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Blood Cholesterol Levels of Family Members of Stroke Patients in Suburban Areas

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Abstract:

Objective: (1) To study dyslipidemia prevalence of members in stroke patients' families (2) To investigate factors related to dyslipidemia of members in stroke patients' families

Material and Methods: In this cross-sectional analytical study, after patients suffered from a stroke, the subjects were visited, interviewed through a questionnaire, and blood was drawn for testing, without fasting. This was in order to establish their cholesterol, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and random plasma glucose. This also included a physical checkup and risk assessment for cardiovascular disease. The data were collected from 120 subjects.

Results: Prevalence of high total cholesterol level was 34.2%, low HDL-C was 15.8%, high LDL-C level was 37.5%, and prevalence of dyslipidemia was 51.7%. The samples were 76 blood relatives and 44 non-blood relatives in the patients' families. The average LDL-C level was 147.12±39.06 and 31.7% of them suffered from Class 1 obesity, and 15.8% of them faced Class 2 obesity. According to Thai CV risk scores, the results revealed that 80.8% of the samples had a low risk, at <10.0%. The factors related to dyslipidemia were underlying diseases, and most groups of underlying diseases were hypertension and diabetes mellitus, respectively.

Conclusion: Prevalence of dyslipidemia in family Members of Stroke Patients was 51.7%. Detection of this abnormality is important to them. This would help in designing a prevention plan, as well as to raise awareness of stroke prevention in family members of stroke patients.

Keywords: cholesterol level, dyslipidemia, family members of stroke

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Introduction

Dyslipidemia is a risk factor for atherosclerosis, and leads to cerebrovascular diseases; such as stroke.[1,2] Strokes are now a serious, global public health problem, and the World Stroke Organization has reported that strokes are the second leading cause of death in the world.[3] In Thailand, strokes are also a major public health issue, and require a lot of resources for medical treatments.[4] It could be seen that one of the risk factors affecting stroke is dyslipidemia.[5–10] According to the experts of the Adult Treatment Panel as well as the National Cholesterol Education program in the United States, it has been suggested that people aged over 20 should have blood testing to check their lipid profiles; as most people with dyslipidemia have invisible symptoms.[11] Prevalence of dyslipidemia can be found in every age group including those of a young age group. In fact, a screening test for dyslipidemia should normally be considered for every age group.[12–19] The causes of dyslipidemia can be attributed to both genetic conditions and food consumption behavior of families.[20–24] Therefore, it is of interest to view the lipid profiles of other family members of stroke patient, as it may outline factors related to dyslipidemia in said people. This would help in designing a prevention plan, so as to decrease stroke incidence, as well as to raise awareness of stroke prevention in said family members in the future.

Material and Methods

This was an analytical cross-sectional study.

The samples were selected by purposive sampling. The population in this study was family members of stoke patients, living outside of Trang Municipality which lies 10 to 40 kilometer from central Trang, Mueang district and, Trang province; from 1 October 2018–31 December 2019. The selection of the samples were calculated by the following formula

$$n = \frac{Z^2 P(1-P)}{d^2}$$

$$n = \frac{1.96^2 \times 0.5 \times (1-0.5)}{(0.1)^2} \approx 97 \text{ samples}$$

n: Sample size

d: Precision for prevalence

P: Expected prevalence

Z: Z statistic for a level of confidence

In this study: Z=1.96, P=0.5, and d=0.1

The inclusion criteria were as follows:

1. A family member living at the same house as a suffering patient. He orshe either genetically-related or a non-blood member, and having been living in the same house as a patient for at least three months.

2. He/she was 20 years old or over.

3. He/she had normal perception, and could normally communicate with other people.

4. He/she was willing to participate in the study.

5. He/she was willing to have a blood test for a lipid profile and blood sugar.

The exclusion criteria were as follows:

1. A family member took cholesterol-lowering medication.

2. He/she had some following underlying diseases or conditions: biliary obstruction, nephrotic syndrome, hypo-thyroidism, hepatitis, and pregnancy.

3. He/she took some following medication: diuretic, cyclosporine, glucocorticoid, and amiodarone.

4. He/she had diabetes mellitus (DM) with poorly controlled disease.

5. He/she had hypertension (HT) with poorly controlled disease.

The samples for this study were family members of stoke patients; living outside of Trang Municipality,

Mueang District and, Trang Province, including 15 sub-districts; from 1 October 2018–31 December 2019. Samples were selected by the aforementioned criteria. After patients have suffered from stroke, the samples (members of each family) were visited, interviewed through a questionnaire, and drawn for direct method of blood testing, without fasting. This was to establish the following: cholesterol, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and random plasma glucose. We also conducted a physical checkup, and risk assessment of cardiovascular disease.

