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ORIGINAL ARTICLE

THE KNOWLEDGE OF DIETARY SODIUM, SODIUM CONSUMPTIVE BEHAVIOR, SODIUM IN FOOD, AND URINARY SODIUM OF HYPERTENSIVE PATIENTS IN THAILAND

Sanhawat Chaiwong[1], *Saby Yeesa*[2], *Rattawan Somporn*[3], *Suwanun Senrit*[4], *Sineenad Chamnannao*[5], *Saowaluk Sudjarawu*[6], *Natcha Chaiwong*[7]

[1]Community Public Health, Faculty of Science Nakhon Phanom University, Thailand
[2]Department of Community Nursing, Nursing and Midwifery Program School of Nurse, Thailand
[3]Community Public Health School of Public Health, Walailak University, Thailand
[4]Employee of Trang Irrigation Project, Trang Province, Thailand
[5]Drug warehouse officer position Thonburi Trang Hospital, Trang Province, Thailand
[6]Scientist Department of Public Health Faculty of Science and Technology Nakhon Si Thammarat Rajabhat University, Thailand
[7]Faculty of Business Administration and Liberal Arts, Rajamangala University of Technology Lanna Lampang, Thailand

ABSTRACT

Background. Consuming salty foods raises blood pressure because of their sodium and salt. Educating hypertension patients about sodium contributes to their diets and can decrease the future effects on their health.

Objective. The objectives aimed to investigate the knowledge about the sodium content in different condiments and raw foods, consumer preferences regarding sodium-rich foods and condiments, the sodium levels in local food, and the urine of hypertensive patients at Nakhon Si Thammarat Province, Thailand.

Material and Methods. The total sample size consisted of 203 individuals. The data collection tool consists of two components: the questionnaire used to assess knowledge and behavior related to consuming foods containing sodium, and the salt meter and the ion-selective electrode (ISE) were the instruments applied to the determination of sodium in food and urine, respectively. Descriptive statistics including averages and percentages, and analytical statistics, namely analysis of variance (ANOVA) were employed.

Results. The study revealed that the sample was mostly made up of females, married, aged over 60 years, and had finished primary education. Participants were most knowledgeable about condiments, especially fish sauce, shrimp paste, and fermented fish. Hypertensive patients have a modest level of awareness regarding sodium. The shrimp paste had the highest consumption behavior, followed by fish sauce, monosodium glutamate (MSG), and seasoning powder or soup cube at a moderate level. Sour soup with mullet fish, stir-fried luffa with eggs, and Nile tilapia fish sour soup with taro stalk are the top 3 southern local meals preferred to consume and are rich in sodium. The sodium in the food of the low-knowledge differed considerably in moderate and high knowledge ($p < 0.05$). In contrast with urinary sodium, in the high-knowledge group, it was considerably different in low and moderate knowledge ($p < 0.05$).

Conclusions. Hypertension patients' degree of knowledge has a significant role in determining their health and ability to lower blood pressure, particularly about using spices that include sodium, and their consumption habits of local foods high in sodium.

Keywords: *hypertensive patients, sodium knowledge, sodium consumptive behavior, sodium in local food, sodium in urine, Thailand*

INTRODUCTION

The WHO observed a rise in hypertension, which now affects over one billion people. The UN aims to reduce non-communicable disease (NCD)-related premature mortality by 30% by 2030. Projections show that 1.5 billion people will be impacted by 2025, with two-thirds in emerging nations. Each year, 7.5 million individuals die from hypertension [1, 2]. Hypertension was the second-highest non-communicable disease mortality rate in Thailand between 2018 and 2020, with 134.0 per 100,000 population [3]. The Sixth

Corresponding author: Sanhawat Chaiwong, Community Public Health, Faculty of Science Nakhon Phanom University, Thailand; email: sanhawatch.ch@npu.ac.th

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National Health Examination Survey in 2019 and 2020 detected excessive hypertension in 24.7% of Thais [4].

