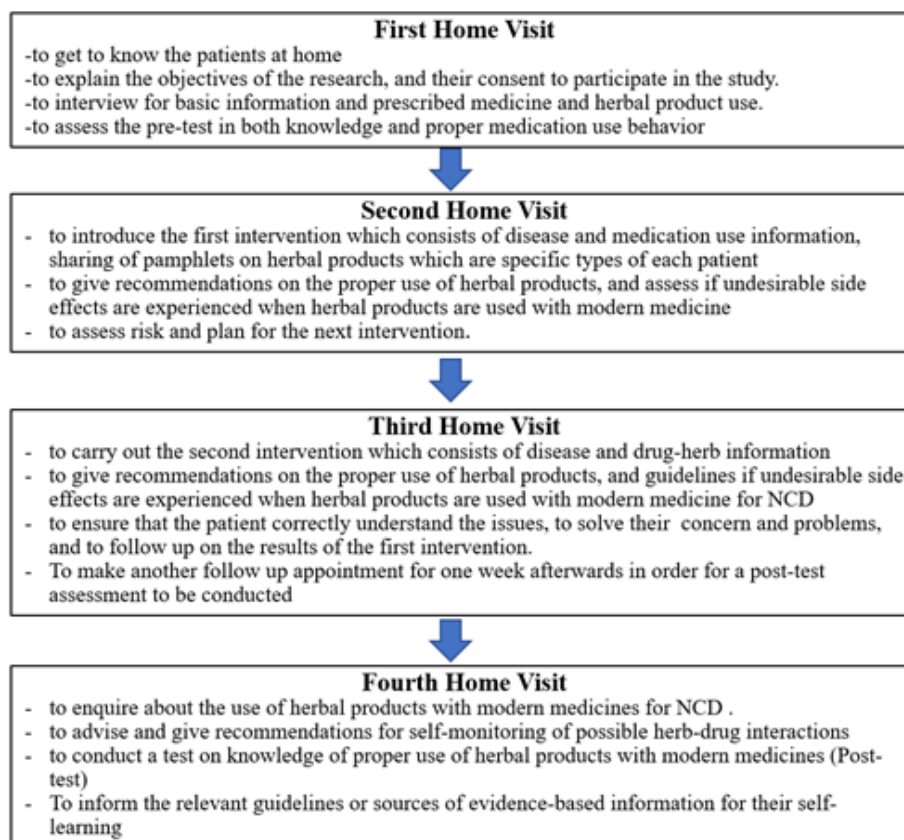From Table 1 on the general characteristics of the samples, the

First Home Visit
- to get to know the patients at home
- to explain the objectives of the research, and their consent to participate in the study.
- to interview for basic information and prescribed medicine and herbal product use.
- to assess the pre-test in both knowledge and proper medication use behavior

Second Home Visit
- to introduce the first intervention which consists of disease and medication use information, sharing of pamphlets on herbal products which are specific types of each patient
- to give recommendations on the proper use of herbal products, and assess if undesirable side effects are experienced when herbal products are used with modern medicine
- to assess risk and plan for the next intervention.

Third Home Visit
- to carry out the second intervention which consists of disease and drug-herb information
- to give recommendations on the proper use of herbal products, and guidelines if undesirable side effects are experienced when herbal products are used with modern medicine for NCD
- to ensure that the patient correctly understand the issues, to solve their concern and problems, and to follow up on the results of the first intervention.
- To make another follow up appointment for one week afterwards in order for a post-test assessment to be conducted

Fourth Home Visit
- to enquire about the use of herbal products with modern medicines for NCD .
- to advise and give recommendations for self-monitoring of possible herb-drug interactions
- to conduct a test on knowledge of proper use of herbal products with modern medicines (Post-test)
- To inform the relevant guidelines or sources of evidence-based information for their self-learning

Figure 1. Flow chart of pharmacy-led home visit and intervention on herb-drug use

Table 1. General Characteristics and Health Information of the sample group (n=32)

