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Food Intake and Lipids Profiles among Hypertensive Patients at the Community Hospitals in Trang Province[†]

Saksit Samtid[1], Naiyana Noonil[2,*] and Saifon Akewarangkoon[2]

[1]Master of Nursing Science in Community Nurse Practitioner, School of Nursing, Walailak University, Nakhon Si Thammarat 80160, Thailand
[2]School of Nursing, Walailak University, Nakhon Si Thammarat 80160, Thailand

([*]Corresponding author's e-mail: nnaiyana@mail.wu.ac.th)

Abstract

Hypertension (HTN) is related to dyslipidemia (DLP) and intake behavior and caused 4.4 million deaths worldwide. Therefore, this cross-sectional study aimed to investigate food intake and blood lipid levels in patients with HTN who received chronic care at community hospitals in Trang province. Two hundred and sixteen patients with HTN and DLP were randomly recruited from 3 community hospitals. Data were collected using demographics and food intake frequency (FIF) questionnaires. Frequency, percentage, mean, and standard deviation were used for analyzing data.

The findings showed that participants' mean (SD) age was 63.27 (16.56). They were males 59.2 %, married 60.3 %, and practiced Buddhism 62.7 %. The mean (SD) of lipid profiles are total cholesterol, HDL-C, LDL-C, and triglyceride were 212.73 (21.12), 42.14 (8.98), 97.19 (14.20), and 145.17 (27.72), respectively. Over 80 % of participants were uncontrolled blood pressure (BP). The mean (SD) of food consumption found a high carbohydrate intake of white rice, 4.32 (0.58); hot drinks, 4.00 (1.12); and cold beverages, 3.97 (1.05); protein intake of fish, 3.50 (0.90); chicken, 3.41 (0.68); and omelets, 3.07 (0.71); and fat intake of soybean oil at 2.80 (0.61); but less fiber intake of cooked vegetables at 3.80 (0.43). Therefore, these patients must be educated and encouraged to engage in healthy eating interventions.

Keywords*:* Food intake, Lipids profiles, Patients with hypertension

Introduction

The incidence rate of HTN is increasing steadily. Twenty-five percent of Thais were diagnosed with HTN (Meelab et al., 2019). This disease caused 7 million deaths, including in Thailand (World Health Organization, 2016). The leading cause of this severity was uncontrolled blood pressure (BP) and undiagnosed hypertension. Almost three-fourths of people with high blood pressure were never seen by healthcare providers, whereas approximately 10 % could control their (Division of Epidemiology, Department of Disease Control, 2016). Furthermore, HTN's significant risk factors and complications were DLP (Leibowitz et al., 2016). Patients with DLP were more likely to develop HTN due to the increased cardiovascular risk, such as cardiovascular disease (CVD) and atherosclerosis (Spannella et al., 2019). Moreover, the prevalence of CVD in patients with HTN and DLP was 15.5 times higher than in those who had no history of those diseases (Ariyanti & Besral, 2019).

Uncontrolled BP is related to CVD and other organ damages, particularly brain and kidney (Meelab et al., 2019). In hypertensive patients, the likelihood of ischemic heart disease and stroke grows double times for every 20 or 10 mmHg increase in diastolic or systolic BP, respectively (Hajar, 2017). According to the pathology of HTN, high BP and excess blood lipids cause turbulent blood flow, which damages artery walls. Chronically damaged arteries and lipid plaques make arteries thicker and less

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elastic, called arteriosclerosis. Eventually, vital organ damages happen because of blood flow obstruction or blood vessel rupture (Nintasen, 2016).

HTN is a chronic health problem that significantly impacts healthcare and the economy. The average cost of HTN in America and Thailand raised to $51.2 billion and $754 million per year (Department of Disease Control, Ministry of Public Health, 2016). Even though the economic cost of DLP in Thailand is lower than the HTN one, it is still high. Although, there is no record of the direct cost of HTN in Thailand. (Hypertension Association of Thailand, 2019). However, the most expensive healthcare system was hospitalization and medication, which were higher than in other countries (Wierzejska et al., 2020).

