FACTORS ASSOCIATED WITH HYPERCHOLESTEROLEMIA IN KOPAT, KARANGSARI, PENGASIH SUBDISTRICT, KULON PROGO, YOGYAKARTA

H. Yuningrum[1]*, S. Sahayati[2]

[1,2] Public Health Department, Health Faculty, Respati Yogyakarta University
***corresponding author: hesti.yuningrum.siregar@gmail.com**

Abstract

Hypercholesterolemia is a major risk factor for coronary heart disease (CHD) because it can cause atherosclerosis. In Indonesia, the prevalence of hypercholesterolemia in the 25-34 year age group (9.3%) has increased (15.5%) in the 55-64 year age group. Risk factors for hypercholesterolemia can be divided into 2: uncontrollable factors such as age and heredity, as well as controllable factors such as obesity, cholesterol intake, high fat intake, low fiber intake, smoking, lack of physical activity and high blood sugar levels. The aim of this study the factors associated with hypercholesterolemia in Kopat Hamlet, Karangsari Village, Pengasih District, Kulon Progo Regency, Yogyakarta. Analytical research used in this study was cross sectional design. The study subjects were residents aged 40 years and above. The sampling technique uses purposive sampling method. The minimum number of samples is 60 people. Data were analyzed using univariate, bivariate (chi-square test) and multivariate (logistic regression). The results of bivariate analysis showed significant results namely BMI (RP = 1.73, 95% CI = 1.01-2.96, p-value = 0.040), fried food consumption (RP = 2.49, 95% CI = 1, 40-4.40, p-value = 0.001), fiber consumption (RP = 2.32, 95% CI = 1.31-4.12, p-value = 0.002), physical activity (RP = 3.14, 95% CI = 1.50-6.58, p-value = 0,000) and hypertension (RP = 1.90, 95% CI = 1.07-3.38, p-value = 0.020). Smoking (IDR = 1.05, 95% CI = 0.61-1.82, p-value = 0.85) and blood sugar levels (RP = 1.38, 95% CI = 0.81-2.35, p- value = 0.28) did not reach statistical significance. The results of multivariate analysis showed that the most influential risk factors for hypercholesterolemia were physical activity (RP = 7.01, 95% CI = 1.66-29.63, p- value = 0.008). Factors associated with hypercholesterolemia are BMI, fried consumption, fiber consumption, physical activity and hypertension.

Keywords: hypercholesterolemia, coronary heart disease, atherosclerosis

1. INTRODUCTION

Indonesia is currently facing a shift in the pattern of diseases from infectious diseases to non-communicable diseases (PTM). The prevalence of some major PTMs is increasing, while infectious diseases are still high, coupled with the presence of new diseases and old diseases that have reappeared [1]. Cardiovascular disease (PKV) is the leading cause of death in various developed countries and there is a tendency to increase as a cause of death in various developing countries. PKV, especially coronary heart disease (CHD) is a cause that needs to get more in-depth attention in developing countries. The high plasma total cholesterol level, arterial hypertension and smoking habits are the 3 main risk factors for CHD. Hypercholesterolemia occupies a very important position, because hypercholesterolemia is the only risk factor that can cause atherosclerosis. Diet or diet is closely related to hypercholesterolemia. Diet or diet is one of the main environmental factors causing CHD through blood cholesterol [2]. Hypercholesterolemia usually occurs in obese or elderly people but this metabolic disorder can occur in thin people even young people [3].

According to the Indonesian Ministry of Health's Research and Development Agency, the prevalence of hypercholesterolemia in the 25-34 year age group is 9.3% and increases according to

the age increase of up to 15.5% in the 55-64 year age group. Hypercholesterolemia is generally more common in women (14.5%) than men (8.6%) [4].

The prevalence rate of some non-communicable diseases in DI Yogyakarta is close to even higher than the national PTM prevalence. The details, hypertension 25.7% compared to national 25.8%, diabetes mellitus (DM) 3.0% compared to national 2.3%, coronary heart disease 1.3% compared to national 1.5%, chronic kidney failure 0.3 % compared to national 0.2%, stroke 16.9% compared to national 12.1% [5]. Special Region of Yogyakarta (DIY) in the results of Riskesdas in 2007, 2010 and in 2013 the prevalence of CHD was above the national figure. The prevalence of the population of Indonesia with the consumption of fatty foods, cholesterol, and fried foods more than or equal to one time per day 40.7%. The five highest provinces with consumption of fatty foods were Central Java (60.3%), DI Yogyakarta (50.7%), West Java (50.1%), East Java (49.5%), and Banten as many as 48 , 8% [6]. In Kulon Progo, the top 20 diseases that cause death are heart disease which ranks fifth and ranks sixth in hypertension [7].

Risk factors for hypercholesterolemia can be divided into 2: uncontrollable factors such as age and heredity, as well as controlled factors such as obesity, cholesterol intake, high fat intake, low fiber intake, smoking, lack of physical activity and high blood sugar levels [8].

