FAST FOOD INTAKE, PHYSICAL ACTIVITY, AND BODY COMPOSITION: THE ROLE IN BLOOD CHOLESTEROL LEVELS AMONG YOUNG ADULT

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Abstract. Hypercholesterolemia is a condition of increased blood cholesterol levels that can increase the risk of heart disease, hypertension and stroke. Hypercholesterolemia is dominated by lifestyle factors. This study aims to analyze the relationship between fast food consumption patterns, body composition and physical activity with blood cholesterol levels. Methods: Cross-sectional study of 100 respondents using purposive sampling with the criteria of age 19-25 years not smoking and not having a history of Non-Communicable Disease (NCD). Body composition data was collected using Bio Impedance Analysis (BIA), fast food consumption using Food Frequency Questionnaire (FFQ), and physical activity using IPAQ. The data were analyzed by Pearson test to be followed by multiple linear regression tests. Results: Analysis shows there is a relationship between percent body fat (p=0.000; r=0.403), visceral fat (p=0.000; r=0.434), fast food consumption patterns (p=0.000; r=528) and physical activity (p=0.000; r= -0.585) with blood cholesterol. Regression results showed that fast food consumption, visceral fat and physical activity simultaneously affect blood cholesterol with a correlation coefficient of 0.09; 3.22; -0.04, respectively. Conclusion: Fast food consumption, percent body fat, visceral fat and physical activity are correlated with blood cholesterol.

Keywords: hypercholesterolemia, fast food, body composition, physical activity, young adult

A. Introduction

Hypercholesterolemia is a condition of fat metabolic disorders characterized by an increase in cholesterol levels above normal, namely ≥ 200 mg/dL [1]. The world's prevalence of hypercholesterolemia is projected to reach 39% [2]. The 2018 Riskesdas data stated that 28.8% of the Indonesian population aged ≥15 years had total cholesterol levels above normal [3]. These results indicate that the problem of hypercholesterolemia does not only occur in adulthood, but is currently starting to be found in younger age groups [4].

Increasing cholesterol levels are generally asymptomatic. Increased blood cholesterol levels that occur for a long time will cause disruption of blood circulation and risk of atherosclerosis [5]. This condition will then trigger the development of various non-communicable diseases such as hypertension, coronary heart disease (CHD), stroke, and death [6].

Lifestyle is the biggest risk factor that can affect body composition and impact health conditions. The fat component as part of body composition is also said to be associated with the incidence of hypercholesterolemia. The body fat component consists of body fat percentage and visceral fat. Percent body fat is the percentage of fat mass of total body weight. The results of research on individuals aged 6-18 years show that percent body fat correlates with blood cholesterol levels [7]. Visceral fat as fat stored in the abdominal area also shows the same thing. Cross-sectional studies in individuals aged ≥18 years in China reported similar results that showed a correlation between visceral fat and blood cholesterol [8]. According to previous research, conditions of nutritional status and excess fat showed an increased risk of up to 3.28 times higher experiencing elevated blood cholesterol levels at the age of ≥18 years [9].

Changes in body composition can be caused by fast food consumption behavior among people known to have increased in the modern era. Excessive consumption of foods high in calories, saturated fat, salt, and low in fiber for a long time, can be a triggering factor for an increase in LDL cholesterol levels [10]. Previous research reported that fast food consumption >3 times per week increased the risk of up to 8.4 times hypercholesterolemia [11].

Physical activity is also cited as a factor that affects body composition and leads to increased cholesterol levels. Data from the 2018 Riskesdas showed that 33.2% of the population aged 20-24 years had insufficient physical activity [3]. The results of previous research show that low physical activity has a 2.23 times greater risk of hypercholesterolemia [12].

Based on the background description above, it can be seen that lifestyle is a risk factor that can increase the risk of hypercholesterolemia so researchers are interested in examining the factors associated with blood cholesterol levels in early adulthood.

B. Research Methods

Observational analytic research with a cross-sectional approach was conducted from January to July 2023. The sample used amounted to 100 people obtained through the calculation of the minimum sample with an anticipated dropout of 10%. Data collection using purposive sampling method was carried out on respondents with criteria aged 18-25 years, did not have a smoking habit either regular or electric, did not have a diagnosis of dyslipidemia and CHD and did not have a family history of dyslipidemia and were not on a specific diet.

The data of this study were taken using the easy touch GCU tool for cholesterol level with 94% sensitivity and 88% specificity, Food Frequency Questionnaire according to standardized guidelines for fast food intake data, Bio Impedance Analysis for body composition data and IPAQ for physical activity with Kaiser-Meyer-Olkin value for the validity of 0.910 and reliability of 0.884 with Cronbach's Alpha test. The category of cholesterol level measurement results in this study refers to the National Cholesterol Education Program (2001), namely normal (<200 mg/dL) and high (≥200 mg/dL) categories. The distribution of data on research variables presented in the form of cross tabulation shows that fast food consumption patterns are categorized according to the mean, visceral fat is categorized according to Sukkriang et al (2021), namely normal (1-9), high (10-14) and very high (≥15). Percent body fat data is categorized according to Williams 2002, namely athletic, good, normal, overweight and obese categories based on gender, while physical activity data is categorized according to IPAQ, namely low (<600 MET minutes/week), moderate (600 - 3000 MET minutes/ week) and high (≥3000 MET minutes/week).