DLP was significantly related to unhealthy food consumption, especially fatty foods and a low fiber diet (Thipwong & Numpool, 2014). Moreover, high carbohydrate and sweetened foods were undirected increased blood lipids because blood glucose level results in increased feelings of satiety (Ratanapanon, 2014). Individuals' appetites and food intake were controlled by their blood glucose levels. People's blood glucose levels tend to lose cravings once blood sugar increases to blood acidosis (Ratanapanon, 2014). In these dangerous diseases, patients must be aware of their eating behaviors (World Health Organization, 2016).

According to Sawangthub and Kunthrongkieat (2013), Thais typically ate high-fat foods such as stir-fried meat and Thai basil, fried chicken, and grilled pork. Furthermore, over 70 % of drinks, but fewer vegetables and fruits (Ekachampaka & Wattanamano, 2017). Due to this unhealthy eating, we were at high risk of having hyperlipidemia and metabolic syndrome, caused by an increase in HDL-C and the decrease of LDL-C. Thus, hypertensive patients who often consumed fatty foods were more likely to develop complications, especially CVD (Sinthavalai, 2015; Dolwitthayakun, 2015), the leading cause of death in Thailand (World Health Organization, 2019).

A literature review showed that DLP was a harmful risk factor for elaborated BP and abnormal lipids profile in hypertensive patients (Tepsuriyanont, 2017). However, most studies on food intake only focused on patients with only DLP or HTN (Sawangthub, 2015; Foosuwan et al., 2016; Aekplakorn, 2015). Little is known regarding food consumption in patients with both DLP and HTN. Therefore, this study aimed to explore blood lipid levels and dietary intake among this patient with hypertension who received chronic care at community hospitals in Trang.

Research methodology

Research design and setting

This cross-sectional study was conducted at three selected community hospitals reported as the top 3 highest registered numbers that Huai Yot Hospital has the highest number of patients.

Study population

Patients with HTN and DLP, about 216 who attended routinely scheduled chronic disease clinics, were recruited to participate in the study following these inclusion criteria: 1) no history of coronary artery disease (CAD), diabetes, or other diseases that require dietary control, 2) able to communicate fluently in Thai, and 3) had previous blood lipid record in the past year. The sample size was calculated using Daniel's formula (2010) at the Z value of 1.96, $p = 0.30$, and $d = 0.03$. The estimated sample size was 180, and to prevent unexpected dropout, the sample size was 20 %, adding up to 260. Stratified random sampling was performed to calculate the required samples from each stratum. Then, 64, 66, and 86 participants were randomly selected from the hypertension clinics of 3 hospital locations, respectively.

Data collection

Data were collected using demographics and the food frequency questionnaire (FFQ) (Aekplakorn, 2015). Participants were asked about gender, age, career, education attainment, income, religion, marital status, weight, height, body mass index (BMI), waist, and sedentary behavior. Moreover, they were assessed how often they consumed each item of specific food groups last month. The selected food items were classified into four groups which were 1) carbohydrates (rice, flour, desserts, and sugar-sweetened beverages), 2) protein (meat, eggs, milk, and grains), 3) fat (vegetable and animal oils), and 4) fiber

(vegetables and fruits). Food intake frequency scores ranged from 0 (none), 1 (1 time/month), 2 (2 - 3 times/month), 3 (1 - 3 times /week), 4 (4 - 5 times/week), and 5 (> 5 times/week).

The questionnaire was validated by five experts and tested for content validity. Item Objective Congruence (IOC) index of all items was 0.80 to 1.00. The questionnaire was then tested its reliability with thirty patients with HTN in other hospitals and showed good internal consistency reliability with Cronbach's alpha equal to 0.87. To collect data, selected participants were interviewed for twenty minutes in duration. Moreover, participants' health status was collected from the hospital data system.