Above normal body mass index (BMI) values such as obesity have a tendency of 30% higher cholesterol levels compared to respondents who have normal body weight [9]. BMI above normal tended to have a higher risk of blood cholesterol levels of 30-39% [10]. The main cause of increased cholesterol levels in the blood is the frequent consumption of foods containing high cholesterol and high saturated fat [11]. Foods that contain saturated fats such as meat, palm oil, brains and innards or trans fats (fast food, fried foods and innards). These foods are dangerous because they contain a lot of cholesterol [12].

Cholesterol can be controlled in several ways, one of which is by consuming fibrous foods. Fiber has many benefits for the body, including lowering cholesterol. Consuming less fibrous foods had a risk of 3,684 times having high total cholesterol levels compared to consuming enough fibrous foods [13].

Other risk factors for hypercholesterolemia are smoking and lack of physical activity. The more the number of cigarettes smoked per day, the total cholesterol will also increase. The duration of smoking also has a significant relationship with the risk of hypercholesterolemia. People who have a smoking habit of more than 15 years have 2.8 times the risk compared to people who have a smoking habit of less than 15 years [11]. Besides smoking, lack of physical activity also affects cholesterol levels. The risk of hypercholesterolemia is more common in respondents who have mild activity than respondents who have heavy activity. There is a significant relationship between physical activity and total cholesterol levels with r = -0,349 and p value <0,001 [14].

Other risk factors for controlled hypercholesterolemia include hypertension. The risk factor for hypercholesterolemia is hypertension. The higher the cholesterol is, the higher the occurrence of hypertension [15]. High LDL levels will damage the integrity of the arteries and inhibit the supply of blood carrying oxygen so that blood pressure can increase [16].

Based on a preliminary study at the Pengasih II Health Center, there were 498 households in Kopat hamlet. From that number, 151 families (30.32%), 98 families (19.68%) and hypertension data at the Pengasih II Puskesmas in April 2018 were 219 people. From the data from the results of the PHBS assessment of household settings in the working area of the UPTD of the Compassionate Health Center in 2017, the number of those who ate fruit and vegetables or fibrous foods was 90 families (18.1%).

Kopat Hamlet data is the most complete data compared to other hamlets. The researchers conducted primary data collection on 25 people for the examination of obesity, blood sugar levels,

and cholesterol. Of the 25 people measured there were 19 people (76%) who had the obesity category, 14 people (56%) who had high blood sugar levels and 17 people (68%) had high total cholesterol levels. Of the 10 people interviewed, it was found that 7 people consumed fried. Puskesmas officials who are authorized in research permits direct that Kopat Hamlet can be used as the research location. Kopat village is a large area in Karangsari village. Karangsari Village is included in the working area of the Compassionate Health Center II.

The purpose of this study was to determine the factors associated with hypercholesterolemia in Kopat Hamlet, Karangsari Village, Pengasih District, Kulon Progo Regency, Yogyakarta.

2. METHODS

This study is an analytical study with a cross sectional design. The research was conducted in Kopat Hamlet, Karangsari Village, Pengasih Subdistrict, Kulon Progo Regency, in September-October 2018. The research subjects were residents aged 40 years and above. The sampling method used was purposive sampling. Inclusion criteria are willing to be respondents by giving informed consent and not undergoing low cholesterol / low fat diits such as Diabetes Mellitus (DM) and CHD. Exclusion criteria were respondents who took drugs that lowered cholesterol levels, had a history of hypertension and had just stopped smoking 3 days earlier. The minimum sample size is 60 residents. The independent variables are BMI, fried consumption, fiber consumption, smoking, physical activity, blood sugar levels, hypertension. The dependent variable is hypercholesterolemia.

Primary data collection is carried out by researchers, assisted by enumerators who have equated their perceptions and nurses. The methods for collecting primary data are as follows:

2.1 Measurement of body weight and height using microtoise. BB and TB values will be used for BMI calculations. Respondents will be grouped into 2 groups, namely groups at risk (BMI ≥ 23 kg / m2) and not at risk (BMI <23 kg / m2) [17]

2.2 Fried food consumption was obtained from Semi Quantitative Food Frequency Questionnaire (SQFFQ) by interviewing respondents to obtain data on frequency and portion of food. After that, the frequency data is multiplied by the portion of each meal. Then the calculation of the frequency and portion of the meal is multiplied by the oil absorption coefficient. After that, the data on fried eating habits were categorized into 2, which were at risk (≥ 67 grams / day) and normal (<67 grams / day).