Research instrument

The questionnaire was divided into two parts:

Part 1: Interview of each sample.

Part 2: Blood testing results of each sample received from the International Organization for Standardization 15189-certified laboratory at Trang Hospital. The test for a serum level of total cholesterol, HDL-C, and LDL-C was conducted by the Direct Enzymatic Colorimetric method.[25,26]

Measurements and definitions

1. Blood relatives are the samples whom had lived in the same house as the stroke patients, and who were 1st degree and 2nd degree relations with the stroke patients.

2. Non-blood relatives are the samples who lived in the same house as the stroke patients, but were not related by blood.

3. Diagnostic level of hyperlipidemia were classified based on the guidelines of the Adult Treatment Panel III (ATP III) of the National Cholesterol Education Program (NCEP III).[11] The cutoff points for parameters were defined as follows:

Total cholesterol level (TC) <200 mg/dL: desirable

TC 200-239 mg/dL: borderline high

TC ≥240 mg/dL: high

HDL-C level <40 mg/dL: low

LDL-C level <100 mg/dL: optimal

LDL-C level ≥160 mg/dL: high

Dyslipidemia is a disorder level of at least one type of cholesterol: total cholesterol level ≥240 mg/dL, HDL-C level <40 mg/dL, LDL-C level ≥160 mg/dL.

4. DM, with poorly controlled disease, was defined as: having a previous diagnosis of diabetes by a physician, and having a Hemoglobin A1C (HbA1C) level >7.0% in the last three months, or without HbA1C testing.

5. HT with poorly controlled disease was defined as: the latest blood pressure of systolic blood pressure ≥140 millimeter of mercury (mmHg), or diastolic blood pressure ≥90 mmHg

6. Weight, including clothing was measured by electronic balance weights with 0.1 kilogram accuracy.

7. Standing height, without shoes, to the nearest 0.1 centimeter (cm) was measured by a wall-mounted height measure.

8. Waist circumference, taken around the body across the belly button; for which the criteria suitable for Asian people are 90 cm of male waist circumference, and 80 cm for females.[27]

9. Measurement of blood pressure is recommended for patients after have stopped drinking tea or coffee and smoking for 30 minutes, and have been at rest for 5 minutes. In addition, patients were required not to talk before or during the measurement. According to the methods of measurement, they placed an arm on the provided table, and an arm cuff was then used to record their heart rate. Blood pressure was measured by a mercury sphygmomanometer. Each patient's blood was pressure measured twice, with a 1-minute break in between. In case the readings of the 1st and 2nd systolic blood pressure were different by 5 mmHg or over, a 3rd measurement should be done, then the average of all readings were summed up.[28] According to hypertension diagnosis by The Seventh Report of the Joint National Committee on Prevention,

Detection, Evaluation, and Treatment of High Blood Pressure, hypertension is defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg.[27,28]

10. Body mass index (BMI) is calculated by weight in kilograms, divided by height in meters squared. Rates of BMI are as follows[28]:

BMI <18.5 kilogram per meter square (kg/m^2) means underweight.

BMI = 18.5–22.90 kg/m^2 means a healthy weight.

BMI = 23–24.90 kg/m^2 means overweight.

BMI = 25–29.90 kg/m^2 means Class 1 obesity.

BMI ≥30 kg/m^2 means Class 2 obesity.

11. The 10-year Thai Cardiovascular (CV) Risk Score indicates risk factors of cardiovascular disease as future risks for Thai people. The results can estimate risks of illness, or death caused by coronary artery disease and stroke in a ten-year time frame. This score was created due to the study of risk factors affecting coronary artery disease, and stroke in Thai people under the project of the Electricity Generating Authority of Thailand Study conducted over 20 years; including looking for five risk levels of myocardial infarction, and fatal and non-fatal strokes over a ten-year time frame.[29]

<10.0%: low

10.0-<20.0%: moderate

20.0-<30.0%: high

30.0-<40.0%: very high

≥40.0%: harmfully high

12. Physical activities are defined as: physical movements using body energy. These activities are divided into three levels by intensity.[30]

A high level: vigorous physical activities for ≥3 days/week, and total metabolic equivalent (MET) minutes per week ≥1,500, or vigorous or moderate physical activities for ≥7 days/week, and MET minutes per week ≥3,000

A moderate level: moderate to high physical activities and vigorous activities for ≥3 days/week, and ≥20 minutes/day, or moderate physical activities, or walking for ≥5 days/week and at least 30 minutes/day, or vigorous or moderate activities or walking for ≥5 days/week, and total MET minutes per week ≥600.

A low level: below the average of moderate and high physical activities.