Ethical consideration

The study was approved by the Ethics Review Committee, Walailak University (WUEC-21-317-01). Before signing informed consent, eligible samples were informed of pertinent information such as the research topic, objectives, data collection process, possible risks, potential benefits, the right to withdraw from the study, and statement confidentiality. In addition, participants were asked to consent permission to gather their medical records.

Data analysis

Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to analyze data on health status and food intake frequency.

Results and discussion

In **Table 1**, the participants were 63.27 years (SD = 16.56). There are males 59.20 %, married 60.3 %, education in high school 42.30 %, Buddhism 62.70 %, employed 75.40 %, and taken care of by husband/wife 59.60 %. They earned sufficient income from their full-time job and had 75.80 % and 75.40 % savings.

Table 1 Participants' demographics.

Demographics	Frequency	Percentage
Gender		
Male	154	59.20
Female	106	40.80
Age min - max = 38 - 98, $\bar{x}$ = 63.27, SD = 16.56		
35 - 60 years	127	48.85
> 60 years	133	51.15
Education attainment		
Never attend school	19	7.30
Primary school	69	26.50
High school	100	42.30
Diploma degree	14	5.40
Bachelor's degree	48	18.50
Religion		
Buddhism	163	62.70
Islam	94	36.20
Christianity	3	1.10

Demographics	Frequency	Percentage
Status		
Married	157	60.30
Widow/divorce/separate	61	23.50
Single	42	16.20
Career		
Employed	196	75.40
Unemployed	48	18.40
Housewife	16	6.20
Income		
Full-time job	197	75.80
Spouse or relative	63	24.20
Income satisfaction		
Sufficient with saving	196	75.40
Sufficient without saving	48	18.50
Insufficient	16	6.10
Residing		
Spouse/partner	145	55.80
Relatives	100	38.40
Alone	13	5.00
Others	2	0.80
Number of family members		
1 - 2	51	19.60
3 - 4	182	70.00
5 - 6	27	10.40
Caregiver		
Husband/wife	155	59.60
Relative	61	23.50
Children and grandchildren	26	10.00
Father/mother	5	1.90
None	13	5.00
Food source		
Only buy ready meals	30	11.50
Cooked yourself and buy sometimes	230	88.50

Health status and lifestyles

The study found that most patients with HTN had a BMI of overweight (71.20 %) and a mini risk of waist circumference (57.60 %). Most of participants, 61.60 % were uncontrolled at 82.30 % and had diagnosed to HTN less than 4 years ($\bar{x}$ = 4.55, SD = 1.79) 61.60 %. Those patients had lipid profiles as total cholesterol, HDL-C, LDL-C, and triglyceride were 212.73 (21.12), 42.14 (8.98), 97.19 (14.20), and 145.17 (27.72), respectively. Moreover, it found lipid abnormalities such as elevated TC levels ≥ 200 mg/dL (61.20 %) and LDL-C levels ≥ 100 mg/dL (78.46 %), Triglyceride level ≥ 150 mg/dL (43.5 %),

but low HDL-C level < 40 mg/dL (41.90 %). Moreover, the results found that they still had risk behaviors such as smoking (38.50 %), drinking (9.20 %), sedentary behavior 4 - 5 days/week (87.70 %), and had breakfast intake 4 - 5 days/week of 69.60 % as shown in **Table 2**.

Table 2 Participants' health status and lifestyles.

