The Prevalence of Dyslipidemia among a Rural Thai Population in the Nakhon Si Thammarat Province

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Objective: *To evaluate the prevalence and risk factors for dyslipidemia among a rural Thai population in the Nakhon Si Thammarat province, Southern Thailand.*

Material and Method: *Following a 12-hour fast, blood was drawn to assess the total cholesterol (TC), triglyceride (TG), high-density lipoprotein (HDL-C), and low-density lipoprotein (LDL-C) cholesterol levels. Dyslipidemia was defined according to the NCEP ATP III guidelines. The demographic and anthropometric data were recorded.*

Results: *Three hundred two subjects (68 men and 234 women) between the ages of 19 and 84 years old were enrolled in the present study. The mean levels of TC, TG, LDL-C, and HDL-C were 207.57±45.66, 122.54±71.54, 125.36±37.22, and 56.96±13.39 mg/dl, respectively. The prevalence of hypercholesterolemia (≥200 mg/dl), hypertriglyceridemia (≥150 mg/dl), high LDL-C (≥130 mg/dl), and low HDL-C (<40 mg/dl) was 56.62%, 26.49%, 43.05%, and 6.95%, respectively. The prevalence of dyslipidemia increased with age. The statistically significant related factors of dyslipidemia, including age, female gender, waist circumference, obesity, diabetes mellitus, smoker, current alcohol consumption, and postmenopausal women, were increased ($p<0.05$).*

Conclusion: *The prevalence of dyslipidemia, based primarily on the presence of hypercholesterolemia and high LDL-C, was elevated in this population. Development of a policy to prevent dyslipidemia is urgently needed.*

Keywords: *Dyslipidemia, Nakhon Si Thammarat, Prevalence, Thailand*

J Med Assoc Thai 2013; 96 (8): 992-1000
Full text. e-Journal: *http://jmat.mat.or.th*

Cardiovascular disease (CVD) is the leading cause of death worldwide. In 2008, the World Health Organization (WHO) reported that 17 million people (48%) died due to CVD. The mortality rate of CVD will approach 23.6 million deaths by the year 2030[1]. The burden of CVD is rapidly growing in low- and middle-income countries because of an increased assimilation of the westernization diet, life changes, and rapid unplanned urbanization[1]. In Thailand, CVD is one of the three causes of death, and the mortality rates from CVD for all ages are 343:100,000 for Thai males and 280:100,000 for Thai females[2]. There are several cardiovascular risk factors that included dyslipidemia, hypertension, insulin resistance, glucose intolerance, abdominal obesity, and microalbuminuria[3]. The most potent factor is dyslipidemia that results from environmental factors (e.g., smoking, lack of exercise, psychological stress, diet, and alcohol consumption) as well as genetic factors (e.g., *LDLR*, *apoB*, *PCSK9*, *CETP*, *apoE*, *MTHFR*, *PON*, and *eNOS*)[4,5].

Early diagnosis of dyslipidemia in affected individuals is essential because CVD can be prevented by improving lifestyle, controlling diet, or receiving pharmacological therapy. Early treatment of dyslipidemia can substantially reduce cardiovascular risk and the rate of morbidity and mortality[6,7]. Although the prevalence of dyslipidemia among rural Thai populations has been studied[8-15], the data in Southern Thailand are rare. The aim of the present study was to evaluate the prevalence of dyslipidemia and the associated risk factors among a rural Thai population in the Nakhon Si Thammarat province, Southern Thailand.

Material and Method

Study population and data collection

The present survey was conducted in the Nakhon Si Thammarat province, which lies 780 km south of Bangkok, between August and November 2012. The subjects included 68 men and 234 women between 19 and 84 years of age were randomly

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recruited from two districts (Sichon and Cha-uat) of the Nakhon Si Thammarat province. They were interviewed to document their medical history, family history, and lifestyle by a questionnaire. The project was approved by the Ethics Committee of Walailak University (Protocol number 12/018), and all of the subjects provided written informed consent before enrollment in the present study. The measured anthropometric data included body weight, height, and blood pressure. Body mass index (BMI) was calculated as body weight divided by height squared (kg/m^2).