General Characteristics	n (%)
1. Gender: Female	21 (65.5%)
2. Age (Average of 67.34 ± 8.20 years) <60 years 60-69 years ≥ 70 years	5 (15.6%) 16 (50.0%) 11 (34.4%)
3. Education level: primary school	17 (53.1%)
4. Health insurance: Universal Coverage (UC)	22 (68.7%)
5. Monthly income ≤ 6,000 THB (≤167 USD) > 6,000 THB (>167 USD)	15 (46.8%) 17 (53.2%)
6. Main occupation Merchant/self-employed Civil servant emeritus	18 (56.1%) 3 (9.3%)
7. Having Drug allergy	2 (6.2%)
8. NCD Hypertension Dyslipidemia Diabetes Cardiovascular diseases Other diseases	29 (90.6%) 21 (65.6%) 12 (37.5%) 9 (28.1%) 6 (18.7%)

total of 32 members, most of them are female (65.6%), between the age of 60-69 (50.0%), with an average age of 67.34 ± 8.20. Most member's highest education level is primary school (53.1%), and most are covered by a universal health coverage scheme. Those who are part of the universal coverage schemes can be further divided into the categories of gold card holders (18.7%), elderly (43.7%), Village Health Volunteers (3.1%), followed by civil servants and state enterprise employees' Medical Benefit Scheme and Social Security Scheme. Most members of the sample group earn 9,001 Baht or above per month (50.0%). Most buy and sell for a living or are self-employed (46.8%), followed by other occupations (43.7%), such as housewives or househusbands.

The health information indicates that most of participant does not have a history of drug allergies (93.7%). Only 2 persons have history of such allergies: 1 person who is allergic to ASA, and 1 person who is allergic to Penicillin. They both suffer from a rash as their allergic reactions. Most of the sample group have 2 NCDs (43.7%). The most common condition that is suffered by the group is hypertension (90.6%), followed by dyslipidemia (65.6%). Other NCDs include gout, cerebrovascular disease, asthma, kidney disease, and lymphoma.

Part 2: Herbal product use

Thirty-two samples had their information on herbal product use logged: the top 10 herbal products used, the number of products used per patient, the purposes of use and the results of the use, as well as the manufacturing source of the herbal products, distribution source of the products, whether doctors are kept informed, and the history of any undesirable side effects from the use of herbal products, as shown in Table 2.

From Table 2, it can be seen that a total of 57 herbal products

were used by patients. Most of them use one herbal product (46.8%), and there is one member who uses 6 herbal products (3.1%). Type of herbal products that were most widely used were Sacha Inchi Tea, Ling Zhi Mushroom, Cordyceps and Ginger. Herbal products were mostly used in their natural form (56.1%). Most members use it for health restorative purposes (35.0%). Other reasons (33.3%) included to relieve gas, indigestion, flatulence, to strengthen bones, increase synovial fluid, flush out toxins, cure and prevent cancer, increase sperm counts, improve blood circulation, and improve the immune system. After use of herbal products, most members saw some improvements that matched the purposes of the product used (75.4%). None of them was found to have worsening symptoms of their illnesses. Most members of patients were introduced to herbal products by word of mouth (59.3%), whilst others heard about them from different sources, such as direct sales by companies. The most common sources of distribution for the herbal products are department stores and market fairs