2.3 Fiber consumption was obtained from SQFFQ by interviewing respondents conducted by researchers to obtain data on frequency and portion of food in the past month. After that, the frequency data is multiplied by the portion of each meal. Then, consumption fiber multiplied by fiber DKBM divided by 100 (because according to DKBM per 100 grams of food weight). Then the data on fiber consumption is categorized into 2, which is at risk (<25 grams / day), not at risk (≥ 25 grams / day)

2.4 The smoking habits of respondents can be known based on the results of interviews using a questionnaire. Smoking status, assessed based on questions given to respondents and categorized as "smoking" and "no smoking".

2.5 Questions on the physical activity questionnaire consist of 16 numbers that are assessed based on the Global Physical Activity Questionnaire (GPAQ), which includes 3 assessments, namely activities of work, travel to and from the place of activity (transport) and recreational activities. Respondents were asked to answer questions about activities carried out daily and the intensity of time needed.

Measuring the level of physical activity is based on the magnitude of the MET, the value used to determine the level of physical activity in the GPAQ questionnaire. The formula used to calculate the total volume of physical activity in units of MET-minutes / week is [(P2 x P3 x 8) + (P5 x P6 x P4) + (P8 x P9 x 4) + (P11 x P12 x 8) + (P14 x P15 x 4)]. According to WHO [18] the level of physical activity is assessed according to the following criteria:

2.5.1 Not at risk if doing heavy activities at least 3 days with a minimum intensity of 1500 MET-minutes per week, or doing a combination of heavy, moderate, and running physical activities in 7 days with a minimum intensity of 3000 MET minutes / week.

2.5.2 At risk if the intensity of strong activity is at least 20 minutes / day for 3 days or more, or doing moderate activities for 5 days or more or walking at least 30 minutes / day, or doing a combination of heavy, moderate, and walking physical activities in 5 days or more with minimum intensity of 600 MET-minutes / week.

2.6 Blood sugar levels. Examination of high blood sugar levels that are used is an examination of blood sugar levels while that can be done at any time without regard to the food that was last eaten. Blood sugar levels were measured by nurses using rapid test easy touch. After being known, blood sugar levels are then grouped into 2, which is risky (≥ 200mg / dL) and not at risk (<200 mg / dL).

2.7 Measurement of Blood Pressure. Blood pressure measurements are carried out by nurses using a digital tensimeter. Blood pressure is categorized into 3, namely low, normal, high. Low blood pressure if <90/60 mmHg, is said to be normal if <130/85 mmHg and is said to be hypertension or high blood pressure if ≥ 140/90 mmHg (19). After known blood pressure and categorized into 3, then the next will be grouped into 2, namely hypertension and not hypertension.

2.8 Measurement of cholesterol was carried out by nurses using rapid test (Easy Touch). After measurement, cholesterol is grouped into 2, which is not at risk (<200 mg / dL) and risky (≥ 200 mg / dL) [20].

Descriptive analysis is done to get the distribution of respondents or characteristics of respondents and get an overview of the independent variables, dependent variables, confounding variables and external variables.

Bivariate analysis using chi-square test to determine the significance statistically and to see the magnitude of the risk of each variable used the prevalence ratio (RP) with 95% confidence interval (CI). Multivariate analysis was to analyze the relationship of several independent variables together with the dependent variable. Multivariate analysis was to analyze the independent variables which in the previous bivariate analysis had a value of p <0.25. Multivariate analysis was carried out with a logistic regression test to find the value of the prevalence ratio (RP) with a 95% confidence interval (CI).

3. RESULTS AND DISCUSSION

The total number of respondents in this study amounted to 60 people. The characteristics of the respondents studied included age and gender. Characteristics of research respondents can be seen in the Table 1. Based on Table 1 above, it can be seen that the majority of respondents included the elderly (51-65) category as many as 31 people (51.7%). The sex of the majority of respondents were 32 women (53.3%).

The variables studied were hypercholesterolemia, BMI, fried consumption, fiber consumption, smoking, physical activity, blood sugar levels, and hypertension. Based on table 3.2, it can be seen that the hypercholesterolemia of respondents in the high category is 29 people (48.3%). BMI of respondents was in the category of kg 23 kg / m2 as many as 27 people (45%). Fries consumption of

respondents in the category 67 grams / days was 26 people (43.3%). The respondent's fiber consumption in the category <25 grams / days was 27 people (45%). The smoking habit of respondents was 20 people (33.3%). The physical activity of respondents in the category of ≤ 600-1500 MET minutes / week was 33 people (55%). The sugar content of respondents in the high category was 13 people (21.7%). Respondents' hypertension was in the category 140/90 mmHg as many as 30 people (50%). The results of univariate analysis can be seen in the Table 2.