Specimen collection and laboratory analysis

Blood samples were collected into tubes after the subjects had fasted for 12 hours. Serum and plasma were isolated by centrifugation at 3,000 rpm for five minutes at 4°C and were analyzed within 48 hours if kept on ice or within three months if stored at -20°C. All biochemical measurements were carried out at the Clinical Chemistry Laboratory, School of Allied Health Science and Public Health, Walailak University. The fasting plasma glucose (FPG) level was measured by the glucose oxidase method. The levels of total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), and triglycerides (TG) were assayed by an enzymatic colorimetric method. All of the testing was performed using the Konelab analyzer (KONELAB 20, Tokyo, Japan). Low-density lipoprotein cholesterol (LDL-C) was calculated by the Friedewald formula in the serum specimens with a TG value <400 mg/dl.

Definition of variables

According to the World Health Organization guidelines for Asian populations, an overweight classification for men and women is defined as a BMI between 23 and 24.9 kg/m^2, obesity I for men and women is defined as a BMI ≥25 kg/m^2, whereas obesity II for men and women is defined as a BMI ≥30 kg/m^2. Central obesity is defined as a waist circumference >90 cm in men and ≥80 cm in women[16]. Diabetes was diagnosed either by a history of established diabetes or a fasting plasma glucose level of ≥126 mg/dl[17]. Lipid disorders were defined according to the Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report[18]. High TC was defined as TC ≥200 mg/dl, and high TG was defined as a serum TG level ≥150 mg/dl. High LDL-C was defined as serum LDL-C ≥130 mg/dl. Low HDL-C was defined as serum HDL-C <40 mg/dl. The subjects were considered hypertensive if their systolic blood pressure exceeded 140 mmHg and/or their diastolic pressure exceeded 90 mmHg or the subjects had a history of hypertension. In terms of smoking habits, the patients were classified as smokers, or non-smokers. Alcohol consumption was recorded as current alcohol consumption, former alcohol consumption or no history of alcohol consumption. Physical activity was defined as exercising strenuously for at least 30 minutes for three or more days per week.

Statistical analysis

Statistical analysis was carried out using SPSS for Windows version 17 (SPSS Inc., Chicago, Illinois, USA). The results are presented as the mean ± standard deviation (mean ± SD) and percentages. Differences in lipid levels were determined by the two-tailed unpaired Student's t-test for normally distributed parameters and the Mann-Whitney U test for non-parametric. A p-value of less than 0.05 was considered significant. Data normality was determined by the one-sample Kolmogorov-Smirnov test. A Chi-square test (X^2) was performed to compare the quantitative data and prevalence of dyslipidemia. A p-value of less than 0.05 was considered statistical significance.

Results

Participants' characteristics

Three hundred two subjects participated, 22.52% were men and 77.48% were women. The age of the subjects ranged from 19 to 84 years old with a mean of 58.37±15.03 years old in men and 52.53±12.83 years old in women. The men were significantly older (p = 0.002) and had higher diastolic blood pressure (p = 0.025) than the women, whereas the women had a higher BMI than the men (p = 0.002) (Table 1). The subjects were farmers (61.73%), employees (19.34%), housekeepers and housewives (8.22%), self-employed (3.29%), government officers (2.05%), students (2.05%), retired government officers (1.64%), and others (1.65%). Approximately 9.9%, 5.9%, 14.85%, and 67% of the subjects had a bachelor degree, high vocational certificate, high school, and less than a high school education, respectively. Approximately 1.49% of subjects had not received any education. Most of the subjects were Buddhists. Only 29 of the subjects were Muslim. The Buddhists showed significantly higher TC, LDL-C, and HDL-C levels than the Muslims. In contrast, the Muslims showed significantly higher FPG levels than the Buddhists (Table 2). Among the 234 women, 101 were

Table 1. Demographic characteristics and anthropometric data of subjects by gender (mean ± SD)