Table 2. Information on herbal product use in the sample group

Information on herbal product use	n (%)
Top 10 of Herbal products frequently used (57 types) 1) Sacha Inchi Tea (*Plukenetia volubilis* L.) 2) LingZhi (*Ganoderma lucidum* (Fr.) Karst) 3) Cordyceps (*Ophiocordyceps sinensis*) 4) Ginger (Zingiber officinale Roscoe) 5) Sappan (Caesalpinia sappan Linn) 6) Ali's Umbrella (*Eurycoma longifolia* Jack) 7) Laurel Clock Vine (Thunbergia laurifolia Lindl) 8) Black Galingale (*Kaempferia parviflora* Wall. Ex Baker) 9) Red bamboo grass (*Bauhinia strychnifolia* Craib.) 10) Turmeric (*Curcuma longa* L.)	 5 (15.6%) 5 (15.6%) 5 (15.6%) 5 (15.6%) 4 (12.5%) 2 (6.2%) 2 (6.2%) 2 (6.2%) 2 (6.2%) 2 (6.2%)
Number of herbs used per person 1 product ≥ 2 products	 15 (46.8%) 17 (53.2%)
Purposes of use (n of herbal types=57) 1) Health Restoration 2) Reduce High Blood Pressure 3) Pain Relief 4) Reduce Blood Sugar Level 5) Lipid lowering 6) Others	 20 (35.0%) 10 (17.5%) 9 (15.7%) 8 (14.0%) 5 (8.7%) 19 (33.3%)
Results of herbal product use (n=57) 1) Improvement Effect 2) No effect	 43 (75.4%) 14 (24.5%)
Source of information on herbal products 1) Word of mouth 2) Television advertisements 3) Medical personnel 4) Online source, ex: Facebook, Line, Youtube 5) Publications, ex: brochure, magazines 6) Others	 19 (59.3%) 4 (12.5%) 4 (12.5%) 3 (9.3%) 2 (6.2%) 4 (12.5%)
Distribution Channels of Herbal Products 1) Grocery Stores 2) Planting for own use 3) Pharmacy 4) Received from someone 5) Ordered by telephone 6) Hospital 7) Others	 8 (25.0%) 7 (21.8%) 5 (15.6%) 5 (15.6%) 2 (6.2%) 1 (3.1%) 11 (34.3%)
Doctors no kept informed of herbal products used	28 (87.5%)

(34.3%), followed by grocery stores (25.0%). Most patient used the herbal products without informing their doctors (87.5%). They have not had any history of side effects from the use of them.

Part 3: Information on the risks of interactions between herbal products and prescribed medicine for NCD

From the study of 32 patients on the risks of interactions between herbal products and modern medicine, the number of patients who are potentially at risk of experiencing such interactions and their severity and possible mechanism of them are shown in Table 3 and 4.

From Table 3, 12 patients (37.50%) who are at risk of interaction between herbal products and modern medicine. It was also found that there were 25 potential interactions between herbal products and modern medicine that were used by NCD patients. Most of these were ≥2 interaction per patient (58.3%), and one case of more than 4 interactions (8.33%). The levels of interaction that were found were most often moderate (76.0%). No severe cases were found.

From Table 4, the total of 57 types of herbal products use and 25 interactions, there are 10 herbal products which may potentially interact with prescribed medicines for NCD. Ginger is found to have the highest potential for interaction (25.0%),

Table 3. Information on the risks of interactions between herbal products and modern medicine	
Information on risks of interaction	**n (%)**
Having potential interaction between herbal products and NCD medicine (n=32)	12 (37.5%)
Having ≥ 2 interactions between herbal products and prescribed NCD medicine/patient (n=12)	7 (58.3%)
Levels of severity of the interaction between herbal products and NCD medicine (n =25) 1) Mild 2) Moderate	 6 (24.0%) 19 (76.0%)