13. Knowledge scores of stroke were marked via a 20-question questionnaire. The questionnaire was designed to be a 3-choice survey item, which were scored by 1 point for each correct answer and 0 points for incorrect or unsure answers. Based on groups, the scores were separated into 80.0% for a high level of stroke knowledge, 60.0-79.0% for a moderate level and less than 60.0% for a low level. This questionnaire was checked for content validity by three experts, and reliability by the method of Cronbach's Alpha Coefficient with a value of 0.82.

14. Routine food means some food which is always eaten at least three times per week.

Salty food means some food containing more than one teaspoon in a day.

Sweet food means some food containing more than six teaspoons in a day.

Fatty meat means some read meat mixed with white meat.

The data were analyzed by Stata program, so as to find out the following kinds of statistics.

1. Descriptive statistics: frequency distribution and, percentage.

2. Inferential statistics: the relationships between factors and lipid profiles of other members in stroke patient families, by chi-square test.

3. Descriptions of directions and relationships, by multivariate logistic regression analysis.

Results

There were 67 families of stroke patients taking part in this research. The samples were 120 family members, 1-2 members in each family. Details: the samples were 76 blood relatives and 44 non-blood relatives in the patients' families.

Characteristics of the study population

1. General Information (Table 1 and 2)

There were 120 subjects in total: 31 males and 89 females. There were 54 female and 22 male blood relatives, counted as 45.0% and 18.3%, respectively. The average age was 48.52±14.57 years. The largest number of educational background was primary school level (49.2%), followed by secondary school level (19.2%), and high school level (15.0%). A average incomes of 10,000-15,000 Baht/month made up 40.8%, followed by less than 5,000 Baht/month (38.3%). Most (75.8%) of the samples had no underlying diseases. Twenty-nine of the samples (24.2%) had some underlying diseases, divided into 20 samples (16.7%) with HT; 7 (5.8%) with DM type 2, one with chronic obstructive pulmonary disease, and one with Epilepsy.

2. Information about health behavior (Table 1)

Overall, the blood relatives had never smoked or consumed alcohol was 50.0%. In terms of annual medical checkups, 38.3% of the samples had never had any annual medical checkup, followed by 25.8% of those who had an annual medical checkup, whilst 21.7% of those went for medical checkup when experiencing some type of symptom, respectively. For the most part, their physical activities were at a low level, 72.5%. Regarding knowledge of stroke, it was found that 54.1% of the samples had a high level of stroke knowledge, followed by 27.6% at a moderate level and 18.3% at a low level, respectively. In addition, the regular food consumed by the subjects were 77.5% of both vegetables and fish, 65.0% of fruit, 46.7% of coffee/tea, 32.5% of fatty meats, 23.3% of high-fat food and food with coconut milk, 18.0% of salty food, and 11.7% of sweet food. When the blood relatives and non-blood relatives groups were compared, there were statistically significant differences at a p-value<0.05 of age group and educational. Trang Hospital was the most frequent place visited when feeling unwell, followed by subdistrict health centers and private clinics; 31.7%, 21.7%, and 20.0%, respectively.

3. Medical checkup information (Table 1 and 2)

The average level of systolic blood pressure was 130.49±17.62 mmHg. Most (70.0%) of their systolic blood pressure was <140 mmHg, a normal level; additionally, the average level of diastolic blood pressure was 80.88± 12.72 mmHg. Their diastolic blood pressure at a normal level was <90 mmHg. The average waist circumstance was 87.21±11.54 cm. Average BMI was 25.65±4.22 kg/m^2. Therefore, it was indicated that 27.5% of the samples had a normal BMI level, 31.7% of them suffered from Class 1 obesity, and 15.8% of them faced Class 2 obesity; including risks of cardiovascular disease. According to Thai CV risk scores, the results revealed that 80.8% of the samples had a low risk, at <10.0%.

Laboratory Results and preihovalence of dyslipidemia (Table 3 and 4)

Average, total cholesterol levels were 224.28± 48.20 (Table 2). From the samples, the prevalence of high total cholesterol (≥240 mg/dL) was 36.7%; the prevalence of borderline-high total cholesterol (200-239 mg/dL) was 29.2%; the prevalence of desirable total cholesterol (<200 mg/dL) was 34.2%.

Average HDL-C was 51.64±12.56 (Table 2). From the samples, the prevalence of low HDL-C (a HDL-C level lower than 40 mg/dL) was 15.8%. Average LDL-C was 147.12±39.06 (Table 2). From the samples, the prevalence of high LDL-C (≥160 mg/dL) was 37.5%. The prevalence of the optimal LDL-C level was 11.7%, and the prevalence of 100-159 mg/dL LDL-C was 50.8%.