	Men (n = 68)	Women (n = 234)	Total (n = 302)	p-value
Age (years)	58.37±15.03	52.53±12.83	53.84±13.55	0.002
Waist circumference (cm)	83.49±11.59	82.26±14.78	82.53±14.11	0.892
Body mass index (kg/m^2)	23.17±3.87	24.83±5.72	24.45±5.41	0.002
Systolic blood pressure (mmHg)	133.41±16.62	131.63±19.78	132.03±19.10	0.228
Diastolic blood pressure (mmHg)	90.75±97.84	83.04±12.71	84.78±47.61	0.025
Total cholesterol (mg/dl)	197.19±42.79	210.59±46.11	207.57±45.66	0.053
Triglyceride (mg/dl)	130.97±83.05	120.09±67.83	122.54±71.54	0.505
LDL-C (mg/dl)	115.95±34.41	129.39±37.53	126.36±37.22	0.009
HDL-C (mg/dl)	54.78±14.09	57.60±13.14	56.96±13.39	0.096
TC/HDL-C ratio	3.74±0.95	3.74±0.77	3.74±0.82	0.999
Fasting plasma glucose (mg/dl)	94.57±21.66	90.00±18.37	91.03±19.23	0.057

Table 2. Demographic characteristics and anthropometric data of subjects by religious affiliation (mean ± SD)

	Buddhist (n = 273)	Muslim (n = 29)	p-value
Age (years)	53.82±13.58	54.03±13.51	0.936
Waist circumference (cm)	82.76±12.98	80.41±22.33	0.913
Body mass index (kg/m^2)	24.27±5.44	26.19±4.81	0.074
Systolic blood pressure (mmHg)	131.46±18.53	137.38±23.53	0.283
Diastolic blood pressure (mmHg)	84.83±49.89	84.28±13.50	0.258
Total cholesterol (mg/dl)	209.86±46.47	186.03±30.09	0.005
Triglyceride (mg/dl)	122.08±68.62	126.86±96.21	0.454
LDL-C (mg/dl)	128.25±37.59	108.62±28.38	0.007
HDL-C (mg/dl)	57.55±13.67	51.41±8.71	0.027
TC/HDL-C ratio	3.75±0.83	3.68±0.68	0.680
Fasting plasma glucose (mg/dl)	89.58±18.34	104.66±22.16	<0.001

premenopausal women, and 133 were postmenopausal women. The mean age for the premenopausal women was 42.69±8.36 years old, and the mean age for the postmenopausal women was 59.99±10.37 years old. The systolic blood pressure and levels of TC, TG, and LDL-C were significantly higher in the postmenopausal women (Table 3).

The mean plasma lipid levels

The women had significantly higher LDL-C levels than the men (p = 0.009). However, the concentrations for TC, TG and HDL-C and the TC/HDL-C ratio were not significantly different between the sexes (Table 1). The levels of TC, TG, and LDL-C but not the HDL-C level or the TC/HDL-C ratio increased with age in both women and men. Overall, the highest levels of TC, TG, and LDL-C were observed in the 60- to 69-year-old age group (Table 4).

Prevalence of dyslipidemia

The prevalence of high TC, high TG, high LDL-C, and low HDL-C were 56.62%, 26.49%, 43.05%, and 6.95%, respectively (Table 5). Compared with the men, the women had a greater prevalence of high TC (51.47% of the men versus 58.12% of the women) and high LDL-C levels (38.24% of the men versus 44.44% of the women), whereas the prevalence of high TG levels (32.35% of the men versus 24.79% of the women), low HDL-C levels (13.24% of the men versus 5.13% of the women), and a high TC/HDL-C ratio (11.76% of the men versus 4.70% of the women) were more pronounced in the men (Table 5, 6).

The prevalence of dyslipidemia and associated risk factors

The prevalence of dyslipidemia by gender, age group, WC, BMI, FPG, blood pressure, cigarette

Table 3. Demographic characteristics and anthropometric data of subjects by menopausal state (mean ± SD)

	Premenopause (n = 101)	Postmenopause (n = 133)	p-value
Age (years)	42.69±8.36	59.99±10.37	<0.001
Waist circumference (cm)	80.59±17.83	83.52±11.87	0.233
Body mass index (kg/m^2)	25.25±6.06	24.50±5.47	0.176
Systolic blood pressure (mmHg)	126.69±18.04	135.38±20.28	0.001
Diastolic blood pressure (mmHg)	82.36±11.63	83.56±13.49	0.582
Total cholesterol (mg/dl)	198.85±40.50	219.50±48.21	<0.001
Triglyceride (mg/dl)	107.77±61.02	129.44±71.38	0.005
LDL-C (mg/dl)	121.08±34.35	135.70±38.73	0.003
HDL-C (mg/dl)	56.18±13.21	58.68±13.04	0.070
TC/HDL-C ratio	3.63±0.75	3.82±0.78	0.067
Fasting plasma glucose (mg/dl)	87.31±14.30	92.05±20.79	0.136