A sedentary lifestyle and nutrition, including consuming sodium-rich meals (above 2,000 mg sodium (Na) or 5 grams of salt daily), are the leading causes of high blood pressure [5-6]. Cardiovascular illness, renal disease, renal stones, osteoporosis, and stomach cancer are complications of high blood pressure [7-13]. The usage of salt is a significant public health concern in Thailand. Thais consumed 4351.7 mg of sodium daily in 2009, twice the recommended minimum [14]. Reduce salt intake to lower blood pressure and risk of related issues [15]. Research in Iran found that over 79% of rural hypertensives add salt to their meals [16]. In the US diet arm and the DASH diet arm, a reduction in sodium intake of 1771 mg was observed. Additionally, the mean blood pressure on the US diet with high sodium intake was 128/81 mmHg, which was shown to decrease by 5.6/-2.8 mmHg after the low sodium intervention was implemented in the pre-hypertensive subgroup [17]. The World Health Organization's guideline of consuming fewer than 2,000 mg of sodium per daily is a preventive step to decrease the incidence of hypertension. The majority of participants (98.40%) stated that they had cooked or prepared food at home at least once in the previous three months. Over 70% of participants in total stated that they had used monosodium glutamate (MSG) in food preparation (72.8%) and bouillon cubes or seasonings (73.1%) at least once in the previous three months [18].

High salt intake contributes to NCD. Thus, limiting salt consumption may improve health and save healthcare expenses [19]. All WHO member nations accepted a 30% salt reduction as one of nine global NCD reduction goals [20]. Health promotion should be emphasized, encompassing the education of individuals on health, increasing knowledge of the dangers associated with high-sodium diets, advocating for a low-sodium regimen, and monitoring sodium consumption within the community. According to the research, patients' diets can help normalize their blood pressure. However, many hypertensives overeat salt or use salt or fish sauce to flavor their meals. These activities cause blood pressure dysregulation and high blood pressure.

The second-largest and most populous province in southern Thailand is Nakhon Si Thammarat Tha Sala District, one of Nakhon Si Thammarat Province's 23 districts, employs most people in agriculture, livestock, and fisheries. Tha Sala District comprises 13 subdistricts, including Ban Han. People consume mostly sour, spicy, and salty cuisine. Salt, fish sauce, and shrimp paste are household staples. Salt, included in many condiments, can raise blood pressure. Because of increasing salt in food and spices, the prevalence of high blood pressure patients in 2021-2023 was 477.1, 507.8, and 858.9 per 100,000 population. Thus, the staff focused on sodium-rich meals, sodium consumption from different seasonings, and sodium levels in hypertensive diets and urine. This data would provide the basis for a campaign to reduce salt in food and condiments to prevent high blood pressure patients from eating too much sodium.

MATERIAL AND METHODS

The research design was cross-sectional descriptive research.

The population consisted of 426 individuals who were officially registered as hypertension patients in the jurisdiction of Ban Han Subdistrict Health Promoting Hospital. Using Crazy and Morgan's (1970) [21] formula, the total sample group was 203 persons.

Inclusion criteria: The sample size must consist of a hypertensive patient over 35 years old, registered in the area under the responsibility of Ban Han Subdistrict Health Promotion Hospital, Tha Sala District, Nakhon Si Thammarat Province, Thailand, who can read and listen in Thai and is willing to participate in the project. Exclusion criteria: A sample group that moved out of the area during the research, abstaining from diuretic medication, and admitted or required hospitalization.

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The researcher received approval from the Human Research Ethics Committee at Walailak University in Nakhon Si Thammarat Province for the human research project, designated WUEC-19-172-01, to protect the rights of the sample group.

Workflow

The first step was treating hypertension patients based on the specified inclusion criteria. Afterward, we gathered data by utilizing a questionnaire that consisted of three sections: 1) General information, 2) Evaluation of knowledge of sodium in food, and 3) Evaluation of behavior in using different condiments containing sodium. The southern area consisted of 14 different varieties of cuisine. Subsequently, we categorized individuals with hypertension into three distinct categories based on their level of knowledge: low, moderate, and high, and performed an essentially random selection of 9 persons with hypertension conditions from each of the three knowledge groups (high, moderate, and low) to get samples of 27 regular breakfast, lunch, and dinner items and urine samples. We analyze salt levels in food and urine specimens. Conduct a thorough examination of the sodium concentration in alimentary and urinary specimens.