The data obtained were then carried out univariate tests to determine the description of the characteristics and then the normality test was carried out. Correlation analysis was performed with the Pearson test with 95% CI. Variables with a p-value <0.25 will then be analyzed with multiple linear regression tests. This study has also been approved by the Health Research Ethics Commission (KEPK) of the Faculty of Health Sciences, Jenderal Soedirman University with letter number 1030/EC/KEPK/II/2023.

C. Results

Tabel 1. Characteristics of research respondents

Characteristics	n	%
Sex		
Male	25	25,0
Female	75	75,0
Cholesterol Levels		
High (≥200 mg/dL)	48	48,0
Normal (<200 mg/dL)	52	52,0
Living Status		
Live alone	76	76,0
Living with parents	24	24,0
Amount of Income		
<Rp 500.000	14	14,0
Rp 500.000 – Rp 1.000.000	49	49,0
>Rp 1.000.0000	37	37,0

Out of the 100 research respondents, 75 people (75%) were female and 48% of respondents were found to have cholesterol levels ≥200 mg/dL. Most of the study respondents had their residence (76%) and the majority (49%) had an allowance of Rp 500,000 to Rp 1,000,000.

Tabel 2. Distribution data of variable characteristics based on blood cholesterol levels

Variable Characteristics	Cholesterol Levels				Total	
	High		Normal			
	n	%	n	%	n	%
Percent Body Fat						
Athletics	0	0	1	100	1	1,0
Good	0	0	5	100	5	5,0
Normal	9	30,0	21	70,0	30	30,0
Overweight	12	48,0	13	52,0	25	25,0
Obese	27	69,2	12	30,8	39	39,0
Visceral Fat						
Normal (<10)	48	48,0	52	52,0	100	100
Visceral Fat according to Mean						
Below the mean (<3.06)	14	25,0	42	75,0	56	56,0
Above the mean (≥3.06)	34	77,3	10	22,7	44	44,0
Fast Food Consumption						
Infrequent (<327.25)	17	31,5	37	68,5	54	54,0
Frequent (≥327.25)	31	67,4	15	32,6	46	46,0
Physical Activity						
Low (600 MET minutes/week)	48	70,6	20	29,4	68	68,0
Moderate (600 – 1300 MET minutes/week)	0	0	32	100	32	32,0

Based on the distribution of data in Table 2, it is known that a high prevalence of elevated cholesterol levels was found in respondents with percent body fat in the obese category (69.2%). The results of measurements on respondents showed that 100% of respondents had normal visceral fat (<10), but according to the distribution of data with categorization according to the mean, there was a tendency for high cholesterol in respondents with visceral fat above the mean (3.06), namely as many as (77.3%). Elevated cholesterol levels also tend to be seen in respondents with frequent fast food consumption (67.4%) and light physical activity (70.6%).

Table 3. Bivariate analysis of factors associated with blood cholesterol levels

Variable	Mean ± SD	*p-value*	Coefficient Correlation
Percent Body Fat	26,26 ±5,99	0,000	0,403
Visceral Fat	3,06 ±1,52	0,000	0,434
Fast Food Consumption	327,25 ±125,397	0,000	0,528
Physical Activity	469,17±220,11	0,000	-0,585

The results of bivariate analysis showed that percent body fat correlated with cholesterol levels ($p<0.05$) with a positive correlation direction (0.403). Body fat is also known to correlate with cholesterol levels ($p<0.05$) with a positive relationship direction (0.434). The statistical results of fast food consumption patterns showed a relationship with cholesterol levels ($p<0.05$) with a positive relationship direction (0.528). While physical activity is known to be negatively correlated with blood cholesterol levels ($p<0.05$; $r= -0.585$).

Table 4. Multivariate analysis

Model	Unstandardized Coefficient B	t	*p-value*
(Constant)	160,621		
Percent Body Fat	0,67	-4,259	0,065
Visceral Fat	0,09	5,676	0,000
Fast Food Consumption	3,22	2,422	0,017
Physical Activity	-0,04	1,868	0,000

Multiple linear regression analysis conducted showed that visceral fat, fast food consumption patterns and physical activity are variables that affect blood cholesterol levels ($p<0.05$), but percent body fat is not a variable that affects cholesterol. Based on the table above, visceral fat is also the variable that has the greatest influence on blood cholesterol with a coefficient of 3.22 followed by fast food consumption (0.09) and physical activity (-0.04).

Tabel 5. F-Test

Model	df	F	*p-value*
Regression	4	31,26	0,000
Residual	95	0	
Total	99		

The results of the F-test show that the variables of fastfood consumption patterns, visceral fat and physical activity can simultaneously affect blood cholesterol levels ($p<0.05$).