Table 4. The age-specific mean values of plasma lipids and TC/HDL-C ratio in all subjects by gender and age groups (mean ± SD)

Age, year	TC (mg/dl)	TG (mg/dl)	LDL-C (mg/dl)	HDL-C (mg/dl)	TC/HDL-C ratio
Women					
19-29	166.22±41.89	79.56±38.33	92.78±35.49	57.56±17.66	2.97±0.60
30-39	198.00±30.82	110.68±69.58	121.89±27.98	54.04±8.03	3.72±0.64
40-49	209.23±42.14	108.65±60.82	128.44±34.14	59.08±15.43	3.66±0.75
50-59	214.32±39.74	125.95±69.12	131.66±36.12	57.46±10.25	3.78±0.64
60-69	230.83±45.23	129.93±76.18	145.28±34.15	59.95±12.86	3.98±0.87
70+	201.50±68.43	142.69±66.23	121.83±51.62	54.96±16.20	3.73±0.99
Total	210.59±46.11	120.09±67.83	129.39±37.53	57.60±13.14	3.74±0.77
Men					
19-29	165.60±44.45	117.80±129.29	90.60±36.02	51.20±9.88	3.44±1.51
30-39	192.67±41.48	109.67±46.52	113.87±33.16	57.00±13.89	3.75±0.63
40-49	191.40±42.59	99.80±60.54	117.00±36.93	50.40±4.04	3.79±0.78
50-59	202.80±41.69	150.35±68.23	117.60±35.81	55.20±18.70	3.91±0.99
60-69	205.00±36.72	148.72±91.91	122.27±32.04	53.06±11.23	3.98±0.86
70+	194.12±50.62	106.18±84.22	114.80±35.99	58.06±14.26	3.42±0.90
Total	197.19±42.79	130.97±83.05	115.95±34.41	54.78±14.09	3.75±0.83
All					
19-29	166.00±41.09	93.21±80.05	92.00±34.28	55.29±15.23	3.14±0.98
30-39	197.58±31.18	110.58±67.09	121.12±27.99	54.32±8.47	3.69±0.63
40-49	207.96±42.12	108.01±60.40	127.66±34.18	58.46±15.06	3.68±0.75
50-59	211.62±40.26	131.69±69.29	128.35±36.33	56.93±12.65	3.81±0.73
60-69	222.95±44.16	135.66±80.96	138.26±34.92	57.59±12.66	3.98±0.87
70+	198.58±61.45	128.26±75.09	119.05±45.73	56.19±15.36	3.61±0.95
Total	207.57±45.66	122.54±71.54	126.36±37.22	51.41±8.71	3.74±0.82

smoking, alcohol consumption, physical activity, and menopausal state is shown in Table 6. The prevalence of high TC, high TG, high LDL-C levels and a high TC/HDL-C ratio increased with age (p<0.001). The prevalence of dyslipidemia increased steadily in parallel with WC (only for TG), BMI (TC, TG, TC/HDL-C), and FPG (except for LDL-C) levels. The prevalence of high TG was the highest among cigarette smokers and the lowest among nonsmokers. In addition, the prevalence of dyslipidemia was found in participants currently consuming alcohol (TG, LDL-C, and TC/HDL-C) and postmenopausal women (except for HDL-C). Hypertension and physical activity were not found to be related to dyslipidemia.