Table 1. Characteristics of Respondents

No	Variable	Number	Percentage (%)
1	**Age**		
	Pre-elderly (40-50) years old	29	48,3
	Elderly (51-65) years old	31	51,7
2	**Sex**		
	Male	28	46,7
	Female	32	53,3

Table 2. Univariate Analysis Results

No	Variable	Number	Percentage (%)
1	**Hypercholesterolemia**		
	High	29	48,3
	Normal	31	51,7
2	**BMI**		
	≥ 23 kg / m2	27	45
	< 23 kg / m2	33	55
3	**Fried Consumption**		
	≥ 67 grams / day	26	43,3
	< 67 grams / day	34	56,7
4	**Fibre consumption**		
	< 25 grams / day	27	45
	≥ 25 grams / day	33	55
5	**Smoking**		
	Smoke	20	33,3
	Not smoke	40	66,7
6	**Physical activity**		
	≤ 600-1500 MET minutes / week	33	55
	> 1500 MET minutes / week	27	45
7	**Blood sugar level**		
	High	13	21,7
	Normal	47	78,3
8	**Hypertensi**		
	≥ 140/90 mmHg	30	50
	< 140/90 mmHg	30	50

Bivariate analysis was carried out to determine the relationship between each independent variable and the variable bound using the chi-square test to determine statistical significance and strength of the relationship seen using the Prevalence Ratio (RP) with 95% Confident Interval (CI). The results of bivariate analysis can be seen on Table 3.

Table 3. Results of Bivariate Analysis

	Hypercholesterolemia					***CI 95%***	
Variabel	**High**	**%**	**Normal**	**%**	***p-value***	***RP***	***Lower***	***Upper***
BMI								
> 25 kg/m^2	17	63	10	37	0,040	1,73	1,01	2,96
≤ 25 kg/m^2	12	36,4	21	63,6				
Fried Consumption								
≥ 67 grams / day	19	73,1	7	26,9	0,001	2,49	1,40	4,40
< 67 grams / day	10	29,4	24	70,6				
Fiber consumption								
< 25 grams / day	19	70,4	8	29,6	0,002	2,32	1,31	4,12
≥ 25 grams / day	10	30,3	23	69,7				
Smoking								
Smoke	10	50	10	50	0,85	1,05	0,61	1,82
Not smoke	19	47,5	21	52,5				
Physical activity								
≤ 600-1500 MET minutes / week	23	69,7	10	30,3	0,00	3,14	1,50	6,58
> 1500 MET minutes / week	6	22,2	21	77,8				
Blood sugar level								
≥ 200 mg/dL)	8	61,5	5	38,5	0,28	1,38	0,81	2,35
<200 mg/dL	21	44,7	26	55,3				
Hypertensive								
≥ 140/90 mmHg	19	63,3	11	36,7	0,02	1,90	1,07	3,38
<140/90 mmHg	10	33,3	20	66,7				

Based on Table 3, respondents have BMI > 25 kg / m2 and have hypercholesterolemia as many as 17 people (63%). The results of bivariate analysis can be seen IMT with risk categories obtained value of RP. 1.73, (Confident Interval) 95% 1.01-2.96 and p-value 0.040. The results of this analysis can be concluded that people who have BMI > 25 kg / m2 at risk of 1.73 times greater for suffering from hypercholesterolemia compared with people who BMI is ≤ 25 kg / m2. BMI has a significant relationship with hypercholesterolemia (p-value <0.05).

BMI> 25 kg / m2 or overweight can increase cholesterol levels. Someone who has more weight has higher total cholesterol, LDL and triglyceride levels compared to normal body weight [21]. Excessive BMI shows enough fat stored in the body and in the blood. Excess weight can cause high cholesterol, heart disease, diabetes and other serious diseases [22]. If you are overweight can increase the risk of atherosclerosis (narrowing and hardening of the arteries) in various ways and tend to have high cholesterol levels and a low amount of HDL [23]. This is supported by the study found that high BMI risked having a high total cholesterol level of 4.643 times compared to respondents with a normal BMI category [13].

Respondents with consumption of fried foods ≥ 67 grams / day and have hypercholesterolemia as many as 19 people (73.1%). The results of bivariate analysis between consumption of fried foods with hypercholesterolemia obtained a value of RP. 2.49, (95% CI=1.40-

4.40 and a p-value of 0.001). The results of this analysis can be concluded that people who consumed fried ≥ 67 grams / day were 2.49 times more likely to suffer from hypercholesterolemia than those who ate fried foods <67 grams / day. Consumption of fried foods has a significant relationship with hypercholesterolemia (p-value <0.05).

Indonesians mostly consume fried foods that contain saturated fats, saturated fats are often referred to as bad fats which are at risk of clogging the blood circulation. The high LDL cholesterol causes constriction of blood vessels due to consuming fried foods rich in saturated fat. Saturated fat is the main cause of increased blood cholesterol and LDL [24]. Other research showed that there was a significant relationship between fried foods (p = 0.047), fried foods (p = 0.013), and fat intake from fried foods (0.036) with dyslipidemia [25].

