Gender Differences in Risk Factors for Dyslipidemia in the Khmer Ethnic People, Vietnam

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Abstract
Background: The majority of the Khmer ethnic people living in the Mekong Delta had a difficult socio-economic life and limited access to information and health services. The study was conducted to determine the prevalence of dyslipidemia and risk factors in men and women of the Khmer ethnic people, in Vietnam.
Methods: A cross-sectional study was conducted on 1.800 Khmer people aged 25 – 64 yr living in Tra Vinh Province in the Mekong Delta region of Vietnam. Data were analyzed using descriptive statistics and multivariate logistic regression.
Results: The prevalence of dyslipidemia was high in men (47.3%) and in women (51.4%). Men had a higher prevalence of high TG (28.9% vs. 23.9%), whereas the prevalence of high TC (34.1% vs. 42.4%), and high LDL-C (28.2% vs. 37.9%) were lower in women, (all $P<0.05$). In men, dyslipidemia was significantly associated with central obesity (OR=2.58, 95% CI=1.32-5.06), overweight/ obesity (OR=2.50, 95% CI=1.75-3.56), and diabetes (OR=2.15, 95% CI=1.22-3.78). In women, dyslipidemia was significantly associated with diabetes (OR=2.14, 95% CI=1.08-4.24), central obesity (OR=1.69, 95% CI=1.18-2.42), overweight/ obesity (OR=1.50, 95% CI=1.06-2.10), and hypertension (OR=1.43, 95% CI=1.03-1.99). Age was significantly associated with increased risk of dyslipidemia in both genders.
Conclusion: Overall, the prevalence of dyslipidemia among Khmer men and women adults aged 25 - 64 years in Vietnam was high. Our findings indicated an urgent need to have dyslipidemia prevention intervention programs for the Khmer ethnic people in the Mekong Delta, especially training about obesity and increasing healthy lifestyles.

Keywords: Dyslipidemia; Risk factors; Vietnam

Introduction

Dyslipidemia is growing in popularity with high incidence and prevalence in countries of all economic groups (1, 2). According to the WHO, dyslipidemia cause one third of ischemic heart disease and one fifth of global cerebrovascular disease, and equates to nearly 2.6 million deaths every year worldwide (2). Dyslipidemia does not have any apparent symptoms and most cases were discovered when patients underwent

periodic medical examinations or were hospitalized due to complications of the disease.

In Asia, dyslipidemia has become a problem of the public health. Some recent studies conducted in Asia have found that the prevalence of dyslipidemia among adults was very high such as 66.5% in Thailand (≥20 years in 2009) (3), 34.64% in Hong Kong (≥20 years in 2011) (4), 16.58% in Korea (40-64 years in 2013) (5), 79.0% in India (≥20 years in 2014) (6), 35.5% in China (≥18 years in 2014) (7), and 30.0% in Iran (≥15 years in 2016) (8). It is worth noting that the prevalence of dyslipidemia varies in urban and rural areas, and among racial/ethnic groups (9-12).

In Vietnam, dyslipidemia rate has a tendency of going up and rejuvenating. According report of Vietnam STEPS survey (2014), the proportion of Vietnam's population aged 18 to 69 never had their total cholesterol measured by a doctor or any other health worker was very high (74.1%) (13). In addition, although several studies have focused on dyslipidmia, there is an overall paucity of studies investigating dyslipidmia in the community, especially among the Khmer ethnic people. Mekong River Delta is a concentration of large population of the Khmer community in Vietnam, particularly in Tra Vinh province (the second highest number of poor households in the Mekong River Delta), with economically and socially unfavorable conditions; the Khmer's approach to information and health services is limited (14).

Therefore, the purpose of this study was to determine the risk factors for dyslipidemia in men and women of the Khmer ethnic group. The findings of this study are expected to contribute to primary prevention and intervention strategies in the treatment of dyslipidemia among the Khmer ethnic people in the Mekong Delta.

Materials and Methods

Research Design

The cross- sectional study was carried out on 1.800 Khmer people aged from 18 to 64 from July 2017 to October 2017 at 30 communes and wards in Tra Vinh Province. Participants had a permanent or temporary address from one year or more, excluding pregnant women or the disabled from scoliosis and leg malformation.