Table 4. Possible mechanism of interaction and the level of severity of herbal product and NCD medicine (n=32)				
Herbal products	**Prescribed medicine for NCD**	**Number of patients (%)**	**Possible mechanism of interaction**	**Levels of severity**
1. Peppermint Oil	Bisoprolol	1 (3.1)	Menthol oil in peppermint oil can suspend the functioning of CYP 3A4 enzymes, leading to less bisoprolol being removed, allowing the level of medicine in the blood to increase and become more potent.[24,25]	Moderate
2. Curcuma longa (Tumeric)	Amlodipine Enalapril	1 (3.1) 1 (3.1)	*Curcuma longa* can suspend the functioning of CYP3A4 enzymes, leading to less Amlodipine Enalapril being removed, allowing the level of medicine in the blood to increase and become more potent.[17]	Moderate
	ASA	1 (3.1)	*Curcuma longa's* main substance is curcumin which has the ability to suspend platelet aggregation and when used with ASA, there is a risk of bleeding.[16]	Moderate
3. Ginseng	ASA	1 (3.1)	Ginseng's main substance is ginsenosides which suspend the aggregation of prothrombin and the creation of thromboxane, thus when used with ASA, there is a risk of bleeding.[26-28]	Moderate
4. Cordyceps	ASA	2 (6.2)	The main substance in Cordyceps is Adenosine which can suspend blood coagulation and prevent blood clotting, thus when used with ASA, there is a risk of bleeding.[29-30]	Moderate
5. Grape Seed	ASA	1 (3.1)	A main substance in Grape Seed is Oligomeric Proanthocyanidin Complexes which can prolong the period of blood coagulation by creating fibrin at a lower rate, thus when used with ASA, there is a risk of bleeding.[31]	Moderate
6. Pine Bark	ASA	1 (3.1)	A main substance in Pine bark is Pycnogenol which can suspend platelet aggregation and blood coagulation, thus when used with ASA, there is a risk of bleeding.[32]	Moderate
7. Ginger	ASA	2 (6.2)	A main substance in Ginger can suspend the process of thromboxane synthesis, increase the level of Prostacyclin, and suspend blood coagulation, thus when used with ASA, there is a risk of bleeding.[16]	Moderate
	Metformin	3 (9.3)	A main substance in Ginger is an antioxidant, an anti-glycation which is antidiabetic, thus when used with Diabetes medicine the blood sugar level may be low.[33]	Mild
	Amlodipine Nifedipine Manidipine	1 (3.1) 1 (3.1) 1 (3.1)	A main substance in Ginger can suspend voltage-dependent calcium channels, which is the same as those medicines in CCBs, reducing blood pressure even further.[34]	Mild

Table 4. Possible mechanism of interaction and the level of severity of herbal product and NCD medicine (n=32)				
Herbal products	**Prescribed medicine for NCD**	**Number of patients (%)**	**Possible mechanism of interaction**	**Levels of severity**
8. Ling Zhi Mushroom	Manidipine Amlodipine	2 (6.2) 1 (3.1)	A main substance in Ling Zhi Mushroom can suspend the functioning of angiotensin-converting enzymes reducing blood pressure even further.[35]	Moderate
	ASA	2 (6.2)	A main substance in Ling Zhi Mushroom can suspend the functioning of Cytochrome P450, which in turn suspends aggregation of platelets, then when used with ASA there is a risk of bleeding.[36]	Moderate
	Insulin	1 (3.1)	A main substance in Ling Zhi Mushroom ganoderan B can increase plasma insulin, reduce hepatic glycogen content, and control the functioning of glucose-metabolizing enzymes in the liver, causing the level of insulin to increase, leading to higher risk of hypoglycemia.[38]	Moderate
9. Gynostemma	ASA	1 (3.1)	Gynostemma can reduce platelet aggregation, thus when used with ASA, there is a risk of bleeding.[39,40]	Moderate
10. Rhodophyta	Lorsartan	1 (3.1)	Astaxanthin in Rhodophyta can stimulate the functioning of CYP 3A4 enzymes, leading to more Lorsartan being removed, allowing the level of medicine in the blood to decrease and become less potent.[41]	Moderate

followed by Ling Zhi Mushroom (18.7%), Curcuma longa (9.3%), and Cordyceps (6.2%). Peppermint Oil, Ginseng, Grape seed, Pine Bark, Gynostemma, Rhodophyta, were each shown to be at a level of 3.1%. The most common pair of interactions between herbal products and modern medicine is among Ginger and Metformin (9.3%).

Part 4: Results of Pharmacy-led advice and home visit on the use of herbal products and NCD medicines

Field studies have been conducted as part of this research in order to give pharmacy-led recommendations and advice on the use of herbal products and NCD medicines. Four home visits were made in order to collect information and at least two interventions/patient were conducted. Each of the interventions consumed approximately 45 minutes/person. The assessments measured and compared the knowledge about herbal products use with modern medicine among participants in the study before and after receiving advice on the proper methods of doing so. Afterwards, the results of the assessments for both before and after receiving pharmacy-led recommendation and advice shall be compared between the same group. They shall also be compared between the numbers of patients using herbal products and modern medicine both before and after receiving pharmacy recommendation and advice. The details are shown in Table 5.