Table 1 Characteristics of the study population

Variable	Family members of stroke patients		
	Blood relatives (n=76) Number (%)	Non blood relatives (n=44) Number (%)	p-value
Sex			
Female	54 (45.0)	35 (29.2)	0.306
Male	22 (18.3%)	9 (7.5)	
Age group (years)			
<35	21 (17.5)	3 (2.5)	0.009*
35-60	44 (36.7)	28 (23.3)	
>60	11 (9.2)	13 (10.8)	
Education			
No education	2 (1.7)	1 (0.8)	0.041*
Primary school level	30 (25.0)	29 (24.2)	
Secondary school level	14 (11.7)	4 (3.3)	
High school level	17 (14.2)	6 (5.0)	
Diploma	8 (6.7)	0 (0.0)	
Bachelor's Degree	5 (4.2)	4 (3.3)	
Occupational			
Employee	15 (12.5)	9 (7.5)	0.337
Trading career	14 (11.7)	6 (5.0)	
Farmer	32 (26.7)	13 (10.8)	
Worked at home	14 (11.7)	15 (12.5)	
Civil servant	1 (0.8)	1 (0.8)	
Income (Baht/year)			
<5,000	26 (21.7)	20 (16.7)	0.321
5,000-10,000	13 (10.8)	7 (5.8)	
10,001-15,000	35 (29.2)	14 (11.7)	
>15,000	2 (1.7)	3 (2.5)	
Underlying disease			
Yes	19 (15.8)	10 (8.3)	0.828
No	57 (47.5)	34 (28.3)	
Systolic blood pressure (mmHg)			
<140	52 (43.3)	32 (26.7)	0.836
140-159	21 (17.5)	10 (8.3)	
≥160	3 (2.5)	2 (1.7)	
Diastolic blood pressure (mmHg)			
<90	57 (47.5)	33 (27.5)	0.749
90-99	13 (10.8)	6 (5.0)	
≥100	6 (5.0)	5 (4.2)	
BMI			
<18.5 kg/m^2: underweight	2 (1.7)	1 (0.8)	0.805
18.5-22.9 kg/m^2: healthy weight	19 (15.8)	14 (11.7)	
23-24.9 kg/m^2: overweight	18 (15.0)	9 (7.5)	
25-29.90 kg/m^2: Class 1 obesity	23 (19.2)	15 (12.5)	
≥30 kg/m^2: Class 2 obesity	14 (11.7)	5 (4.2)	
Random plasma glucose (mg%)			
<180	74 (61.7)	43 (35.8)	0.903
≥180	2 (1.7)	1 (0.8)	
Regular food consumed by the subjects			
High fat food and food with coconut	18 (15.0)	10 (8.3)	0.905
Fatty meats	29 (24.2)	10 (8.3)	0.082
Sweet food	10 (8.3)	4 (3.3)	0.504
Salty food	13 (10.8)	5 (6.6)	0.396

Table 1 (continued)

Variable	Family members of stroke patients		
	Blood relatives (n=76) Number (%)	Non blood relatives (n=44) Number (%)	p-value
Coffee/tea	39 (32.5)	17 (14.2)	0.180
Dessert	14 (11.7)	9 (7.5)	0.785
Fish	59 (49.2)	34 (28.3)	0.964
Fruit	49 (40.8)	29 (24.2)	0.876
Vegetables	60 (50.0)	33 (27.5)	0.618
Physical activities			
A high level	5 (4.2)	2 (1.7)	0.734
A moderate level	15 (12.5)	11 (9.2)	
A low level	56 (46.7)	31 (25.8)	
Current smoking state (%)			
Never	60 (50.0)	38 (31.7)	0.312
Past or current	16 (13.3)	6 (5.0)	
Current drinking state (%)			
Never	60 (50.0)	38 (31.7)	0.312
Past or current	16 (13.3)	6 (5.0)	
Annual medical checkup			
Never	31 (25.8)	15 (12.5)	0.636
Checkup in case of some disorders	17 (14.2)	9 (7.5)	
Once a year	18 (15.0)	13 (10.8)	
2 times/year	2 (1.7)	0	
>2 times/year	8 (6.7)	7 (5.8)	
Knowledge scores of stroke			
High level	12 (10.0)	10 (8.3)	0.520
Moderate level	23 (19.2)	10 (8.3)	
Low level	41 (34.2)	24 (20.0)	
Thai CV risk score (%)			
<10	64 (53.3)	33 (27.5)	0.067
10-<20	6 (5.0)	6 (5.0)	
20-<30	2 (1.7)	5 (4.2)	
≥30	4 (3.3)	0 (0.0)	

*Chi-square test

Note: Data are expressed as means±S.D. or n (%).