Study Area and Sample

The sample size was calculated using the following formula (15):

$$n = Z^2_{(1-\alpha/2)} \ \frac{p \times (1 - p)}{d^2} \ \times DE$$

To apply the above formula with p=0.535: the prevalence of dyslipidemia according to a research (16), 53.5% of Vietnamese people had dyslipidemia (≥ 1 abnormal level of a serum lipid), α=0.05, d=0.10: absolute error, DE=2: design effect. Determination of the sample size in researching was based on the WHO guideline in the STEPwise approach to surveillance (STEPS). The stratified sample was categorized according to 8 groups of age (4 groups of age: 25-34, 35-44, 45-54 and 55-64 years for men and women) (17). Hence, there were 8 groups of respondents in the research. So the minimum sample size for each group was 192. In fact, the total number of eight groups was 1,800 people.

Sampling Method

Multistage sampling was employed. Stage 1: There are 106 commune-level administrative units (communes, wards, townships) under Tra Vinh province as clusters in a sample frame. Thirty clusters were selected using the Probability Proportionate to Size method. One commune or ward among each cluster was randomly chosen. Stage 2: Based on the number of the Khmer people aged from 18 to 64 in each commune or ward, and then each cluster of 60 people were randomly chosen to examine and test for dyslipidemia.

Health workers responsible for obtaining blood samples were trained in the standard aseptic technique for obtaining blood samples. Taking 2 ml blood sample each participant (the participants must not eat anything for at least 8 hours and take a rest at least 10 minutes before being got the blood). The blood samples were pre-

served from $+2\ ^0C$ to $+8^0C$ and transferred immediately to Columbia laboratary, which was authorized by the Ho Chi Minh City's Department of Health. Samples were quantified for total cholesterol (TC), triglyceride (TG), HDL cholesterol (HDL-C), and LDL cholesterol (LDL-C) by the clinical chemistry analyzer AU680. The blood glucose was quantified according to GOD- PAP method by manual biochemistry analyzer Hitachi 717.

Measures

Behavioural Risk Factor Index

Body mass index (BMI) was calculated by the formula, BMI = weight (kg)/height (m²). The respondents were divided into four groups according to the Asian-Pacific cutoff points (18): underweight (BMI <18.5 kg/m²), normal weight (18.5 kg/m² ≤ BMI ≤ 22.9 kg/m²), overweight (23 kg/m² ≤ BMI ≤ 24.9 kg/m²), and obese (BMI ≥ 25 kg/m²).

Waist circumference was measured by placing a tape horizontally midway between the lower margin of the last palpable rib and iliac crest on the mid-axillary line. Hip circumference was measured at a level parallel to the floor, at the largest circumference of the buttocks. WHR was then calculated from waist and hip circumference (cm). Cut-off values for central obesity including waist circumference for male and female were ≥ 90 and ≥ 80 cm, WHR for male and female were ≥ 0.90 and ≥ 0.80 (19).

Hypertension

Blood pressure was measured three times with a minimum of 5-minute rest period in between each reading; participants were in a sitting position with the measurement on their right arm, taken over loose clothing using a portable digital blood pressure device. Hypertension was defined by the JNC VII (20), systolic blood pressure ≥ 140 mmHg; or diastolic blood pressure ≥ 90 mmHg for average of the three readings; past history of diagnosis of hypertension; or receiving antihypertensive medication and captured in a dichotomous coded variable.

Diabetes

Diabetes mellitus was defined as a fasting plasma glucose ≥ 7.0 mmol/L (126 mg/dL) or a HbA1C ≥ 6.5%, or on treatment for diabetes (21).

Dyslipidemia

A examination and blood lipid test were performed at commune health stations to identify the presence and absence of dyslipidemia in accordance with the criteria of the National Cholesterol Education Program (NCEP) for the management of dyslipidemia in adults (22). Dyslipidemia was defined as either high TC, high TG, high LDL, or low HDL. Dyslipidemia was defined by the NCEP ATP III: high TC (TC ≥ 200 mg/dL [5.17 mmol/L]), high TG (TG ≥ 150 mg/dL [1.70 mmol/L]), high LDL-C (LDL ≥ 130 mg/dL [3.36 mmol/L]), and low HDL-C (HDL < 40 mg/dL [1.03 mmol/L]).