Research instrument

The research instruments were divided into two categories:

1. The instrument for data collection was a questionnaire consisting of three parts, as follows:
   Part 1: A questionnaire on general information, including gender, age, status, education, occupation, direct relatives, and income, consisting of a total of seven items.
   Part 2: The assessment of sodium consumption knowledge has 15 items, encompassing both affirmative and negative inquiries [22]. A positive response to a correctly posed question results in a score of 1 point, but a negative response to an incorrectly posed question also results in a score of 1 point. When analyzing the significance of the score values, the researcher establishes the criteria based on the scores. A scores ranging from 0-8, 9-11, and 12-15 points indicate a low, moderate, and high degree of knowledge, respectively.
   Part 3: Sodium Intake: The behavior assessment comprises 14 questions presented in a Likert scale format [23], with respondents assessing their consumption levels on a scale of five levels: the highest, high, moderate, low, and the lowest. The criteria are as follows: The scores for consuming sodium for 7 days, 5-6 days, 3-4 days, 1-2 days, and no weekly consumption ranged from 0-4 points. We interpret the sodium consumption behavior scores as follows: 0.00-0.80, 0.81-1.60, 1.61-3.40, 3.41-4.20, and 4.21-5.00, indicating commendable, good, moderate actions requiring improvement, and poor behavior, respectively.
2. Laboratory tools:

We divided the hypertension patients into three knowledge groups based on their level of expertise: low, moderate, and high, by random sampling. Each group consisted of nine individuals. The study team took 24-hour food and urine samples in the morning to check for sodium. The following were the steps in sample preparation:

2.1. Urinary sodium analysis

Container preparation: A sodium urine test was conducted in a laboratory. To maintain contamination, one cleaning approach involves rinsing with deionized water (DI water) for 24 hours. Then, it is submerged in a solution of 3% nitric acid for 24 hours. Seal the cover and dehydrate in an oven set to 60˚C, then store in a storage until needed.

24-hour urine sample collection: Upon awakening, obtain a midstream urine specimen of 2-10 ml. Subsequently, the name, last name, date, and time will be affixed onto the urine sample and dispatched to the laboratory for examination utilizing the ion-selective electrode (ISE) apparatus.

We utilized the 24-hour urine collection to determine the individuals' salt excretion during the same period. A brochure including information and the requisite equipment (standard urine collection container) was provided to 27 participants throughout the experiment, and the 24-hour urine retention method was employed. The urine collection location collected the 24-hour urine volume and documented the start and finish times of collection to evaluate the completeness of the 24-hour urine sample. Urine specimens were deemed incomplete if the collection duration was under 22 hours or if the total volume was insufficient. The capacity was under 100 ml. We aliquoted 100 mL of 24-hour urine into a cryotube using a pipette and subsequently transported it to Tha Sala hospital laboratory. An automated biochemical analyzer quantified urine sodium using the ion-selective electrode (EForL ATELICA).

2.2. The determination of sodium in food

Food samples were collected from the sample group and consumed for 24 hours, encompassing breakfast, lunch, and supper, to determine the sodium content. If the food did not dissolve, it should be liquefied, crushed, or dissolved in 100 mL of water. The steps for conducting the test were as follows: 1) Immerse the probe tip of the sodium meter into the liquid meal measurement, 2) To obtain an accurate measurement, refrain from measuring the temperature of the meal. At the same time, if it is still hot, ensure that the probe tip remains in the food and avoid touching the container, and 3) Press and hold the power button to initiate the measurement and view the sodium value on the screen (https://www.thaisaltsurvey.com/manual_app).

Quality control for instruments

We utilized the content validity of the instrument, employing the index of item objective congruence (IOC) to identify and evaluate three hypertension experts by academics from the Ministry of Public Health, university lecturer, and experts in non-communicable diseases based on the following criteria: A score of +1, 0, and -1 indicates a high level of confidence, a lack of confidence, and an incongruous confidence in the questionnaire, respectively. The researcher selected questions with IOC values ranging from 0.50 to 1.00. After that, the revised questionnaire was tested on 30 hypertensive patients in the Pho Thong Subdistrict of Tha Sala District, Nakhon Si Thammarat Province, and found that the knowledge questionnaire had a Kuder-Richardson 20 value of 0.70 and the behavior questionnaire had a Cronbach's alpha coefficient of 0.72, which were found using the correct formulas.

Data analysis employing two categories of statistics: descriptive statistics, including mean, frequency, and

percentage, and inferential statistics, incorporating ANOVA at a significance level of 0.05.