Health Status and lifestyles	**Frequency**	**Percentage**
BMI (min - max = 18.50 - 36.05, $\bar{x}$ = 27.26, SD = 2.57)		
18.5 - 24.9 (Healthy)	41	15.70
26 - 30 (Overweight)	185	71.20
≥ 30 (Obese)	34	13.10
Waist (min - max = 54 - 98, $\bar{x}$ = 84.36, SD = 6.70)		
70 - 80 cm (Normal)	68	26.20
80 - 90 cm (Minimal risk)	150	57.60
≥ 90 cm (High risk)	42	16.20
HT duration (min - max = 2 - 12 year, $\bar{x}$ = 4.55, SD = 1.79)		
≤ 4 years	160	61.60
5 - 7 years	83	31.90
≥ 8 years	17	6.50
The blood pressure level in the past year		
Controlled (≤ 140/90 mmHg)	46	17.70
Uncontrolled (> 140/90 mmHg)	214	82.30
TC (min - max = 172 - 278, $\bar{x}$ = 212.73, SD = 21.12)		
Normal < 200 mg/dL	101	38.80
Over ≥ 200 mg/dL	159	61.20
LDL-C (min - max = 76 - 140, $\bar{x}$ = 97.19, SD = 14.20)		
< 100 mg/dL	56	21.54
≥ 100 mg/dL	204	78.46
HDL-C (min - max = 34 - 48, $\bar{x}$ = 42.14, SD = 8.98)		
< 40 mg/dL	109	41.90
≥ 40 mg/dL	151	58.10
TG (min - max = 98-230, $\bar{x}$ = 145.17, *SD* = 27.72)		
< 150 mg/dL	147	56.50
≥ 150 mg/dL	113	43.50
Follow-up		
Regular	251	96.50
Irregularly	9	3.50
Smoking		
No	160	61.50
Yes	100	38.50
Drinking		
No	236	90.80
Yes	24	9.20

Health Status and lifestyles	Frequency	Percentage
Exercise		
No	194	74.70
Yes	66	25.30
Sedentary behavior		
6 - 7 days/week	9	3.50
4 - 5 days/week	228	87.70
≤ 3 days/week	23	8.80
Breakfast consumption		
6 - 7 days/week	53	20.40
4 - 5 days/week	181	69.60
Sometimes (≤ 3 days/week)	26	10.00

Frequency of food intake

The top three highest means (SD) of food intake included carbohydrates intake as white rice, 4.32 (0.58), hot drinks, 4.00 (1.12), and cold beverages, 3.97 (1.05); protein intake as fish, 3.50 (0.90), chicken, 3.41 (0.68), and omelets, 3.07 (0.71); fat and fiber intake as soybean oil, 2.80 (0.61), and cooked vegetables, 3.80 (0.43), as shown in **Table 3**.

Table 3 Frequency of food intake.

Food intake	Frequency						$\bar{x}$	S.D.
	None	1 /month	2 - 3 /month	1 - 3 /week	4 - 5 /week	> 5 /week		
Carbohydrates								
White rice	-	-	-	16 (6.15)	146 (56.15)	98 (37.69)	4.32	0.58
Brown rice	45 (17.31)	112 (43.08)	91 (35.00)	10 (3.85)	2 (0.77)	45 (17.31)	1.28	0.82
Sticky rice	-	26 (10.00)	179 (68.85)	48 (18.46)	7 (2.69)	-	2.14	0.61
Noodles	-	5 (1.92)	49 (18.85)	177 (68.08)	29 (11.15)	-	2.88	0.60
Vermicelli	-	-	23 (8.85)	134 (51.54)	103 (39.62)	-	3.31	0.63
Slices of bread	-	75 (28.85)	136 (52.31)	33 (12.69)	16 (6.15)	-	1.96	0.81
Ice cream	1 (0.38)	110 (42.31)	141 (54.23)	4 (1.54)	4 (1.54)	-	1.62	0.61
Caramel desserts	-	40 (15.38)	107 (41.15)	88 (33.85)	25 (9.62)	-	2.38	0.86
Thai desserts	-	1 (0.38)	26 (10.00)	198 (76.15)	35 (13.46)	-	3.03	0.50
Unsweetened milk	-	10 (3.85)	63 (24.23)	151 (58.08)	36 (13.85)	-	2.82	0.71
Flavored milk	-	15 (5.77)	187 (71.92)	49 (18.85)	9 (3.46)	-	2.20	0.59
Soy milk	-	8 (3.08)	119 (45.77)	101 (38.85)	30 (11.54)	2 (0.77)	2.61	0.76