Statistical Methods

After cleaning, data were entered into Epi Data 3.1 software and transferred to Stata 13.0 software for data analysis. Absolute values and percentages were used to describe categorical variables. Statistical analysis was performed using Chi-square test with significance level of *P*-value < 0.05 to consider factors related to dyslipidemia. Using the odds ratio (OR) with 95% confidence interval to measure the associations.

Ethics approval

We received ethical approval from the National Institute of Hygiene and Epidemiology in Vietnam (NIHE-IRB-18/2016). The study was approved by Tra Vinh's Department of Health. The research was allowed by the District Health Office in the selected districts, and the communes and wards at the research sites. The Khmer ethnic people voluntarily participated in the survey. All study procedures were carried out free of charge for the participants. Data were treated with high confidentiality and used only for scientific purposes. People with dyslipidemia were advised on treatment. The study results were disseminated to relevant stakeholders in order to inform policies and interventions to

improve the dyslipidemia status of the Khmer and pave the way for future studies.

Results

A total of 1,800 eligible adults participated in this study, there were more women participants than men (52.9% and 47.1%). The BMI of men and women were 21.4 ± 3.1 kg/m^2 and 22.6 ± 3.6 kg/m^2, respectively. The prevalence of overweight/obesity was higher in women (42.9%) than in men (24.8%) (*P*<0.05). The prevalence of central obesity was higher in women (35.4%) than in men (7.6%) (*P*<0.05). The prevalence of hypertension was higher in men (36.8%) than in women (29.2%) (*P*<0.05) (Table 1).

**Table 1:** Basic characteristics of participants according to dyslipidemia status

Characteristic	Male (N=848)						Female (N=952)					
	Total		Dyslipidemia		Non-dyslipidemia	P-value	Total		Dyslipidemia		Non-dyslipidemia	P-value
	n	%	n	%	n	%	n	%	n	%	n	%
Overall	848	100.0	401	47.3	447	52.7		952	100.0	489	51.4	463	48.6
Age groups(yr)												
25 – 34	198	23.3	72	36.4	126	63.6	0.006	215	22.6	64	29.8	151	70.2	<0.001
35 – 44	205	24.2	102	49.8	103	50.2		236	24.8	101	42.8	135	57.2
45 – 54	215	25.4	111	51.6	104	48.4		252	26.5	148	58.7	104	41.3
55 – 64	230	27.1	116	50.4	114	49.6		249	26.2	176	70.7	73	29.3
Education level												
No formal education	173	20.4	78	45.1	95	54.9	0.044	309	32.5	179	57.9	130	42.1	<0.001
Primary	265	31.3	109	41.1	156	58.9		331	34.8	183	55.3	148	44.7
Secondary	244	28.8	132	54.1	112	45.9		215	22.6	91	42.3	124	57.7
Tertiary	114	13.4	54	47.4	60	52.6		61	6.4	27	44.3	34	55.7
University/College	52	6.1	28	53.9	24	46.1		36	3.8	9	25.0	27	75.0
Occupation status												
Agriculture	507	59.8	238	46.9	269	53.1	0.348	466	49.0	240	51.5	226	48.5	0.021
State employee	40	4.7	24	60.0	16	40.0		15	1.6	3	20.0	12	80.0
Worker	231	27.2	102	44.2	129	55.8		186	19.5	91	48.9	95	51.8
Housewife	7	0.8	4	57.1	3	42.9		202	21.2	102	50.5	100	49.5
Others	63	7.4	33	52.4	30	47.6		83	8.7	53	63.9	30	36.1
BMI status												
Normal weight	638	75.2	259	40.6	379	59.4	<0.001	544	57.1	231	42.5	313	57.5	<0.001
Overweight/ Obesity	210	24.8	142	67.6	68	32.4		408	42.9	258	63.2	150	36.8
Central obesity												
No	784	92.4	350	44.6	434	55.4	<0.001	615	64.6	259	42.1	356	57.9	<0.001
Yes	64	7.6	51	79.7	13	20.3		337	35.4	230	68.3	107	31.7
Hypertension												
No	536	63.2	226	42.2	310	57.8	<0.001	674	70.8	302	44.8	372	55.2	<0.001
Yes	312	36.8	175	56.1	137	43.9		278	29.2	187	67.3	91	32.7
Diabetes												
No	785	92.6	359	45.7	426	54.3	0.001	893	93.8	442	49.5	451	50.5	<0.001
Yes	63	7.4	42	66.7	21	33.3		59	6.2	47	79.7	12	20.3