From Table 5, when comparison on the average scores of knowledge of patients' use of herbal products and NCD medicine before and after pharmacy-led recommendation and advice are received, it is improved with a statistical significance ($p<0.001$). When each question was considered before advice were given, it was found that afterwards, most patients answered more questions correctly. In term of the proper behavior on use of herbal products and NCD medicine before and after pharmacy-led advice were given. The average scores were improved significantly.

About the number of patients who were potentially at risk of experiencing interactions decreased after their receipt of pharmacy-led recommendations and advice with a statistical significance ($p=0.031$) from 12 persons (37.5%) to 8 persons (25.0%).

DISCUSSION

From the results of this study, 37.5% of NCD patients found the potential herb-drug interaction. This is in line with the study of Sornsuvit et al.[18] on the use of herbal and supplement products which may potentially interact with medicines that are used on

Table 5. Comparison the result of before and after pharmacy-led advice on herbal use are given			
	Mean±SD		
Assessment: effect of pharmacy-led advice on herbal use with NCD medicine	**Before: Pharmacy advice**	**After: Pharmacy advice**	***p* value**
Knowledge on the use of herbal products (Full score of 10)	5.80±1.80	8.42±1.60	<0.001[a]
Proper use of herbal products with prescribed medicine for NCD (Full score of 30)	21.70±2.90	24.40±3.09	<0.001[a]
Number of patients who have the potential herb-drug interaction; n (%)	12 (37.5%)	8 (25.0%)	0.031[b]

[a] Paired t-test, [b] McNemar Chi-square test

chronically ill patients. The elderly is a high-risk group which may make them more prone to illnesses such as deterioration of the body, being older, and conduct and behavior in their daily lives. When they suffer from chronic illnesses, they need continuous treatment for long periods of time, and may need alternative treatments along with NCDs medicine. This may increase their interest in herbal product use. This is similar with the study of Chaimay et al.[19] (2012) which examined the issues affecting the use of herbs for basic healthcare. It found that people who were suffering from a chronic disease were twice as likely to seek out herbs to be used for their basic healthcare than those who weren't. An investigation by Muangchang et al[20] (2017) analyzed the relationship between the behavior of herbal use and self-care of the population of Maejai district, Payao province. It discovered that those who are chronic ill may pay more attention to the benefits and the importance of looking after their own health with herbs. The examination revealed that the most common chronic disease is Hypertension (90.6%). As a study by Wongboonnak et al.[21] (2016) which examined the use of, and problems with herbal and supplementary products by the elderly, with a case study in Samut Prakarn Province. It was found that the most common chronic disease among the elderly was hypertension (70.5%). An investigation by Sornsuvit et al.[18] (2012) also found that hypertension is the condition that most frequently afflicts NCD patients (83.9%). These findings are different from a public health statistical report for 2007–2014 which stated that Diabetes is the most prevalent condition in this respect. This may be because the surveys were done in different time periods, and the other two studies were conducted in areas where there may be a large number of people with hypertension.

From the information survey on the use of herbal products in NCD patients in Nakwichai Community, it was found that the type of herbal products that were utilized most often were Sacha Inchi Tea, Ling Zhi Mushroom, Cordyceps and Ginger (15.6% for each). This differs from a study that was carried out by Sornsuvit et al.[18] which examined a sample group who had follow up treatments at Health Care Hospital at Chang Peurk sub-district, Muang district, Chiangmai province. This found that the types of herbs or supplementary products that are most commonly employed are Moringa (24.4%) Gynostemma (6.9%) and *Curcuma Longa* (5.8%). There was also an investigation by Djuv et al.[22] (2013) on the co-use of conventional drugs and herbs among patients in Norwegian general practice: a cross-sectional study conducted in Norway. It was found that the most frequently used herbs are Bilberry (41.0%) Green tea (31.0%) Garlic (27.0%), and Aloe Vera (26.0%). This may be because there are different herbs in different areas and thus the nature of access to herbs is different. This study found that most members of the sample group were introduced to the herbal products that they use by word of mouth (59.3%) which is similar to the findings of a study by Wongboonnak et al (2016).[21] That study found that most elderly people receive their supplementary products from others (35.8%). It showed that recommendations from those they know may be a factor that affects their choice of herbal products. In that study,