Table 5. The prevalence of high TC, high TG, high LDL-C, low HDL-C concentrations, and a high TC/HDL-C ratio according to gender and age (%)

Age, year	Total	TC ≥200 mg/dl	TG ≥150 mg/dl	LDL-C ≥130 mg/dl	HDL-C <40 mg/dl	TC/HDL-C ratio ≥5
Women						
19-29	9	2 (22.22)	0 (0)	1 (11.11)	2 (22.22)	0 (0)
30-39	28	14 (50.00)	6 (21.43)	8 (28.57)	0 (0)	0 (0)
40-49	65	33 (50.77)	12 (18.46)	28 (43.08)	5 (7.69)	3 (4.62)
50-59	63	39 (61.90)	17 (26.98)	29 (46.03)	1 (1.59)	0 (0)
60-69	43	34 (79.07)	12 (27.91)	29 (67.44)	1 (2.33)	6 (13.95)
70+	26	14 (53.85)	11 (42.31)	9 (34.62)	3 (11.54)	2 (7.69)
Total	234	136 (58.12)	58 (24.79)	104 (44.44)	12 (5.13)	11 (4.70)
Men						
19-29	5	2 (40.00)	1 (20.00)	1 (20.00)	1 (20.00)	1 (20.00)
30-39	3	2 (66.67)	1 (33.33)	1 (33.33)	0 (0)	0 (0)
40-49	5	2 (40.00)	1 (20.00)	2 (40.00)	0 (0)	0 (0)
50-59	20	11 (55.00)	9 (45.00)	7 (35.00)	4 (20.00)	3 (15.00)
60-69	18	9 (50.00)	8 (44.44)	9 (50.00)	3 (16.67)	2 (11.11)
70+	17	9 (52.94)	2 (11.76)	6 (35.29)	1 (5.88)	2 (11.76)
Total	68	35 (51.47)	22 (32.35)	26 (38.24)	9 (13.24)	8 (11.76)
All						
19-29	14	4 (28.57)	1 (7.14)	2 (14.29)	3 (21.43)	1 (7.14)
30-39	31	16 (51.61)	7 (22.58)	9 (29.03)	0 (0)	0 (0)
40-49	70	35 (50.00)	13 (18.57)	30 (42.86)	9 (12.86)	3 (4.29)
50-59	83	50 (60.24)	26 (31.33)	36 (43.37)	5 (6.02)	3 (3.61)
60-69	61	43 (70.49)	20 (32.79)	38 (62.30)	4 (6.56)	8 (13.11)
70+	43	23 (53.49)	13 (30.23)	15 (34.88)	4 (9.30)	4 (9.30)
Total	302	171 (56.62)	80 (26.49)	130 (43.05)	21 (6.95)	19 (6.29)

Discussion

In the present study, the authors demonstrated the prevalence of dyslipidemia among a rural population in the Nakhon Si Thammarat province, Southern Thailand. The most prevalent dyslipidemia was high TC levels (56.62%) followed by elevated LDL-C levels (43.04%), high TG levels (26.49%), low HDL-C levels (6.95%), and a high TC/HDL-C ratio (6.29%). The women had a higher prevalence of high TC levels (51.47% of the men versus 58.12% of the women), and high LDL-C levels (38.24% of the men versus 44.44% of the women) than the men. However, the men had a greater prevalence of high TG levels (32.35% of the men versus 24.79% of the women), low HDL-C levels (13.24% of the men versus 5.13% of the women), and a high TC/HDL-C ratio (11.76% of the men versus 4.70% of the women) than the women. The authors' results agreed with other studies on rural areas that showed the women had higher TC levels than the men[9,12-14]. In addition, the mean TC, TG, and LDL-C levels but not the HDL-C level increased with age in both sexes. Our results were consistent with many studies[9,12-14]. The mechanisms may be related to genetic predisposition and degenerative processes.

Among the rural population, the mean TC concentration (208 mg/dl) in our results was similar to healthy rural subjects in the Chachoengsao province (208 mg/dl)[12] but higher than healthy rural subjects in the Ang Thong (190 mg/dl) and Khon Kaen provinces (163 mg/dl and 183 mg/dl in 1993 and 2005, respectively)[8,9,13]. The mean TC levels in our findings were also higher than in the rural subjects in the Khon Kaen province in both genders and in the Songkhla province in only the women. It is difficult to compare the prevalence of dyslipidemia with other reports because the studies used different cut-off values to define dyslipidemia (Table 7). With regard to the religious subgroups, the Muslims had significantly lower TC, LDL-C, and HDL-C levels but higher FPG levels compared to the Buddhists. A previous study has shown that the female Muslims had lower TC, LDL-C, and FPG levels than the female Buddhists. Furthermore, the male Muslims had lower HDL-C levels compared to the male Buddhists[15]. The variation in lipid levels among populations may be due to a differential distribution in risk factors (e.g., genetic predisposition, age, sex, ethnicity, dietary habits, smoking habits, alcohol consumption, lack of physical activity, and