Table 1 shows the characteristics of the respondents of dyslipidemia in men and women. The percentage of dyslipidemia in men was 47.3% and in women was 51.4%. In both men and women, the majority of respondents worked in agriculture, had a primary level of education and the percentage of dyslipidemia individually increased by age. Besides, the respondents that

had overweight/ obesity, central obesity, hypertension, and diabetes also represented a high percentage of dyslipidemia in both genders.

Fig. 1 shows the prevalence rates of hypercholesterolemia, hypertriglyceridemia, high LDL, and low HDL were 34.1%, 28.9%, 28.2%, and 1.1%, respectively. The prevalence of dyslipidemia was 47.3% in males and 51.4% in females. The study participants showed a

statistical difference in the prevalence of high TG, high TC, and high LDL-C between male and female participants. Men compared with women participants had a higher prevalence of high TG (28.9% vs. 23.9%), whereas the prevalence of high TC (34.1% vs. 42.4%), and high LDL-C (28.2% vs. 37.9%) were lower in women, (all $P<0.05$).
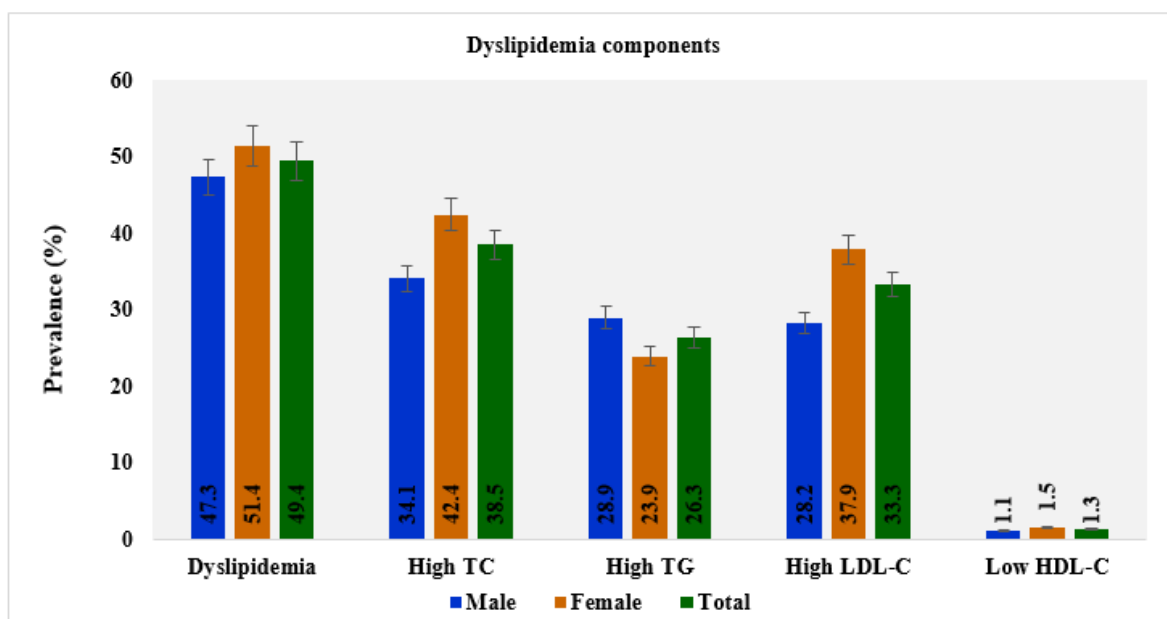
Fig. 1: Proportion of concentrations classification of TC, TG, HDL-C and LDL-C in the Khmer ethnic people

The prevalence of dyslipidemia stratified by gender and age groups, significant differences were observed. Men age 55 years and over had a lower prevalence of dyslipidemia than women ($P<0.05$) (Fig. 2).