BMI=body mass index, TC=total cholesterol, HDL-C=high-density lipoprotein cholesterol, LDL-C=low-density lipoprotein cholesterol, SBP=systolic blood preesure, DBP=dystolic blood preesure, FBG=fasting blood glucose, Thai CV risk score=Thai cardiovascular risk score

The prevalence of dyslipidemia calculated from at least one type of an unusual level of cholesterol (LDL-C ≥160 mg/dL or HDL-C <40 mg/dL or total cholesterol ≥240 mg/dL) was 51.7%. In terms of random plasma glucose, average blood sugar was 104.43±36.88 (Table 2).

Table 2 Mean of the study population

Variable	Mean±S.D.
Average age (years)	48.52±14.57
Systolic blood pressure (mmHg)	130.49±17.62
Diastolic blood pressure (mmHg)	80.88±12.72
Waist circumstance (cm)	87.21±11.54
Body mass index (kg/m^2)	25.65±4.22
Random blood glucose (mg/dL)	104.43±36.88
Total cholesterol (mg/dL)	224.28±48.20
<240	194.83±29.76
≥240	275.14±26.58
HDL-C (mg/dL)	51.64±12.56
<40	35.63±3.02
≥40	54.65±11.32
LDL-C (mg/dL)	147.12±39.06
<160	122.33±23.66
≥160	188.42±19.85

mmHg=millimeters of mercury, cm=centimeter, BMI=body mass index, kg/m^2=kilograms divided by height in meters squared, mg/dL=milligram per deciliter, HDL-C=high-density lipoprotein cholesterol, LDL-C=high density lipoprotein cholesterol

Table 3 Laboratories result of the study population

Variable	Family members of stroke patients (n=120)		
	Blood relatives (n=76) Number (%)	Non-blood relatives (n=44) Number (%)	p-value
Cholesterol (mg/dL)			
<200	26 (21.6)	15 (12.5)	0.733
200-239	23 (19.2)	12 (10.0)	
≥240	27 (22.5)	17 (14.2)	
HDL-C (mg/dL)			
<40	10 (8.3)	9 (7.5)	0.291
≥40	66 (55.0)	35 (29.2)	
LDL-C (mg/dL)			
<100	8 (6.7)	6 (5.0)	0.845
100-159	40 (33.3)	21 (17.5)	
≥160	28 (23.3)	17 (14.2)	
Dyslipidemia			
Yes	35 (29.2)	27 (22.5)	0.106
No	41 (34.2)	17 (14.2)	

mg/dL=milligram per deciliter, HDL-C=high-density lipoprotein cholesterol, LDL-C=high density lipoprotein cholesterol

Table 4 Prevalence of blood cholesterol level

Variable	Prevalence		
	Blood relatives (n=76)	Non-blood relatives (n=44)	Family members of stroke (n=120)
Total Cholesterol (mg/dL)			
<200	34.2%	34.1%	34.2%
200-239	30.3%	27.3%	29.2%
≥240	35.5%	36.6%	36.7%
HDL-C (mg/dL)			
<40	13.1%	20.5%	15.8%
≥40	86.8%	79.5%	84.2%
LDL-C (mg/dL)			
<100	10.5%	13.6%	11.7%
100-159	52.6%	47.7%	50.8%
≥160	36.8%	38.6.%	37.5%
Dyslipidemia			
Yes	46.1%	61.4%	51.7%
No	53.9%	38.6%	48.3%

mmHg=millimeters of mercury, cm=centimeter, BMI=body mass index, Kg/m^2=kilograms divided by height in meters squared, mg/dL=milligram per deciliter, HDL-C=high-density lipoprotein cholesterol, LDL-C=high density lipoprotein cholesterol

Dyslipidemia and risk factors (Table 5)

In this study, out of 120 patients, there were 62 patients with dyslipidemia (51.7%) and 58 patients without dyslipidemia. The participants of both groups liked to consume the same foods: vegetables and fish. The percentage of dyslipidemia people who preferred fish, vegetables, and fruits was 77.5, 77.4, and 61.3, respectively. These results were not significantly different from the results of people with normal lipid levels, calculated as 77.5%, 77.5%, and 69.0%, respectively. Most of the dyslipidemia samples did a few physical activities (74.2%). Likewise, most of the normal-cholesterol samples performed a few physical activities (70.7%). Like normal-cholesterol participants, most of dyslipidemia participants had never consume alcohol or smoked. In terms of their annual medical checkup, 45.2% of the dyslipidemia subjects