Table 6. The prevalence of dyslipidemia in rural subjects by gender, age, WC, BMI, FPG, blood pressure, cigarette smoking, alcohol consumption, physical activity, and menopausal state (%)

	Total	TC ≥200 mg/dl	TG ≥150 mg/dl	LDL ≥130 mg/dl	HDL <40 mg/dl	TC/HDL-C ≥5
Gender		X^2 = 59.66, p<0.001	X^2 = 16.20, p<0.001	X^2 = 46.80, p<0.001	X^2 = 0.43, p = 0.513	X^2 = 0.47, p = 0.491
Men	68	35 (51.47)	22 (32.35)	26 (38.24)	9 (13.24)	8 (11.76)
Women	234	136 (58.12)	58 (24.79)	104 (44.44)	12 (5.13)	11 (4.70)
Age		X^2 = 39.19, p<0.001	X^2 = 20.28, p<0.001	X^2 = 38.14, p<0.001	X^2 = 3.71, p = 0.156	X^2 = 9.58, p = 0.008
19-39	45	20 (44.44)	8 (17.78)	11 (24.44)	3 (6.67)	1 (2.22)
40-59	155	85 (54.84)	39 (25.16)	66 (42.58)	10 (6.45)	6 (3.87)
60+	102	66 (64.70)	33 (32.35)	53 (51.96)	8 (7.84)	12 (11.76)
WC (men ≥90 and women ≥80)		X^2 = 2.11, p = 0.146	X^2 = 11.25, p = 0.001	X^2 = 2.49, p = 0.114	X^2 = 0.43, p = 0.513	X^2 = 2.58, p = 0.108
<90/<80	142	76 (53.52)	25 (17.61)	56 (39.44)	9 (6.34)	6 (4.23)
≥90/≥80	160	95 (59.38)	55 (34.38)	74 (46.25)	12 (7.50)	13 (8.13)
BMI (kg/m^2)		X^2 = 38.52, p<0.001	X^2 = 13.30, p = 0.004	X^2 = 31.66, p<0.001	X^2 = 7.00, p = 0.072	X^2 = 9.42, p = 0.024
<23	117	69 (58.97)	20 (17.09)	53 (45.30)	6 (5.13)	5 (4.27)
23-24.9	54	24 (44.44)	17 (31.48)	20 (37.04)	5 (9.26)	4 (7.41)
25-29.9	94	57 (60.64)	28 (29.79)	43 (45.74)	9 (9.57)	9 (9.57)
≥30	37	21 (56.76)	15 (40.54)	14 (37.84)	1 (2.70)	1 (2.70)
Diabetes (FPG ≥126)		X^2 = 144.15, p<0.001	X^2 = 54.45, p<0.001	X^2 = 114.49, p<0.001	X^2 = 13.76, p<0.001	X^2 = 11.84, p = 0.001
No	292	164 (56.16)	73 (24.32)	126 (43.15)	19 (6.51)	17 (5.82)
Yes	10	7 (70.00)	7 (70.00)	4 (40.00)	2 (20.00)	2 (20.00)
Hypertension (≥140/90)		X^2 = 9.83, p = 0.002	X^2 = 1.80, p = 0.180	X^2 = 7.88, p = 0.005	X^2 = 3.86, p = 0.050	X^2 = 0.47, p = 0.491
No	185	106 (57.30)	34 (18.38)	81 (43.78)	15 (4.97)	11 (5.95)
Yes	117	65 (55.56)	46 (39.32)	49 (41.88)	6 (1.99)	8 (6.84)
Cigarette smoking		X^2 = 91.37, p<0.001	X^2 = 31.25, p<0.001	X^2 = 70.89, p<0.001	X^2 = 3.86, p = 0.050	X^2 = 2.58, p = 0.108
No	261	148 (56.70)	65 (24.90)	113 (43.40)	15 (4.97)	13 (4.98)
Yes	41	23 (56.10)	15 (36.59)	17 (41.46)	6 (1.99)	6 (16.22)
Alcohol consumption		X^2 = 217.93, p<0.001	X^2 = 82.68, p<0.001	X^2 = 163.40, p<0.001	X^2 = 13.71, p = 0.001	X^2 = 18.11, p<0.001
No	258	148 (57.36)	65 (25.19)	112 (43.41)	15 (4.97)	15 (5.81)
Current alcohol consumption	22	12 (54.55)	8 (36.36)	11 (50.00)	3 (0.99)	3 (13.64)
Former alcohol consumption	22	11 (50.00)	7 (31.82)	7 (31.82)	3 (0.99)	1 (4.55)
Physical activity		X^2 = 2.11, p = 0.146	X^2 = 0.05, p = 0.823	X^2 = 3.72, p = 0.054	X^2 = 2.33, p = 0.127	X^2 = 0.47, p = 0.491
No	166	95 (57.23)	39 (23.49)	76 (45.78)	14 (4.64)	11 (6.63)
Yes	136	76 (55.88)	41 (30.15)	54 (39.71)	7 (2.32)	8 (5.88)
Postmenopause		X^2 = 16.94, p<0.001	X^2 = 9.93, p = 0.002	X^2 = 16.96, p<0.001	X^2 = 1.33, p = 0.248	X^2 = 4.46, p = 0.035
No	98	44 (44.90)	17 (17.35)	31 (31.63)	4 (0.66)	2 (2.04)
Yes	136	92 (67.65)	41 (30.15)	73 (53.68)	8 (2.65)	9 (6.62)