Food intake	Frequency						$\bar{x}$	S.D.
	None	1 /month	2 - 3 /month	1 - 3 /week	4 - 5 /week	> 5 /week		
Cold sweetened beverages	6 (2.31)	- -	17 (6.54)	36 (13.85)	114 (43.85)	87 (33.46)	3.97	1.05
Soft drinks	116 (44.62)	58 (22.31)	59 (22.69)	15 (5.77)	4 (1.54)	8 (3.08)	1.07	1.24
Hot drinks	8 (3.08)	2 (0.77)	8 (3.08)	45 (17.31)	98 (37.69)	99 (38.08)	4.00	1.12
Proteins								
Chicken	2 (0.77)	- -	- -	162 (62.31)	80 (30.77)	16 (6.15)	3.41	0.68
Pork Fillet	68 (26.15)	- -	- -	126 (48.46)	64 (24.62)	2 (0.77)	2.48	1.54
Pork belly	72 (27.69)	- -	43 (16.54)	99 (38.08)	46 (17.69)	- -	2.18	1.47
Fish	8 (3.08)	- -	25 (9.62)	47 (18.08)	180 (69.23)	- -	3.50	0.90
Sea-foods	2 (0.77)	28 (10.77)	122 (46.92)	47 (18.08)	61 (23.46)	-	2.53	0.99
Offal	- -	88 (33.85)	148 (56.92)	15 (5.77)	9 (3.46)	- -	1.79	0.70
Instant foods	- -	136 (52.31)	119 (45.77)	5 (1.92)	- -	-	1.50	0.54
Salted fish	- -	124 (47.69)	124 (47.69)	10 (3.85)	2 (0.77)	- -	1.58	0.61
Boiled egg	28 (10.77)	12 (4.62)	135 (51.92)	74 (28.46)	11 (4.23)	- -	2.11	0.96
Omelet	5 (1.92)	- -	27 (10.38)	167 (64.23)	61 (23.46)	- -	3.07	0.71
Beans	6 (2.78)	17 (7.87)	78 (36.11)	126 (58.33)	33 (15.28)	- -	2.63	0.87
Canned fish	- -	48 (18.46)	145 (55.77)	61 (23.46)	6 (2.31)	- -	2.10	0.71
Fats								
Soybean oil	- -	12 (4.62)	44 (16.92)	188 (72.31)	16 (6.15)	- -	2.80	0.61
Palm oil	64 (24.62)	75 (28.85)	64 (24.62)	38 (14.62)	19 (7.31)	- -	1.51	1.22
Coconut milk	23 (8.85)	24 (9.23)	51 (19.62)	146 (56.15)	16 (6.15)	- -	2.42	1.04
Fibers								
Fresh vegetables	- -	- -	36 (13.85)	110 (42.31)	113 (43.46)	1 (0.38)	3.30	0.71
Cooked vegetables	- -	- -	2 (0.77)	50 (19.23)	207 (79.62)	1 (0.38)	3.80	0.43
High-sugar fruits	- -	- -	24 (9.23)	137 (52.69)	99 (38.08)	- -	3.29	0.63
Low-sugar fruits	- -	- -	48 (18.46)	157 (60.38)	55 (21.15)	- -	3.03	0.63

Discussion

The study found that most of the patients with HTN were male, average aged 63.27 years (SD = 16.56). They had HTN for 4.55 years (SD = 1.79), and almost all of them were uncontrolled BP (> 140/90 mmHg). In addition, the study found the prevalence of obesity (BMI ≥ 30 kg/m²) was 13.10 %, relevant to Brazil's adult population, which has increased from 2.8 to 12.4 % in men and from 8.0 to 16.9 % in women (Shepherd, 2009). Overweight and obesity, characterized by excessive accumulation of adipose tissue in the body, represent a growing epidemiological problem worldwide and a great challenge to public health in several countries (Shepherd, 2009).