RESULTS

Demographic data

The majority of the sample were female (61.1%), with an average age of 66.2 years and marital status (57.6%), followed by widowed (31.5%), single (8.4%), and divorced or separated (2.5%). Education is at the primary school level (78.3%). The most common occupation is agriculture (57.1%). Most have an average income of less than 137 USD per month (73.3%), followed by an income between 137-274 USD (18.7%). Moreover, a direct relative with hypertension, including parents (27.6 %), is presented in Table 1.

Knowledge-related sodium consumption

The questions that received the highest number of correct answers were related to understanding

Table 1. Number and percentage of personal information (n = 203)

Personal information	Number	Percentage
Gender		
Male	79	38.9
Female	124	61.1
Age		
37-47 years	17	8.4
50-59 years	48	23.6
60 years or higher	138	68.0
Marital status		
Single	17	8.4
Married	117	57.6
Divorced/Separated	5	2.5
Widowed	64	31.5
Level of education		
Not educated/Less than primary school	1	0.5
Primary school	159	78.3
Secondary school	21	10.3
High school level 4-6/Vocational certificate	16	7.9
Associate degree/Vocational certificate	3	1.5
Bachelor's degree or higher	3	1.5
Careers		
Agriculture	116	57.1
Employee	29	14.3
Trade	14	6.9
Private business	6	3.0
State enterprise	2	1.0
Others	36	17.7
Average monthly income		
Less than 137 USD	149	73.4
138-275 USD	38	18.7
276-410 USD	12	5.9
More than 410 USD	4	2.0
Direct relatives		
No having	147	72.4
Having (Identified)	56	27.6
Father	15	26.8
Mother	30	53.6
Both father and mother	11	19.6

fermented fish, shrimp paste, and fish sauce as goods with a high sodium content, with an accuracy rate of 83.3% (169 persons). It was closely followed by the awareness that ingesting a large quantity of sodium can lead to high blood pressure, with an accuracy rate of 82.3% (167 persons).

The somewhat accurate responses were as follows: consuming a significant quantity of sodium (79.3%) leads to cerebral infarction (161 persons); consuming substantial amounts of sodium (75.4%) in instant noodles and instant porridge (153 persons); and abstaining from salt intake (71.4%) hinders the body from obtaining sufficient sodium (145 persons).

The knowledge question group with the least correct answers was: some vegetables such as cucumbers, tomatoes, long beans, Chinese cabbage, and Chinese morning glory also contain sodium at 52.7% (107 persons), eating pork or beef causes the body to receive sodium at 51.7 % (105 persons), and milk is a food that does not contain sodium at 47.8% (97 persons), respectively, as detailed in Table 2.

The evaluation of sodium intake knowledge revealed that the participants in the sample group had knowledge scores categorized as moderate (49.3%), low (35.0%), and high (15.8%), as indicated in Table 3.

The examination of the conduct of individuals with hypertension who ingested sodium-rich food in the previous week revealed that shrimp paste (mean = 0.6) was the most often consumed food, followed by fish sauce and MSG (mean = 1.7). The behavior with the

Table 2. Percentage and interpretation of knowledge on sodium consumption of hypertensive patients classified by item (n = 203)

Item	Knowledge of sodium consumption	Correct answer (%)	Interpretation of knowledge.
1.	Fermented fish, shrimp paste, and fish sauce are sodium-rich items	83.3	High
2.	High sodium intake leads to hypertension	82.3	High
3.	Excessive sodium consumption leads to cerebral infarction	79.3	Moderate
4.	Instant noodles and instant porridge are sodium-rich dietary options	75.4	Moderate
5.	Insufficient sodium intake occurs when sodium is not consumed	71.4	Moderate
6.	Hypertensive patients should avoid processed meals such as Chinese sausage and pork buns due to their high salt content	67.0	Moderate
7.	Using soy sauce or seasoning sauce in cooking aids the body in obtaining sodium	66.5	Moderate
8.	Bananas, watermelon, and guava are fruits that have a low salt content	65.0	Moderate
9.	Monosodium glutamate (MSG) is sodium-free	61.6	Moderate
10.	Hypertensive patients should limit their daily sodium intake to 2 teaspoons, equivalent to 1 gram, or around 400 mg	61.6	Moderate
11.	Certain veggies, including cucumbers, tomatoes, green beans, Chinese cabbage, and Chinese morning glory, also possess sodium	52.7	Low
12.	Consuming pork or beef leads to the body's absorption of sodium	51.7	Low
13.	Milk is a sodium-free food	47.8	Low
14.	Sodium is exclusively present in foods that have a salty taste	41.9	Low
15.	Foods that include sodium only utilize salt throughout the cooking process	25.1	Low

Table 3. Number and percentage of knowledge level of sodium consumption in hypertensive patients (n = 203)

Knowledge Group	Number	%
Low	71	35.0
Moderate	100	49.3
High	32	15.7

lowest consumption rate was instant porridge, with a mean value of 3.6, as presented in Table 4.