Table 5 Dyslipidemia and risk factors

Characteristic	Dyslipidemia (n=62)		Non-dyslipidemia (n=58)	
	Relatives (n=35) Number (%)	Not relatives (n=27) Number (%)	Relatives (n=41) Number (%)	Not relatives (n=17) Number (%)
The regular foods consumed by the subjects				
High-fat food and food with coconut milk	6 (9.7)	7 (11.3)	12 (20.7)	3 (5.2)
Fatty meat	11 (17.7)	5 (8.1)	18 (31.0)	5 (8.6)
Sweet foods	4 (6.5)	1 (1.6)	6 (10.3)	3 (5.2)
Salty foods	6 (9.7)	3 (4.8)	7 (12.1)	2 (3.4)
Coffee/tea	17 (27.4)	10 (16.1)	22 (37.9)	7 (12.1)
Dessert	8 (12.9)	4 (6.5)	6 (10.3)	5 (8.6)
Fish	28 (45.2)	20 (32.3)	31 (53.4)	14 (24.1)
Vegetables	29 (46.8)	19 (30.6)	31 (53.4)	14 (24.1)
Fruit	21 (33.9)	17 (27.4)	28 (48.3)	12 (20.7)
Physical activities				
A high level	3 (4.8)	1 (1.6)	2 (3.4)	1 (1.7)
A moderate level	8 (12.9)	4 (6.5)	7 (12.1)	7 (12.1)
A low level	24 (38.7)	22 (35.5)	32 (55.2)	9 (15.5)
Tobacco use				
Never	26 (41.9)	23 (37.1)	34 (58.6)	15 (25.9)
Past or current	9 (14.5)	4 (6.5)	7 (12.1)	2 (3.4)
Alcohol use				
Never	25 (40.3)	23 (37.1)	35 (60.3)	15 (25.9)
Past or current	10 (16.1)	4 (6.5)	6 (10.3)	2 (3.4)
annual medical checkup				
Never	15 (24.2)	13 (21.0)	16 (27.6)	2 (3.4)
Checkup in case of some disorders	1 0(16.1)	4 (6.5)	7 (12.1)	5 (8.6)
Once a year	5 (8.1)	7 (11.3)	13 (22.4)	6 (10.3)
2 times/year	0 (0.0)	0 (0.0)	2 (3.4)	0 (0.0)
>2 times/year	5 (8.1)	3 (4.8)	3 (5.2)	4 (6.9)
Knowledge scores of stroke				
High level	8 (12.9)	5 (8.1)	4 (6.9)	5 (8.6)
Moderate level	9 (14.5)	6 (9.7)	14 (24.1)	4 (6.9)
Low level	18 (29.0)	16 (25.8)	23 (39.7)	8 (9.1)
BMI				
<18.5: underweight	0 (0.0)	0 (0.0)	2 (3.4)	1 (1.7)
18.5-22.9: healthy weight	11 (17.7)	10 (16.1)	8 (13.8)	4 (6.9)
23-24.9: overweight	8 (12.9)	6 (9.7)	10 (17.2)	3 (5.2)
25-29.90: Class 1 obesity	11 (17.7)	8 (12.9)	12 (20.7)	7 (12.1)
≥30: Class 2 obesity	5 (8.1)	3 (4.8)	9 (15.5)	2 (3.4)
Thai Cardiovascular risk score				
<10%: low	28 (45.2)	19 (30.6)	36 (62.1)	14 (24.1)
10-<20%: moderate	4 (6.5)	5 (8.1)	2 (3.4)	1 (1.7)
20-<30%: high	1 (1.6)	3 (4.8)	1 (1.7)	2 (3.4)
30-<40%: very high	2 (3.2)	0 (0.0)	2 (3.4)	0 (0.0)
>40%: harmfully high	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

BMI=body mass index

had never gone for an annual medical checkup, followed by 22.6% of those who went for checkups in case of some disorder and 19.4% of those who went once a year. In the group of normal-cholesterol subjects, 32.8% of them had a checkup once a year, 31.0% of them had never done any checkup, and 20.7% of them went for a checkup if there were some symptoms of illness. In regards to knowledge of stoke and cardiovascular disease, there were no statistically significant differences between both groups. According to the Thai CV risk scores, the participants in both groups had a lot of knowledge as well as, less possibility of cardiovascular disease. Regarding BMI, most of the subjects, in both groups, had a healthy weight. Only 22.6% of dyslipidemia subjects risked Class 1 obesity, while 30.7% risked Class 2 obesity. In normal-cholesterol subjects 22.4% were overweight, 30.7% had Class 1 obesity, and 13.0% had Class 2 obesity. Interestingly, there were more dyslipidemia subjects maintaining a healthy weight than the normal-cholesterol subjects, 33.9% and 20.7%, respectively. There was the highest number of normal-cholesterol subjects having Class 1 obesity while there was the largest number of dyslipidemia subjects being of a healthy weight.