Table 2 shows the significant risk factors associated with dyslipidemia of both genders. Risk factors for dyslipidemia showed different patterns for men and women. In men, dyslipidemia was significantly associated with central obesity (OR=2.58, 95% CI=1.32-5.06), overweight/ obesity (OR=2.50, 95% CI=1.75-3.56), and diabetes (OR=2.15, 95% CI=1.22-

3.78). In women, dyslipidemia was significantly associated with diabetes (OR=2.14, 95% CI=1.08-4.24), central obesity (OR=1.69, 95% CI=1.18-2.42), overweight/ obesity (OR=1.50, 95% CI=1.06-2.10), and hypertension (OR=1.43, 95% CI=1.03-1.99). Age was significantly associated with increased risk of dyslipidemia in both genders. In men, study subjects in 35-44, 45-54, and 55-64 age groups were more likely to have dyslipidemia than that of under 35 years old; while, in women, study subjects in 45-54 and 55-64 age groups were more likely to have dyslipidemia than that of under 35 years old.
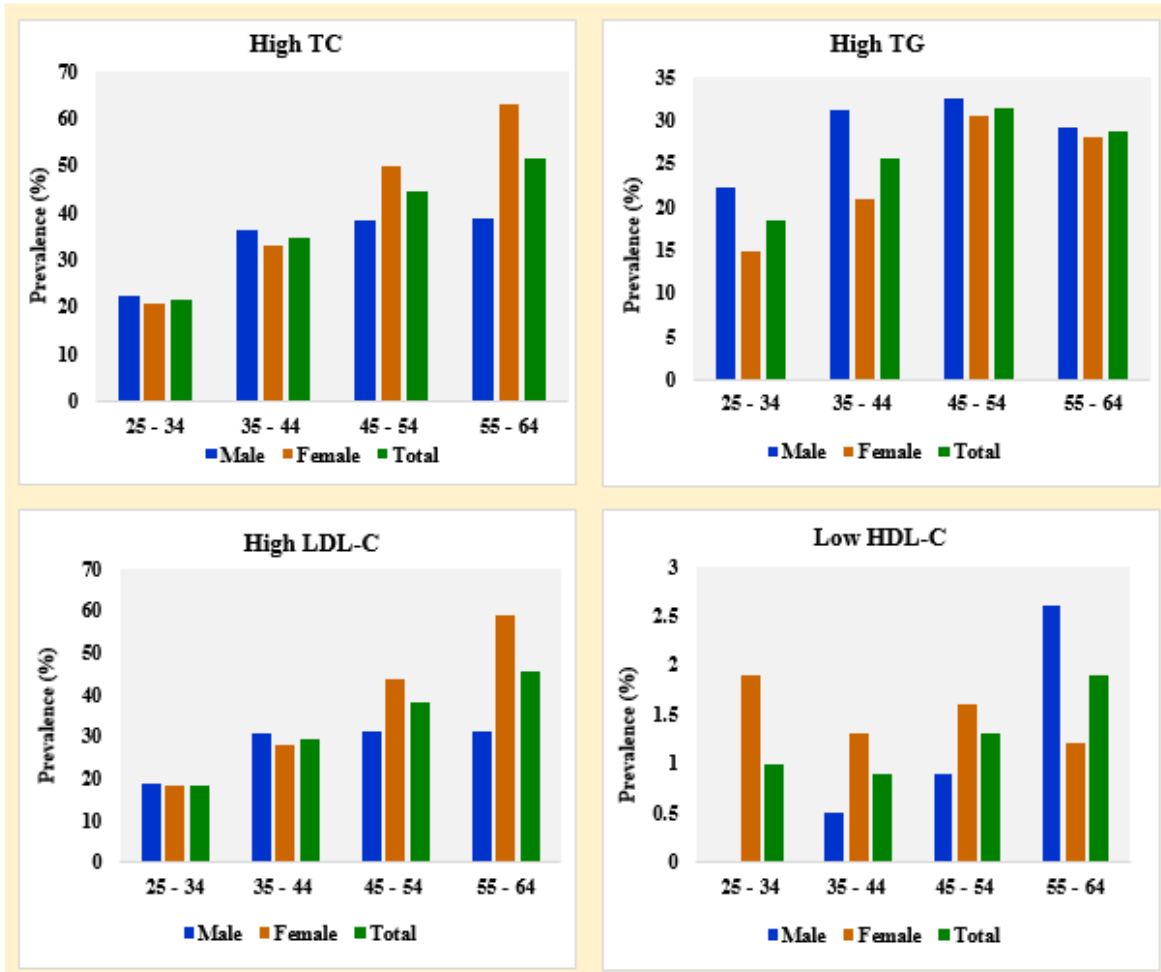
Available at: http://ijph.tums.ac.ir