Respondents with consumption of fiber (<25 grams / day) and have hypercholesterolemia as many as 19 people (70.4%). The results of bivariate analysis between fiber consumption and hypercholesterolemia obtained a value of RP 2.32, (95% CI 1.31-4.12 and p-value 0.002). The results of this analysis can be concluded that people who consume fibrous foods <25 grams / day risk 2.32 times greater suffer from hypercholesterolemia compared with people who consume fibrous foods ≥ 25 grams/day. Fiber consumption has a significant relationship with hypercholesterolemia (p-value <0.05).

Fiber serves to bind fat derived from food in the digestive process so as to prevent an increase in LDL cholesterol levels. The recommended fiber consumption is 25-40 grams per day, or equivalent to 6 red apples with skin or 6 vegetable bowls [26]. Getting a lot of consumption of fibrous foods can reduce the risk of constipation, eating lots of vegetables and fruits can also maintain blood pressure, blood sugar levels and blood cholesterol within normal limits [27]. Adequate fiber consumption can also protect our heart by lowering bad cholesterol (LDL) without reducing good cholesterol (HDL) [28]. This is supported by research which found that there was a relationship between fiber consumption and cholesterol levels [29].

Respondents smoked and had hypercholesterolemia as many as 10 people (50%). The results of bivariate analysis between smoking and hypercholesterolemia obtained a value of RP 1.05, (95% CI 0.61-1.82 and a p-value of 0.85). The results of the analysis can be concluded that people who smoke have a risk of 1.05 times greater suffering from hypercholesterolemia compared with people who do not smoke. Statistically smoking did not have a significant relationship with hypercholesterolemia (p-value > 0.05).

The risk proportion of hypercholesterolemia is more common in respondents who smoke (55.9%) than non-smokers (51.6%). Cigarettes have a risk of hypercholesterolemia. Smoking can increase blood cholesterol levels. Smoking habits can affect total cholesterol levels because smoking can reduce HDL levels in the blood [30]. Some studies also prove that smoking can increase LDL cholesterol levels and suppress HDL cholesterol. High levels of nicotine in the blood can also lead to abnormalities in blood vessels that have an impact on health problems [31].

Respondents with no physical activity (≤ 600-1500 MET minutes / week) and had hypercholesterolemia as many as 23 people (69.7%). The results of bivariate analysis between physical activity and hypercholesterolemia obtained a value of RP 3.14, (95% CI 1.50-6.58 and a p-value of 0,000). The results of this analysis can be concluded that people who have physical activity ≤ 600-1500 MET minutes / week 3.14 times greater risk of suffering from hypercholesterolemia compared with people who have physical activity > 1500 MET minutes / week. Physical activity had a significant relationship with hypercholesterolemia (p-value <0.05).

Physical activity affects one's LDL and HDL levels. Lack of physical activity can increase LDL levels and reduce HDL levels [31]. Regular exercise is also effective in reducing total cholesterol levels and increasing HDL cholesterol in patients with hypercholesterolemia [32]. Physical activity can reduce LDL levels and total cholesterol levels, this is evidenced by research showing a relationship between physical activity and total cholesterol and LDL levels with p =0.001 [14]. Other research, shows a relationship between physical activity and blood cholesterol levels [33].

Respondents with blood sugar levels are ≥ 200 mg / dL and have hypercholesterolemia as many as 8 people (61.5%). The results of bivariate analysis between blood sugar levels and hypercholesterolemia obtained a value of RP 1.38, (95% CI 0.81-2.35 and a p-value of 0.28). The results of this analysis can be concluded that people who have high blood sugar levels ≥ 200 mg / dL risk 1.38 times greater suffer from hypercholesterolemia compared with people who have low blood sugar levels <200 mg / dL. Statistically, blood sugar levels did not have a significant relationship with hypercholesterolemia (p-value> 0.05).

Statistically blood sugar levels do not have a significant relationship with hypercholesterolemia. In theory, people who have high blood sugar will have lower HDL cholesterol (good cholesterol), and LDL cholesterol (bad cholesterol). When sugar levels are high, the body responds by releasing high amounts of insulin. Insulin is an important hormone for metabolizing sugar and cholesterol (fat) in the blood. Insulin functions to make sugar circulating in the blood can be transported to the body's cells. If insulin levels rise, LDL cholesterol goes up while HDL cholesterol will decrease. Then, if the body has stored all the sugar as needed, but there is still a lot of blood sugar circulating in the bloodstream, then insulin helps convert the sugar into triglycerides. When high blood sugar, body fat in the form of triglycerides can also go up, because blood sugar, cholesterol and triglycerides are interconnected [34].

Respondents with hypertension (≥140/90 mmHg) and have hypercholesterolemia as many as 19 people (63.3%). The results of bivariate analysis between hypertension and hypercholesterolemia obtained a value of RP 1.90, (95% CI 1.07-3.38 and a p-value of 0.020). The results of this analysis can be concluded that people who are at risk of hypertension 1.90 times more likely to suffer from hypercholesterolemia compared with people who are not hypertensive. Hypertension has a significant relationship with hypercholesterolemia (p-value <0.05).