Factors related to dyslipidemia (Table 6)

When the factors related to the dyslipidemia people (cholesterol ≥240 mg/dL or HDL-C <40 mg/dL or LDL-C ≥160 mg/dL) were determined by the multivariate model, it was found that the factors were underlying diseases. The patients with some underlying diseases were more likely to have dyslipidemia than those patients without underlying disease (adjusted odd ratio=6.13, 95% CI=2.27-16.55).

Table 6 Factors related to dyslipidemia

Variables	Dyslipidemia		
	Odds ratio	p-value	95% CI
Gender			
Male	1.00		
Female	0.45	0.592	0.03-8.12
Age (years)			
<35	1.00		
30-60	0.99	0.994	0.43-2.26
>60	1.44	0.441	0.56-3.69
Current smoking state			
No	1.00		
Yes	0.61	0.79	0.01-25.07
Current drinking state			
No	1.00		
Yes	2.79	0.497	0.14-54.04
Underlying disease			
No	1.00		
Yes	6.13	0.000*	2.27-16.55
Educational level			
No education/Primary school	1.00		
High school/Bachelor's degree	0.87	0.724	0.42-1.79
BMI			
Normal BMI	1.00		
Abnormal BMI	0.68	0.340	0.30-1.49

Table 6 (continued)

Variables	Dyslipidemia		
	Odds ratio	p-value	95% CI
Waist circumstance (cm)			
<90 (male)/80 (female)	1.00		
≥90 (male)/80 (female)	8.05	0.064	0.89–73.17
Systolic blood pressure (mmHg)			
<140	1.00		
140–159	1.15	0.728	0.50–2.64
≥160	0.63	0.629	0.10–4.00
Diastolic blood pressure (mmHg)			
<90	1.00		
90–99	0.94	0.904	0.35–2.53
≥100	4.70	0.056	0.96–22.99
Physical activities			
A high level	1.00		
A moderate level	0.20	0.319	0.00–4.72
A low level	0.26	0.702	0.03–11.15
Relatives suffered from stroke			
No	1.00		
Yes	2.37	0.537	0.25–1.14
Annual medical checkup			
Never/checkup in case of some disorders	1.00		
Once a year/≥2 times/year	0.73	0.607	0.22– 2.37
Knowledge scores of stroke			
High level	1.00		
Moderate level	0.51	0.501	0.07–3.58
Low level	1.26	0.776	0.25–6.28
Thai cardiovascular risk score (%)			
<10			
≥10	1.06	0.952	0.14–7.86
Regular food consumed by the subjects			
High-fat food and food with coconut milk	0.33	0.272	0.05–2.34
Fatty meats	0.53	0.486	0.09–3.18
Sweet food	0.70	0.774	0.06–7.88
Salty food	0.85	0.869	0.12–5.97
Coffee/tea	0.85	0.815	0.22–3.33
Dessert	1.21	0.825	0.23–6.42
Fish	0.47	0.503	0.05–4.33
Fruit	0.34	0.235	0.06–2.01
Vegetables	2.94	0.312	0.36–23.72

CI=confidence interval, mmHg=millimeters of mercury, BMI=body mass index

Discussion

Currently, there have been few of studies on cholesterol levels of family members of stroke patients. The studies of dyslipidemia in Thailand were different according to patients' age ranges and characteristics. For example, a study in 2000 revealed that 21.1% of working adults had dyslipidemia.[31] In contrast, when male elderly people were diagnosed, the prevalence of total cholesterol at >200 mg/dL and LDL ≥160 mg/dL was 87.5% and 55.4%, respectively. For female elderly people, the prevalence of total cholesterol at ≥200 mg/dL and LDL ≥160 mg/dL was 100.0% and 80%, respectively.[32] Therefore, the aforementioned results were different from this study results due to the smaller number of working adults of study as above. In fact, epidemiology of dyslipidemia in Thailand was high total cholesterol, high LDL-C, Low HDL-C and high triglyceride.[33] In this study, although high total cholesterol and high LDL-C were similarly found, only 15.8% of low HDL-C was found. HDL-C at ≥40 mg/dL was 84.2% in this research. Regarding the study by Suchat et al.[34] during 2004-2006 (Thai Epidemiologic study), it was found that the prevalence of hyperlipidemia (fasting cholesterol ≥200 mg/dL) in stroke patients and non-stroke patients was 77.1% and 65.7%, respectively. The results of the non-stroke patients were similar to the samples of this research-65.8% of patients with hyperlipidemia (cholesterol ≥200 mg/dL).