Sodium content in the diets of hypertensive patients

The analysis of sodium content in each meal, daily sodium intake, and sodium in urine revealed that patients with knowledge about low hypertension consumed high-sodium breakfasts and lunches. The moderate knowledge group, on the other hand, consumed the most sodium-containing dinners. In addition, it was found that the low knowledge group had the highest sodium intake in food and urine among the three knowledge groups. All three groups exceeded the World Health Organization's recommended limit of 2,000 mg of sodium per day [24]. The moderate and low knowledge groups had higher levels of urinary sodium than the specified limit of 1,800 mg per day, except for the high knowledge group of hypertension. The body excretes sodium through urine in 24 hours, not exceeding 1,800 mg daily [24]. The statistical analysis showed a notable disparity in sodium intake between the groups with low knowledge and those with moderate and high knowledge. Additionally, there was a substantial contrast in the quantity of sodium in urine between the moderate and low knowledge groups and the high knowledge group, as shown in Table 5.

The hypertensive patients predominantly consumed foods with high sodium content, such as

Table 4. The averages and interpretations of sodium-related food consumption behavior in 1 week (n = 203)

Items	Consumption behavior related to foods containing sodium	Mean	Interpretation of consumptive behaviors
1.	Shrimp paste	0.6	High
2.	Fish sauce	1.7	Moderate
3.	Monosodium glutamate	1.7	Moderate
4.	Seasoning powder or soup cube	2.1	Moderate
5.	Light soy sauce	2.7	Low
6.	Salted fish	3.0	Low
7.	Canned fish	3.1	Low
8.	Pickled cabbage	3.3	Low
9.	Processed foods such as sausages	3.4	Low
10.	Salted egg	3.5	Low
11.	Pickled fish	3.5	Low
13.	Bean paste	3.5	Low
14.	Instant porridge	3.6	Low

Table 5. Mean of dietary sodium at each meal, total sodium, and urinary sodium by knowledge group of hypertensive patients (n = 27)

Knowledge levels	Meal	Average sodium content in each meal (mg)	Average sodium intake (mg)	Average urinary sodium (mg/day)
High	Breakfast	269.8	2084	1710
	Lunch	342.0		
	Dinner	291.7		
Moderate	Breakfast	361.0	2144	1961[b]*
	Lunch	395.0		
	Dinner	361.2		
Low	Breakfast	439.3	2474[a]*	2300[b]*
	Lunch	439.3		
	Dinner	358.2		

Note: For adults, WHO recommends less than 2000 mg/day of sodium (equivalent to less than 5 g/day salt (just under a teaspoon) [24]; [a]* – the average sodium intake (mg) of the low-knowledge group significantly differed from that of the moderate- and high-knowledge groups ($p < 0.05$); [b]* – the average urinary sodium (mg/day) of moderate- and high-knowledge groups significantly differed from that of the low-knowledge groups ($p < 0.05$).

Nile tilapia fish sour soup with taro stalk (707 mg), sour soup with mullet fish (511 mg), and stir-fried luffa with eggs (511 mg). On the other hand, foods with the least sodium content were chicken with roasted chili curry (197 mg), caramelize pork (sweet pork) (138 mg), and catfish curry recipe with coconut milk (Thai style) (98 mg). The World Health Organization's standards on acceptable salt levels in food revealed that 16 varieties of food, accounting for 69.6% of the total, included amounts of sodium that were deemed hazardous [24]. The sodium content in 100 mL of meals should not exceed 275 mg [25] as indicated in Table 6.