Hypertension or high blood pressure can cause the hardening of the arteries to become fast which is the main cause of atherosclerosis [35]. Atherosclerosis is a major danger of triggering hypertension. One of the causes of atherosclerosis is hypercholesterolemia. Atherosclerosis can be initiated by hypercholesterolemia, but atherosclerosis is not always experienced by people with hypercholesterolemia. Many factors encourage atherosclerosis. One of them is high LDL levels. The formation of oxidized LDL will damage the proteins making up the arterial walls so that the integrity of the arteries becomes damaged [16]. Other research shows a significant relationship between hypertension and hypercholesterolemia (p-value = 0.001) [15]. There is a connection between total cholesterol levels with systolic and diastolic blood pressure. The total serum cholesterol level increases according to the increase in blood pressure [36].

Multivariate analysis was carried out by logistic regression test. The variables included in the multivariate analysis were BMI variables, fried consumption, fiber consumption, physical activity and hypertension because of the p-value <0.25 during bivariate analysis. There are 3 models in multivariate analysis, namely model 1 which includes all variables, model 2 variable hypertension is omitted, model 3 variable BMI is omitted. The results of multivariate analysis showed that the variable physical activity was the most risky factor for hypercholesterolemia. The results of multivariate analysis can be seen in the Table 4.

Table 4. Multivariate Analysis Results

Variable	Model 1 RP CI 95% *p-value*	Model 2 RP CI 95% *p-value*	Model 3 RP CI 95% *p-value*
BMI			
> 25 kg/m^2	3,51 (0,80-15,46) 0,096	3,97 (0,92-17,06) 0,109	
Fried consumption			
≥ 67 grams / day	5,19 (1,16-23,11) 0,031*	5,67 (1,30-24,76) 0,021*	4,28 (1,13-16,22) 0,032*
Fiber consumption			
< 25 grams / day	3,85 (0,89-16,57) 0,071	4,60 (1,13-18,76) 0,033*	5,64 (1,44-22,00) 0,013*
Physical activity			
≤ 600-1500 MET minutes / week	7,01 (1,66-29,63) 0,008*	7,08 (1,70-29,54) 0,007*	7,06 (1,80-27,68) 0,005*
hypertension			
≥ 140/90 mmHg	1,93 (0,45-8,22) 0,374		

*sig

Statistically the quality of the model depends on the value of calibration and discrimination. In the prediction model with the output in the form of categorical, the calibration value was tested by analysis of Hosmer and Lemeshow while the value of discrimination was with area under curve (AUC). Calibration is said to be good if the p value in the Hosmer and Lemeshow test is greater than 0.05, which means there is no difference between the value of observation (observed) and expectation (expected). The discrimination value is said to be good if the AUC value is greater or equal to the expected minimum AUC value. Generally the AUC value is said to be strong if it is greater than 80% [37]. Determination of the final model uses the Hosmer and Lemeshow analysis to see the quality of the model from the calibration aspects and ROC analysis. The main output of the ROC analysis is the ROC image value, area under ROC curve value (AUC) and the confidence interval. The results of multivariate analysis obtained three models, namely model 1, model 2 and model 3. The quality of the model statistically can be seen in the Table 5.

The results of the analysis of all models have good calibration because the p value in the Hosmer and Lemeshow test is greater than 0.05. Based on the AUC value, the best models in a row are model 1, model 2 and model 3. The final model used is model 1 because it has an AUC value that is greater than model 1 and model 2. The AUC value of model 1 is 0.881. The AUC value of 0.80-0.90 is included in the strong classification [37]. It can be concluded that statistically, the logistic regression equation model 1 is strong for predicting the incidence of hypercholesterolemia. The equation contains BMI variables, fried consumption, fiber consumption, physical activity and hypertension. The final model, model 1, shows that people who have physical activity ≤ 600-1500

MET minutes / week risk 7.01 times greater suffering from hypercholesterolemia compared to people who have physical activity> 1500 MET minutes / week.

Multivariate results show that physical activity is the most influential variable with hypercholesterolemia (RP = 7.01, 95% CI = 1.66-29.63, p-value = 0.008). The results of this analysis can be concluded that people who have physical activity ≤ 600-1500 MET minutes / week risk 7.01 times greater suffering from hypercholesterolemia compared with people who have physical activity > 1500 MET minutes / week. These results indicate that the variables of fried consumption and physical activity after being analyzed together with the dependent variable, the results showed that they remained significantly meaningful in bivariate and multivariate ways, but there was a significant relationship with hypercholesterolemia.