According to Choowong et al. (2005)[35], it was claimed that prevalence of hypercholesterolemia (≥200 mg/dL), low HDL-C (<40 mg/dL), and high LDL-C (≥130 mg/dL) was found in 31.0%, 14.0%, and 20.0% of citizens who lived in rural areas of Khon Kaen. The prevalence of low HDL in the abovementioned research and in this research was similar. On the other hand, the prevalence of hypercholesterolemia and high LDL found in this study was higher. Referring to the study by Wichai et al. (2009)[33], 19,021 samples over-20-year-old patients, were looked at, and the results showed that the prevalence of high LDL-C and low HDL-C was 29.6% and 47.1%, respectively. Differently, the prevalence of high LDL-C in this study was higher (37.5%) and the prevalence of low HDL-C was lower (15.8%). In terms of dyslipidemia, this study results were related to the study by Pornpimon et al. (2017)[36]. The samples were 44 patients at the age of 35-60 who lived in Khon Kaen. The prevalence of LDL-C at ≥130 mg/dL was 41.2%, but it was higher in this study-75 patients with dyslipidemia (62.5%) compared with the previous studies showed that trends in prevalence of lipid abnormality was increased likely due to national advancement, convenient transportation, and information access, which may contrite and be consequences of dietary changes.[31-39] Nevertheless, all the mentioned comparisons were inconclusive since the number of samples in each research were not alike. It was suggested that there should be more samples in this research. The oversea study of the prevalence of dyslipidemia among stroke patients by Iyad et al. (2015)[40] in Palestine revealed that 28.6% of patients had high LDL-C (≥130 mg/dL), 17.1% had high total cholesterol (≥ 200 mg/dL), and 61.3% had low HDL (<40 mg/dL). It could be seen in this study when compared to Iyad et al. (2015) that the prevalence of high cholesterol and high LDL-C was higher and the prevalence of low HDL-C was lower. Regarding the prevalence of LDL-C, even though the prevalence of high LDL-C was not high (37.5%), there were 106 (88.3%) out of 120 patients who had higher than optimal LDL-C (≥100 mg/dL).

This finding is alarming that build the awareness of this risk group is necessary because the highest number of subjects with dyslipidemia were those that had never undergone a medical checkup, thus appropriate screening, checkup and therapeutic lifestyle change programs for high-risk groups must be scaled up. The factor related to dyslipidemia was underlying diseases. Hypertension (16.7%) was the highest proportion in this

study, followed by diabetes mellitus (5.8%). The chronic diseases were likely to affect dyslipidemia.

In terms of stroke knowledge, there were no statistically significant differences between blood relatives and non-blood relative samples, nor between dyslipidemia and non-dyslipidemia samples. The participants in every group mostly knew a lot of stroke information; nevertheless, having a lot of stroke knowledge could not predict that they would not have dyslipidemia. Concerning risks of cardiovascular disease in the next ten years, via the Thai CV risk score, although the samples of this study had low physical activities and high BMI which was considered as obesity, the assessment results indicated that most of the samples were ranked as low risk possibly due to younger ages (adults), in that they are at a lower risk level than their elderly counrerparts. According to the data of the National Health Survey in the Thai population, the prevalence of hypercholesterolemia increased with age from below 10.0% in young adults, to about 25.0% in the elderly.[32] In addition, most of the samples in this study did not smoke, and their waist circumference and systolic blood pressure were not above the criteria; hence, the CV risks were low. Prevalence of blood relatives and non-blood relatives of stroke patient were no difference; they are the same family so regular food preferences, there were no statistically significant differences between blood relatives and non-blood relatives subjects, with a similar percentage having the same dietary habits. Even though the samples had knowledge in regards to health problems related to high-fat food;, including food with coconut milk, fatty meats, and tea/coffee, dyslipidemia was still a factor for them. However, there was a high percentage of fish, vegetable, and fruit eaten, and a low percentage of salty/sweet food consumed in these two groups. Therefore, there was high prevalence of dyslipidemia in the family members of stroke patients, including conditions of overweight and prehypertension. The causes of dyslipidemia could be genetic conditions, and consumption behaviors of each family. This could have an influence on health behaviors. In consequence, care for stroke patients should not only include medical treatments, but primary prevention, secondary prevention coupled with, health promotion should also be provided to patients' relatives and family members.

Conclusion

Most family members of stroke patients in this study were of a working age; they had no underlying diseases, and were blood relatives of the stroke patients, but had a low level of physical activities. Most samples did not drink alcohol or smoke, additionally most did not prefer to have regular medical checkups, or just preferred to visit a medical center only when they were feeling unwell. Most of them had a high level of stroke knowledge, apart from diets containing high-fat food, fatty meats, food with coconut milk, and tea/coffee. Also most liked to eat fish, vegetables and fruit. Furthermore, most of them were overweight, and had prehypertension. Prevalence of dyslipidemia in family Members of Stroke Patients was 51.7%. Detection of this abnormality is important to them. This would help in designing a prevention plan, as well as to raise awareness of stroke prevention in family members of stroke patients.

Conflict of interest

There were no potential conflicts of interest to declare.

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