For lipid profile, this study showed the prevalence of dyslipidemia with either elevated LDL-C level ≥ 100 mg/dL (78.46 %), TC level ≥ 200 mg/dL (61.20 %), Triglyceride level ≥ 150 mg/dL (43.50 %), and lower HDL- C level < 40 mg/dL (41.90 %), respectively. Moreover, the patients with HTN still had risky lifestyles that caused high BP, such as smoking (38.50 %), drinking (9.20 %), and sedentary behavior 4 - 5 days/week (87.7 %). Patients with high BP who are smokers had a 1.50-fold increase in the risk of heart disease and an 8-fold increase in hypercholesterolemia, and a 2.28-fold increase in stroke risk among non-smokers with hypertension. Smoking cessation is important to reduce the risk of developing cardiovascular disease; persistent smoking behavior for a long time increases blood pressure. The nicotine in cigarettes will result in the walls of the blood vessels becoming stiffer (Franzen et al., 2018). This study indicated the high prevalence of sedentarism, which is a cause of concern because physical activity is a decisive factor in increasing HDL-C levels.

This study showed that the most frequent food intake was carbohydrates such as white rice, Thai noodle (Kanom jeans), dessert, and hot and cold sweetened beverages such as tea, coffee, and cocoa. Excessive consumption of carbohydrates causes too much energy, increases triglyceride levels, and dyslipidemia risk (Aekplakorn, 2015). Dehghan et al. (2017) recommended that high carbohydrate intake was significantly associated with an increased CVD risk. Likewise, (Lana et al., 2018) indicated that the BP and blood lipid levels among people who consumed sugar-free foods and beverages declined and stayed the healthy physical. In addition, this study found that most of the frequency consumptions in the protein group were fried fish, fried chicken, and omelets. The high fried food intake was associated with a high prevalence of HTN than non-fried food consumers, which was more apparent for samples with a higher BMI (Provido et al., 2020). It is at risk of developing high BP in patients with hypercholesterolemia; there is a greater risk of controlling high BP (Chinwong et al., 2016). The protein and fatty foods had higher energy than the other group, especially fried foods of pork belly and omelet. The menu of the rich food group of soybean oil and coconut milk, such as coconut curry, coconut milk soup, and coconut milk desserts, was positively correlated with LDL cholesterol levels (Nonsurat, 2020).

However, in the fruit and vegetable consumption, it was found that fresh vegetables such as lentils, cucumbers, and eggplants were associated with cholesterol foods (Chinwong et al., 2016). Most experts recommend that fiber be obtained through consuming foods because this form allows the consumption of many micronutrients and bioactive compounds in high fiber foods, which provide nutritional benefits. In addition, physicians recommend increasing the consumption of fiber foods to reduce obesity, cardiovascular disease, type 2 diabetes, and some cancers (Institute of Medicine, National Academy of Sciences, 2020). However, the study found that the participants ate fewer fruits and cooked vegetables such as morning glory, kale, and cabbage, consistent with (Nonsurat, 2020).

Cholesterol is a sterol compound, which the body can synthesize in the form of esters and fatty acids. Most cholesterol is made by the liver and the consumption of food (Jaceldo-Siegl et al., 2017) that is more than necessary until causing the level of cholesterol in the blood to be higher than usual, known as dyslipidemia and in the liver, kidneys, skin. The results of this research are consistent with those (Sinthavalai, 2015), showing that improper dietary habits lead to excess intake of nutrients than the body's needs, increase the risk of dyslipidemia, and lead to high BP. Since low carbohydrate and less fried food benefit maintaining BP levels and a lipid profile; therefore, hypertensive patients with DLP must be educated and encouraged to engage in low energy diet interventions.

A limitation of the present study was that the participants using medications to control dyslipidemia or other drugs that could interfere with the lipid profile were not excluded. However, it is essential to

investigate the prevalence of dyslipidemia in hypertensive patients to investigate the type of food intake for promoting preventive and curative lipid abnormalities for CVD. The results of this study are an essential analysis instrument for the creation or remodeling of food consumption programs to improve the health of the patients with HTN groups.

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