Table 5 Quality Comparison of Models 1, 2 and 3

Model	Variable	Calibration	AUC (CI 95%)
Model 1	BMI Fried consumption Fiber consumption Physical activity Hypertension	Good *p value*=0,262 (p>0,05)	Strong 0,881 (0,788-0,974)
Model 2	BMI Fried consumption Fiber consumption Physical activity	Good *p value*=0,849 (p>0,05)	Strong 0,879 (0,787-0,970)
Model 3	Fried consumption Fiber consumption Physical activity	Good *p value*=0,716 (p>0,05)	Strong 0,857 (0,759-0,955

4. CONCLUSION

Our conclusion are BMI, fried consumption, fiber consumption and physical activity have relationship with hypercholesterolemia in Kopat hamlet, Karangsari village, Pengasih district, Kulon Progo district, Yogyakarta. Smoking, blood sugar and hypertension were not related to hypercholesterolemia in Kopat Hamlet, Karangsari Village, Pengasih Subdistrict, Kulon Progo Regency, Yogyakarta

5. ACKNOWLEDGEMENTS

The authors would like thank to

5.1 Pusat Penelitian dan Pengabdian Masyarakat (PPPM) of the University of Respati Yogyakarta for funding support during the conduct of research

5.2 Primmary Health care Pengasih II Kabupaten Kulon Progo

5.3 Head of the Kopat hamlet, Karangsari village, Pengasih subdistrict, Kulon Progo regency.

REFERENCES

[1] Kementrian Kesehatan RI. (2012). *Petunjuk Teknis Penyelenggaraan Pengendalian Penyakit Tidak Menular Di Puskesmas,* Direktorat Jenderal Pengendalian Penyakit dan Penyehatan Lingkungan, Jakarta.

[2] Hatma, R.D. (2012). *Sosial Determinan Dan Faktor Risiko Kardiovaskular (Analisa Data Sekunder Riskesdas 2007)*, Buletin Jendela Data dan Informasi Kesehatan, Volume 2, Triwulan 2.

[3] Fitnella V. (2009). *Awas Bahaya Laten Kolesterol*. Yogyakarta: Azna Books; 49-51.

[4] Aurora, R., Sinambela, A., Noviyamti, C. (2012). Peran Konseling Berkelanjutan pada Penanganan Pasien Hiperkolesterolemia, *Jurnal Indonesia Medical Assoc*, Volume: 62, Nomor: 5, Mei 2012.

[5] Sudjatmiko,T. (2016). *Angka Kematian Penyakit Tidak Menular Melesat*, diakses 21 Januari 2018 dari http://www.krjogja.com

[6] Kesehatan Kementerian RI. (2013). *Riset Kesehatan Dasar (Riskesdas)*. Badan Penelitian dan Pengembangan Kesehatan. Diakses 19 Februari 2018, dari http://www.depkes.go

[7] Dinkes Kulon Progo. (2016). Profil Kesehatan Kabupaten Kulon Progo Tahun 2016. Dinas Kabupaten Kulon Progo.

[8] Anies. (2015). *Kolesterol & Penyakit Jantung Koroner: Solusi Pencegahan dari Aspek Kesehatan Masyarakat.* Yogyakarta: Ar-Ruzz Media.

[9] Yani, M. (2015). Mengendalikan Kadar Kolesterol pada Hiperkolesterolemia. *Jurnal Olahraga Prestasi*, vol. 11, no. 2.

[10] Soleha, M. (2012). Kadar Kolesterol Tinggi dan Faktor-Faktor yang Berpengaruh Terhadap Kadar Kolesterol Darah. *Jurnal Biotek Medisiana Indonesia*, vol. 1, no. 2.

[11] Ayuandira, A. (2012). Hubungan Pola Konsumsi Makan, Status Gizi, Stres kerja dan Faktor Lain Dengan Hiperkolesterolemia Pada Karyawan PT. Semen Padang. *Skripsi*. Fakultas Kesehatan Masyarakat, Universitas Indonesia.

[12] Herliana, E., & Sitanggang, M. (2009). *Solusi Sehat Mengatasi Kolesterol Tinggi.* Jakarta Selatan: PT Agromedia Pustaka.

[13] Sari, D., Azrimaidaliza, A., Purnakarya, I. (2010). Faktor Resiko Kolesterol Total Pasien Penyakit Jantung Koroner Dirumah Sakit Achmad Mochtar Bukittinggi. Jurnal Kesehatan Masyarakat. Vol. 4, No. 2. hal 77-81.

[14] Zuhroiyyah, S, F., Sukandar, H., & Sastradimaja, S, B. (2017). Hubungan Aktivitas Fisik dengan Kadar Kolesterol Total, Kolesterol Low-Density Lipoprotein, dan Kolesterol High-Density Lipoprotein pada Masyarakat Jatinangor. JSK, volume 2, no 121.

[15] Hasliani, D. (2017). Hubungan Kadar Kolesterol dengan Hipertensi Pada Penderita Penyakit Ginjal Kronik di RSUD Dr. Moewardi. Skripsi. Universitas Muhammadiyah Surakarta.