Fig. 2: Prevalence of different types of dyslipidemia by age groups and gender

Table 2: Univariate and multivariate logistic regression analyses for dyslipidemia among the Khmer ethnic people adults aged 25 years and above

Characteristic	Male (N=848)						Female (N=952)					
	Crude OR (95% CI)			Adjusted ORᵃ (95% CI)			Crude OR (95% CI)			Adjusted ORᵃ (95% CI)		
	OR	LL	UL	OR	LL	UL	OR	LL	UL	OR	LL	UL
Age groups												
25 – 34	1.00	-	-	1.00	-	-	1.00	-	-	1.00	-	-
35 – 44	1.73**	1.16	2.58	1.64*	1.09	2.48	1.77**	1.20	2.61	1.44	0.96	2.16
45 – 54	1.87**	1.26	2.77	1.66*	1.10	2.51	3.36***	2.28	4.94	2.42**	1.61	3.63
55 – 64	1.78**	1.21	2.63	1.55*	1.03	2.32	5.69***	3.81	8.49	3.79**	2.46	5.84
Education level												
No formal education	1.00	-	-				1.00	-	-			
Primary	0.85	0.58	1.25				0.90	0.66	1.23			
Secondary	1.44	0.97	2.12				0.53***	0.37	0.76			
Tertiary	1.10	0.68	1.76				0.58	0.33	1.00			
University/College	1.42	0.76	2.65				0.24***	0.11	0.53			
Occupation status												

Agriculture	1.00	-	-				1.00	-	-			
State employee	1.70	0.88	3.27				0.24*	0.07	0.85			
Worker	0.89	0.65	1.22				0.90	0.64	1.27			
Housewife	1.51	0.33	6.80				0.96	0.69	1.34			
Others	1.24	0.74	2.10				1.66*	1.03	2.70			
BMI status												
Normal weight	1.00	-	-	1.00	-	-	1.00	-	-	1.00	-	-
Overweight/ Obesity	3.06***	2.17	4.32	2.50***	1.75	3.56	2.33***	1.78	3.06	1.50*	1.06	2.10
Central obesity												
No	1.00	-	-	1.00	-	-	1.00	-	-	1.00	-	-
Yes	4.86***	2.55	9.90	2.58**	1.32	5.06	2.95***	2.21	3.95	1.69**	1.18	2.42
Hypertension												
No	1.00	-	-				1.00	-	-	1.00	-	-
Yes	1.75***	1.31	2.35				2.53***	1.87	3.43	1.43*	1.03	1.99
Diabetes												
No	1.00	-	-	1.00	-	-	1.00	-	-	1.00	-	-
Yes	2.37**	1.34	4.30	2.15**	1.22	3.78	4.00***	2.05	8.38	2.14*	1.08	4.24