Table 7. Mean serum TC and prevalence of dyslipidemia in a rural population in Thailand

Year	Population	Region	n	Age (yr)	mean TC (mg/dl)	Prevalence of dyslipidemia
1978	Healthy rural subjects (Chaiya, Ang Thong)[8]	Central	49	24-56	190	N/A
1993	Healthy rural subjects (Phon, Khon Kaen)[9]	Northeast	923	30-65	163 (men: 158, women: 166)	N/A
1998	Healthy rural subjects (Nampong, Khon Kaen)[10]	Northeast	355	30-65	Men: 186, women: 195	N/A
2005	Healthy rural subjects (Chachoengsao)[11]	East	443	≥35	208	TC ≥240 mg/dl 19% LDL-C ≥160 mg/dl 10% HDL-C ≤35 mg/dl 7%
2005	Healthy rural subjects (Khon Kaen)[13]	Northeast	325	20-88	183 (men: 169, women: 192)	TC >200 mg/dl 31% TG >150 mg/dl 40% LDL-C >130 mg/dl 20% HDL-C <40 mg/dl 14%
2005	Healthy rural subjects (North, Northeast, and South)[11]	North, Northeast, and South	5,305	≥35	Men: 186, women: 200	N/A
2005	Healthy rural subjects (Thepa, Songkhla)[15]	South	1,475	15-66	Buddhist (men: 196, women: 186) Muslim (men: 192, women: 181)	TC ≥240 mg/dl (men: 12.9%,women: 9.7%) LDL-C ≥130 mg/dl (men: 44.2%, women: 38.5%) HDL-C <40 mg/dl (men: 37.1%, women: 17.4%)
2006	Healthy urban and rural subjects (Khon Kaen)[14]	Northeast	916 (595 urban; 321 rural)	20-88	Rural (men: 169, women: 192)	Rural men TC ≥240 mg/dl 3.7% LDL-C ≥160 mg/dl 3.7% Rural women TG ≥200 mg/dl 18.2% HDL-C <40 mg/dl 15.0%
2012	Healthy rural subjects (Nakhon Si Thammarat) (present study)	South	302	19-84	208 (men: 197, women: 211)	TC ≥200 mg/dl 56.62% TG ≥150 mg/dl 26.49% LDL-C ≥130 mg/dl 43.05% HDL-C <40 mg/dl 6.95%

N/A = not applicable

menopausal state). Our results showed that several factors (e.g., increased age, female gender, high BMI, high WC, high FPG, smoking, current alcohol consumption, and postmenopause) were related to dyslipidemia. During the menopausal transition, the authors observed that postmenopausal women had higher TC, TG, and LDL-C levels than premenopausal women. Our findings were similar to previous reports in the literature[19,20].