[16] Lingga, L. (2012). Bebas Hipertensi Tanpa Obat. Jakarta Selatan: PT AgroMedia Pustaka.

[17] Sudargo, T., Freitag, H., Rosiyani, F., & Kusmayanti, N. A. (2014). Pola Makan dan Obesitas. Yogyakarta: Gadjah Mada University Press.

[18] Hamrik, Z., Sigmundova., Kalman, M., Pavelka, J., & Sigmund, E. (2014). Physical Activity Sedentary In Behaviour In Czech Adults: Result From The GPAQ Study. European Journal of Sport Science, volume 14, no 2.

[19] Vitahealth. (2006). Hipertensi. Jakarta: PT Gramedia Pustaka Utama.

[20] Kurniadi, H. (2013). Stop Gejala Penyakit Jantung Koroner. Yogyakarta: Familia.

[21] Wijayakusuma, H. (2008). Ramuan Herbal Penurun Kolesterol. Jakarta: Pustaka Bunda.

[22] WHO. (2013). What is Moderate-intensity and Vigorous-intensity Physical Activity? Retrieved November 27, 2018, from World Health Organization: https://www.who.int/dietphysicalactivity/physical_activity_intensity/en/

[23] Nilawati., Krisnatuti, D., Mahendra, B., Djing, O. (2008). Care Your Self : Kolesterol, Jakarta : Penebar Plus

[24] Hanum, Y. (2016, Desember). Dampak Bahaya Makanan Gorengan bagi Jantung. Jurnal Keluarga Sehat Sejahtera, volume 14.

[25] Sudargo, T., Sari, F, T., & Naomi, N, D. (2017). The Correlation of Obesity, Smoking, Fried Foods Consumption Pattern and Food Intake With Lipid Profile In Civil Servant In Yogyakarta, Indonesia. International Journal of Community Medicine and Public Health, volume 4.

[26] Mumpuni, Y., & Wulandari, A. (2011). Cara Jitu Mengatasi Kolesterol. Yogyakarta: C.V Andi Offset.

[27] Permenkes RI. (2014). Peraturan Menteri Kementerian Kesehatan Nomor 41 Tahun 2014, Pedoman Gizi Seimbang. Diakses July 25, 2018, dari Peraturan.go.id: http://peraturan.go.id/permen/kemenkes-nomor-41-tahun-2014.html.

[28] Aphrodita. (2014). Terapi Jus Buah dan Sayur. (M. Sandra, Penyunt.) Jogjakarta: KATAHATI.

[29] Mamat. (2010). Faktor-Faktor Yang Berhubungan Dengan Kadar Kolesterol HDL Di Indonesia (Analisis Data Sekunder IFLS 2007/2008). Tesis. Universitas Indonesia.

[30] Sistiyono., Martiningsih, M. A., & Hastuti, F. (2016). Gambaran Kadar Kolesterol Total Pada Penderita Hipertensi Sebelum dan Sesudah Terapi Bekam Basah. Jurnal Teknologi Laboratorium, vol. 5, no. 1.

[31] Ruslianti. (2014). Kolesterol Tinggi Bukan untuk Ditakuti (1 ed.). (D. Ari, Ed.) Jakarta Selatan: FMedia (Imprint AgroMedia Pustaka).

[32] Shirazi, S. A. (2006). Effect of Exercise on Plasma Cholesterol. Gomal Journal of Medical Sciences, volume 4.

[33] Agustiyanti, P.N., Siti, F.P., dan Rony A. (2017). Hubungan Asupan Makanan, Aktivitas Fisik dan Penggunaan Kontrasepsi Hormonal dengan Kadar Kolesterol Darah (Studi Pada Wanita Keluarga Nelayan Usia 30-40 Tahun di Tambak Lorok, Semarang Tahun 2017). Jurnal Kesehatan Masyarakat, volume 5, no 4, Oktober.

[34] Upahita, D. (2018). Waspada, Gula Darah Tinggi Bisa Bikin Kolesterol dan Trigliserida Naik, diakses 21 Januari 2018 dari https://hellosehat.com/hidup- sehat/tips-sehat/gula-darah-tinggi-kolesterol-naik/

[35] Fikri, F. (2014). Bahaya Kolesterol: Memahami, Mendeteksi, dan Mengotrol Kolesterol. (A. Aziz, Penyunt.) Jogjakarta: KATAHATI.

[36] Margarita, Y., Princen., Andi., Rumawas, M. E., Kidarsa, V. B., Sutrusna, B. (2013). Kadar Kolesterol Total dan tekanan Darah Orang Dewasa Indonesia. Jurnal Kesehatan Masyarakat Nasional, vol. 8, no. 2.

[37] Dahlan, S. (2009). Penelitian Diagnostik : Dasar-Dasar Teoritis dan Aplikasi dengan Program SPSS dan Stata. Jakarta: Salemba Medika