DISCUSSION

According to the study's findings, hypertension patients' knowledge about foods rich in sodium, including components containing sodium and spices containing sodium, was at a low level of 35.0% and a moderate level of 49.3% [26]. The study focused on the factors connected to dietary sodium linked to the risk of hypertension in rural northern Thailand (Rusmevichientong et al., 2021). Comparable research in other nations revealed a link between hypertension and knowledge, attitudes, and dietary salt intake [27-29]. After analyzing each item, we found that fish sauce, shrimp paste, and fermented fish include high sodium content (83.3%), and high sodium might cause hypertension (82.3%). However, it is at odds with the sample group's consumption patterns, which showed that they preferred to use the top three condiments – shrimp paste, fish sauce, and monosodium glutamate (Table 4). In Thailand and Southeast Asian countries like Malaysia and Indonesia (93.35%), shrimp paste is considered a common condiment [18]. The knowledge and behavior of the sample group should be coordinated with the study's findings. According to

Table 6. Typically consumed meals in southern Thailand by individuals with hypertension and associated sodium content

Items	Names of traditional foods	Sodium contents (mg per 100 mL)
1.	Nile tilapia fish sour soup with taro stalk	707*
2.	Sour soup with mullet fish	511*
3.	Stir-fried luffa with eggs	511*
4.	Pork curry with parkia speciosa	472*
5.	Chicken curry with yellow curry paste	472*
6.	Spicy curry bitter bean with pork	472*
7.	Pork curry with morning glory (Kaeng thepho)	472*
8.	Fish curry with pickled bamboo shoots	393*
9.	Stir-fried papaya with pork	358*
10.	Thai fish organs sour soup (Gaeng tai pla)	342*
11.	Tofu soup	322*
12.	Vegetable soup (Kaeng lieng)	314*
13.	Fried fish	314*
14	Paco fern salad	287*
15.	Stir-fried vegetables	283*
16.	Herbed soya beans dipping (Tao jiaw lon)	279*
17.	Fish boil	259
18.	Pork boil	248
19.	Coconut cream soup with galangal and pork	248
20.	Mackerel in dried red curry	208
21.	Chicken with roasted chili curry	197
22.	Caramelize pork (Sweet pork)	138
23.	Catfish curry recipe with coconut milk (Thai style)	98

* Denotes food with a sodium content above 275 mg/100 mL.

the social cognitive theory (SCT), to carry out a certain activity, an individual must be proficient in both knowledge and skills [30]. Most campaigns focus on increasing information, which may or may not transfer into action. It occurs because practical applications sometimes overemphasize the transmission of knowledge and downplay the significance of belief. The fact that existing measures to reduce sodium intake have not increased people's interest in or attitudes about engaging in sodium reduction is one of the barriers preventing progress in sodium reduction among the general population [31]. As a result, the WHO advises limiting sodium consumption, which involves evaluating the amount of sodium in food and its sources. Improving sodium-related knowledge, attitudes, and behaviors should be the initial step in this strategy WHO Guideline [32]. Understanding how attitudes and knowledge affect an individual's sodium consumption behavior is valuable [33]. Related to the findings of Jung et al. study (2012) [34], which showed that nutrition education was the only time when there was a positive shift ($p < 0.001$) in the overall nutrition knowledge score connected to sodium consumption and hypertension and the dietary behavior score associated with excessive salt intakes. The instruction program on reducing sodium consumption and the subsequent study demonstrated favorable outcomes for hypertensive individuals' blood pressure, sodium intake, nutrition knowledge, and dietary behavior. Positive consumer attitudes, behaviors, and knowledge are associated with better health outcomes. Aligned with the findings of Claro et al. (2012) [33], who indicated that the sample group's awareness of salt intake constitutes the primary risk factor and necessitates vigilant oversight as a personal competency. Excessive sodium consumption positively correlates with blood pressure, particularly higher systolic blood pressure if daily salt or sodium intake is uncontrolled (James et al., 2014) [35], and queued up with study findings, which showed that urinary sodium was significantly higher in the low and moderate knowledge groups than in the high knowledge group ($p < 0.05$) and that the low sodium knowledge group had a significantly higher mean daily sodium intake than the moderate and high knowledge groups. Because it affects consumption, raising awareness of the effects of food-related sodium on attitudes, behaviors, and knowledge is crucial, particularly for patients with hypertension. The sample's knowledge and awareness rose after participating in an educational program focused on reducing salt or sodium intake. Ultimately resulted in a decrease in behaviors associated with reduced salt intake, including the avoidance of pickles, the utilization of less salt in culinary practices, and restricting snacks to under 3 mg per day. According to Johnson et al. (2017) [36], there was no statistically significant difference in the mean salt consumption between those with greater education (9.21 ± 8.55-9.87 g/day) and those with lesser education (9.34 ± 8.57-10.12 g/day) ($p = 0.82$). Therefore, alternative channels must be employed to inform people about sodium's negative health impacts. The involvement of community volunteers was crucial in lowering salt intake, according to the Aziz et al. (2003) [37] study. They demonstrated a statistically significant decrease in the behaviors of individuals who ingested fat and salt by 48% and 41%, respectively, and provided family education following home visits. According to Claro et al. (2012) [33], over 80% of the sample group requested that food labels include explicit warnings and a high, medium, and low salt content on the packaging of high-salt goods. Furthermore, using a salt meter to measure the sodium content of food consumed by patients with high blood pressure is an activity that combines behavior and knowledge in providing patients with evidence-based information. The population of hypertensive patients is also elderly. Spicier food may be necessary due to the deterioration of the salty taste receptors. An alternative to enhance food flavor is to practice good personal hygiene, such as brushing and tongue exercises to stimulate the taste buds. By stimulating the salivary glands and quickening the turnover of taste bud cells, these techniques improve tongue taste perception for meals. This is compatible with the findings of Trachootham et al. (2018) [38], who examined the taste buds of Thai and Japanese individuals and discovered that Thais perceive salty flavors less strongly than Japanese do. Thais thus frequently use strong spices to season their food, which causes them to consume more salt than is healthy and eventually results in hypertension.