In conclusion, the prevalence of dyslipidemia in rural areas in the Nakhon Si Thammarat province was especially high in participants with high hypercholesterolemia and high LDL-C levels. Therefore, dyslipidemia is an important health problem among this population. Health education, a health policy, or a specific campaign is urgently needed to reduce the incidence of dyslipidemia and prevent CVD.

Acknowledgement

The authors are very grateful for the kind support of the Chief Executive of the Sichon and Thapracha Subdistrict Administration Organizations. The authors wish to thank Miss Thunyalak Plyduang and Miss Dararat Punwong for their kind laboratory assistance.

Funding source

This study was supported by a research grant from the Walailak University.

Potential conflicts of interest

None.

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ความชุกของภาวะไขมันในเลือดผิดปกติในประชากรไทยที่อาศัยอยู่ในเขตชนบทจังหวัดนครศรีธรรมราช

นุชจรี จีนด้วง, สมิทธ์ หวันมาแซะ, ปารวี ศรีภาวินทร์, สุปราณี กุลบุตร

วัตถุประสงค์: *เพื่อศึกษาความชุกของภาวะไขมันในเลือดผิดปกติในกลุ่มประชากรไทยที่อาศัยในเขตชนบท จังหวัดนครศรีธรรมราช*
วัสดุและวิธีการ: *ผู้เข้าร่วมโครงการได้รับการเจาะเลือดภายหลังอดอาหาร 12 ชั่วโมง เพื่อตรวจระดับโคเลสเตอรอล, ไตรกลีเซอไรด์, แอลดีแอล โคเลสเตอรอล, และเอชดีแอล โคเลสเตอรอล ภาวะไขมันในเลือดผิดปกติใช้เกณฑ์การวินิจฉัยตาม National Cholesterol Education Program (NCEP), Adult Treatment Panel (ATP III) รวมถึงมีการเก็บข้อมูลพื้นฐานและการวัดสัดส่วนของร่างกาย*
ผลการศึกษา: *มีผู้เข้าร่วมโครงการทั้งสิ้น 302 ราย เป็นชายจำนวน 68 ราย และหญิงจำนวน 234 ราย มีอายุระหว่าง 19-84 ปี ระดับโคเลสเตอรอล, ไตรกลีเซอไรด์, แอลดีแอล โคเลสเตอรอล, และเอชดีแอล โคเลสเตอรอล มีค่าเฉลี่ย 207.57±45.66, 122.54±71.54, 125.36±37.22, และ 56.96±13.39 mg/dl ตามลำดับ การศึกษาพบความชุก ของภาวะโคเลสเตอรอลสูง (≥200 มก./ดล.) ร้อยละ 56.62 ภาวะไตรกลีเซอไรด์สูง (≥150 มก./ดล.) ร้อยละ 26.49 ภาวะแอลดีแอล โคเลสเตอรอลสูง (≥130 มก./ดล.) ร้อยละ 43.04 และภาวะเอชดีแอล โคเลสเตอรอลต่ำ (<40 มก./ดล.) ร้อยละ 6.95 ซึ่งความชุกของภาวะไขมันในเลือดผิดปกติเพิ่มขึ้นตามอายุ นอกจากนี้พบว่าภาวะไขมันในเลือดผิดปกติเกี่ยวข้องกับเพศหญิง การมีอายุ ค่าเส้นรอบเอว ค่าดัชนีมวลกาย และระดับน้ำตาลในเลือดที่สูงขึ้น รวมถึงการสูบบุหรี่ การดื่มแอลกอฮอล์ และหญิงวัยหลังหมดประจำเดือน*
สรุป: *ความชุกของภาวะไขมันในเลือดผิดปกติในประชากรกลุ่มนี้มีค่าสูง โดยเฉพาะภาวะโคเลสเตอรอลสูงและภาวะแอลดีแอล โคเลสเตอรอลสูง ดังนั้นจึงควรมีนโยบายในระดับชุมชน ให้ความรู้แก่ประชาชนเพื่อลดภาวะไขมันในเลือดผิดปกติอันนำไปสู่การป้องกันการเกิดโรคหัวใจ*