most members of the sample group used herbal products without informing their doctors (87.5%), which is in line with the investigation by Wongboonnak et al (2016).[21] The study revealed that only 7.7% of the elderly people informed their doctors that they were taking traditional medicines or dietary supplements in addition to modern medicine. The absence of notification can be classified as creating a risk of interaction between herbal products and modern medicine. This is in concurrence with a study by De Smet (2007)[13] on Clinical risk management of herb–drug interactions which demonstrated that a commonly found risk factor of interaction between herbal products and modern medicine is that patients fail to inform their doctors of their use of herbal products. This may be because the patients were anxious that the doctors may tell them off.

From the study of information on the potential risk of interactions between herbal products and modern medicine, it was found that Moringa had the highest potential risk of interaction with medicine (63.2%), followed by Garlic or Garlic Oil (21.0%), *Curcuma Longa* (13.8%), Tamalaki (10.8%), *Centella Asiatica* (7.2%), *Andrographis Paniculata* (6.8%) and Gynostemma (5.3%), respectively. The most commonly found set of interactions between herbal products and modern medicines was between Moringa and Enalapril (25.0%). An investigation by Peng et al. (2004)[23] on Incidence and Severity of Potential Drug–Dietary Supplement Interactions in Primary Care Patients was conducted on 458 out-patients of two veteran's hospitals in the United States. Most interactions were with an anticoagulant group of medicines: warfarin. The differences between the studies may be explained by four factors. Firstly, each area has different herbs. Access to or acquisition of herbs differs. Secondly, the timing of the studies was different. Thus, the popularity of each herb at different times varies, as mentioned earlier. Additionally, there may be more studies done on interactions between herbal products and modern medicine. Thirdly, the tools for the studies were dissimilar, with diverse sources of information. Lastly. The sample groups from each study were not alike. Both of the previous studies had more participants and examined a wider range of diseases.

CONCLUSION

Rational Herb-drug use with understanding on the risk of potential interactions between herbal product and prescribed medicine of NCDs is very important for protecting patients from the danger of adverse effects due to those interactions. This is one of the main roles of pharmacist on drug safety and rational drug use, especially patients with multi NCDs at home. Pharmacy-led recommendation and advice about herb-drug use through home visits for understanding patients' context in drug adherence in this study, found the significant effectiveness on promoting patients' knowledge on herbal products that they have used. It also promotes the increase in appropriate behavior in these matters. We can conclude that pharmacy-led advice at home is a beneficial strategy for risk management on

herb-drug reaction in NCD patients.

Limitations of the study

There is a time limitation in field data collection. The period of time used to measure pre-test and post-test assessments on the proper use of herbal products and modern medicines was quite short. This resulted in small improvement in the behavior of the sample group. This study examined the potential risk of interaction in theory, in accordance with a structure which may occur, using clinical evidence or case studies which are few in number. There is a follow up on the clinical results which may occur after herbal products and modern medicine are used together. However, as it is a short-term study, there are no clinical results which may occur in the longer term that can be shown at the current time.

Impact of findings on practice statements

Enhance pharmacist's role and clinical practice on herb-drug use because this role and practice will increase the perception of patients on pharmacists about preventing them from adverse drug interactions. Herb-drug interaction might be happening much more in elderly patients with NCD then it will be more important in the aging age.

Promote rational herbal use which is another clinical practice issue that much more found in NCD patient, pharmacist and primary care providers should concern and give the counselling to patients at their home on this issue. From this study results confirmed the value of pharmacy-led intervention on rational herbal use.

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INSTITUTIONAL REVIEW BOARD STATEMENT

This study was approved by the Ethics Committee of Faculty of Pharmacy, Mahasarakham University with an approval number of PD003/2560

PATIENT CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the patients in home visit interview.

DATA AVAILABILITY STATEMENT

The data presented in this study are the part of the final report of the community project. They are approved by Faculty of Pharmacy, Mahasarakham Universtiy, Thailand.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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