Statistically significant. *p< 0.05; **p< 0.01; ***p< 0.001

Discussion

In Vietnam, status of dyslipidemia among adults has recently been warned as an important social problem that has attracted the attention of public health researchers. In this study, the majority of respondents had low education levels, unfavorably economic conditions, and their main occupation was farming, which was one of the main characteristics of the Khmer in the Mekong Delta. The results of the study showed a high prevalence of dyslipidemia among men (47.3%) and women (51.4%). We concluded that dyslipidemia occurs quite popular in the Khmer ethnic community in Vietnam. Low education levels were one of the barriers that made it difficult for the Khmer ethnic people to access socioeconomic advances as well as dyslipidemia related medical care (14). In addition, the Khmer ethnic people lived mainly in rural and remote areas, so they had difficult travel conditions, and limited access to technology, internet, and medical care (14). The observed prevalence of dyslipidemia in this study suggests the need for a comprehensive national policy to control dyslipidemia in Vietnam. The results of the present study are similar to that of some recent studies about dyslipidemia among men and women, which have shown high preva-

lence of dyslipidemia such as 61.3% in men and 71.7% in women in Thailand (≥20 years in 2009) (3), 34.4% in men and 37.6% in women in China (≥18 years in 2010) (7), 64.5% in men and 65.7% in women in Germany (18-79 years in 2011) (23), 46.8% in men and 31% in women in South Korea (45-80 years in 2014) (24). A growing body of evidence indicates the frequency of dyslipidemia among racial/ethnic subgroups, Asian Indians, Filipinos and Hispanics are at greater risk for dyslipidemia (10, 11, 25, 26). Differences in study design, racial/ethnic subgroups, resident region, dietary habits, lifestyles, and accessibility to health care may account for much of the variations in the prevalence of dyslipidemia.

Our results found that the proportion of dyslipidemia was higher among 35-64 age group of men and 45-64 years age group of women compare to the under 35 years old group. It was summarized that age was the major risk factors of dyslipidemia among men and women in Vietnam and other countries (7, 12, 27). In Northwestern China, the prevalence of dyslipidemia was higher among 35-54 age group of men and 55-88 years age group of women compare to the other groups (25). In rural and urban China, men below age 50, were more likely than women to have dyslipidemia, whereas after age 59, men showed

lower risk of dyslipidemia than women (28). Early mandatory screening, even using rapid tests for dyslipidemia, contribute to earlier detection and prompt control. The results of this study have significant implications regarding the need for the government and local leaders to focus on methods and policies in preventing and controlling dyslipidemia among the Khmer adults, especially in the elderly. Tra Vinh provincial Department of Health should focus on upgrading and building modern medical facilities in ethnic minority areas. The results of our study showed that the possible risk factors for dyslipidemia of both genders by multivariate analysis. In fully adjusted model in both men and women, higher age, higher body mass index, central obesity, and diabetes were positively associated with dyslipidemia. In addition, among women having hypertension were positively associated with dyslipidemia. The odds ratio of dyslipidemia was higher in those with a higher age, a higher body mass index and diabetes in both men and women, which is consistent with an earlier study in Vietnam (29). This finding was consistent with some several previous studies among Asian population which demonstrated that the higher age, higher body mass index, central obesity and diabetes were the risk factors for dyslipidemia (25, 28, 30, 31). These findings provide further evidence of suboptimal management of risk factors for dyslipidemia among men and women.

Some limitations should be noted in this study. First, the present study was conducted in a rural population, and the age of participants were limited to 25 - 64 years old, so that we could not estimate the incidence of dyslipidemia and the estimates of prevalence rates of dyslipidemia in this study may not represent those of whole population. Second, this was a cross-sectional study, cause and effect relationship could not be established. Thirdly, this study was that the potential risk factors of dyslipidemia were not taken into consideration. Finally, there is very little research on the prevalence of the disease among the Khmer. Therefore, further research is required with a continued focus in large population and

should be conducted population-based cohort study to prevent dyslipidemia and NCDs.

Conclusion

Dyslipidemias are common in both men and women of the Khmer ethnic group in Vietnam. The associated factors of dyslipidemias in women and men were studied, provided important evidence for effective screenings and potential interventions for the treatment and control of dyslipidemias.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

Conflict of interest

The authors declare that there is no conflict of interests.

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