Furthermore, residents of the coastal southern area are well-known for their love of spicy, salty, and sour cuisine. Thus, fisheries products are transformed into spices for regular meals, such as fish sauce and shrimp paste. Similar to the study's results, which state that the top three regional dishes that those with high blood pressure enjoy are stir-fried lentils with eggs, mullet fish soup, and Nile tilapia fish soup with taro stalks. Table 6 shows that these three items have the highest salt content (707, 511, and 511 mg/100 mL, respectively). The use of food and flavors like salt, fish sauce, and shrimp paste defines a particular food culture. Food cravings result from ingrained attitudes and values transmitted from one generation to the next. Consequently, each region's social culture has an impact on the cuisine that people consume. As a result, it is challenging to encourage individuals to reduce their sodium intake since determining the appropriate amount of salt to use when cooking calls for expertise and experience. However, the following

associated issues should be the attention of relevant organizations to limit salt intake in the community:

1. To increase awareness, food labels should include details on the health impacts, optimum consumption quantities, and salt content.
2. Creating a support network and promoting community involvement in creating policies or community charters about using sodium in the community.
3. Public health organizations can set up self-efficacy awareness improvement programs as part of their health services to encourage at-risk groups to improve their self-efficacy in preventing disease.

Limitation of the study

The study revealed that the majority of the sample groups were over 60 years of age and had completed primary education, which influenced their comprehension of the questionnaire content, encompassing both positive and negative inquiries. It necessitated the involvement of additional assistants to elucidate the content, resulting in potential bias and leading responses in the questionnaire. Furthermore, the researchers failed to quantify the food intake during each meal by the sample groups, potentially influencing salt consumption. Furthermore, statistical analysis examining the correlation between variables, including body weight relative to sodium consumption per meal and body weight relative to urinary sodium, should be employed in this research.

CONCLUSIONS

The study found that the sample group still lacked knowledge about the amount of sodium in natural foods, especially in plant foods, vegetables, milk, and meat, as well as the preference for consuming processed foods, canned foods, adding seasonings, and ready-to-eat foods available in the market. In addition, the popularity of consuming spicy foods, such as high-fat, salty, and spicy foods in South Thailand, has affected sodium intake. It aligns with the research findings, which demonstrated that groups with low and moderate levels of knowledge about sodium and their consumption of sodium-containing foods differed significantly from those with high levels of knowledge, and this difference impacted the amount of sodium present in their urine. It was found that the group with high and moderate levels of knowledge about sodium had a statistically significant amount of sodium in urine compared to the group with low knowledge. So, it's essential for agencies to quickly start a campaign to educate people about sodium in natural foods, especially in plants, vegetables, milk, and meat, to help lower sodium intake from different seasonings, including creating labels for foods and seasonings that have high sodium levels. We urgently need to implement and publicize the study through various media channels.

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Conflicts of interest

The authors declare no conflict of interest. The funders had no role in the design of the study, in the collection, analysis, or interpretation of data, in the writing of the manuscript, or in the decision to publish the results.

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