Table 6. Coefficient of Determination Analysis

Model	R	R^2	Adjusted R^2
1	0,754	0,568	0,550

The coefficient of determination analysis shows that visceral fat, fast food consumption patterns and physical activity can explain cholesterol levels by 56.8% and the remaining 43.2% is explained by other variables outside this study. The results of the multivariate analysis that has been carried out can produce the following regression formula:

$$Y = 160,621 + 0,09\ X_1 + 3,22\ X_2 - 0,04\ X_3$$

D. Discussion

1. Characteristics of Research Respondents

Based on Table 1, research respondents were dominated by women (75%). on respondents with female gender. This can be caused by the food-purchasing behavior of female respondents who are influenced by visual appeal and mood factors when compared to men [13]. Women tend to use food by increasing consumption of unhealthy foods as an effort to control their mood and relieve negative internal conditions within themselves [14].

Most of the respondents in this study had an income in the interval of Rp 500,000 to Rp 1,000,000. This condition causes a crisis of changes in unhealthy eating behavior due to the availability and easy access to unhealthy foods that encourage respondents to consume fast food to meet the needs of the body. In addition, the amount of income will also encourage a person to choose modern food and tend to override prices in the selection of food ingredients but other considerations are still made such as sensory and ease of providing food [15].

2. Body Composition and Blood Cholesterol Levels

Measurements of body fat components are better used to predict individual obesity conditions when compared to Body Mass Index (BMI) as well as percent body fat and visceral fat [7]. Body fat is also known to be used to monitor changes in serum fat biomarkers as an evaluation of cardiovascular disease risk [16].

The statistical test results of this study showed that percent body fat correlated and visceral fat correlated with blood cholesterol levels with a positive correlation direction. These results are in line with previous research that percent body fat has a relationship with blood cholesterol levels [7]. Another study conducted on individuals ≥18 years old in China also found that there was a correlation between visceral fat and blood cholesterol [8].

The greatest prevalence of elevated cholesterol levels above normal in this study was shown by study respondents with body fat that tended to be high according to both percent body fat and visceral fat parameters. Obesity or excessive fat is known to affect blood cholesterol levels. The mechanism occurs due to an increase in Hormone Sensitive Lipase (HSL) which affects the release of free fatty acids in adipose tissue so that cholesterol levels in the blood increase [17]. In addition, the activity of the enzyme lipoprotein lipase (LPL) will also decrease which contributes to a decrease in HDL levels and affects cholesterol clearance in blood vessels [18].

Increased body fat can be triggered by the consumption behavior of foods with a high glycemic index such as snacks, fast food and composite foods [19]. Foods characterized by high simple carbohydrates can increase hunger. In addition, foods that are processed by frying also contribute a higher amount of fat so risk of increased fat accumulation becomes higher [20]. Another study added that lack of physical activity can induce an increase in body fat due to the formation of energy that is not used by the body [21].

3. Fast Food Consumption Patterns and Blood Cholesterol Levels

The results of statistical analysis of this study indicate that fast food consumption patterns correlate with student blood cholesterol levels. These results are in line with previous research that fast food consumption correlates with blood cholesterol and consumption ≥3 times per week will increase the risk of 8.4 times experiencing an increase in blood cholesterol [11], [22].

Most of the study respondents have their living status so meal preparation is done independently. Previous studies have revealed that the transition period of residence is a factor that can influence food choices with a tendency to consume unhealthy foods [23]. The busyness also causes respondents to tend to choose to consume fast food because it is practical, cheap

and easy to obtain [24]. This condition is also reflected in the FFQ fast food results which show that most of the respondents in this study consume high-fat foods.

The mechanism of increasing cholesterol levels due to fast food is associated with high energy and fat content in food which can cause a positive energy balance and lack of fulfillment of body nutrients [10]. If this is not balanced with efforts to increase energy expenditure, it can cause the risk of increased body fat deposits and increased cholesterol [25]. In addition, fast food intake can cause postprandial lipemia and lipid peroxidation which will affect LDL and HDL levels so that it can trigger atherosclerosis in blood vessels [26].

4. Physical Activity and Blood Cholesterol Levels

The results of statistical tests in this study showed that physical activity did not correlate with blood cholesterol levels. In line with previous research that reported that there was no correlation between physical activity and total cholesterol levels of university students [27]. Nevertheless, based on Table 2, the tendency of high cholesterol was seen in respondents with low physical activity (66.1%).

Most of the respondents in this study had low physical activity. Based on brief interviews conducted, the physical activities carried out by the research respondents were sweeping, mopping, light lifting, and walking with an average activity performed less than 30 minutes per day. Previous studies on individuals aged ≥18 years showed that respondents with low physical activity showed a high lipid profile [28]. One way that can be done to control cholesterol levels is by doing aerobic physical activity regularly for 30-60 minutes / day [29] with examples of physical activities such as swimming, cycling, walking, and small runs [30].

Regular physical activity is said to change LDL and HDL cholesterol levels in the body [31]. The mechanism of increasing lipoprotein lipase (LPL) enzyme activity due to physical activity can accelerate the process of transporting cholesterol in the blood to cells for ATP formation [32]. Physical activity can also increase HDL levels in the blood which function in reverse transport by transporting LDL so that cholesterol levels in blood vessels decrease [33].

5. Effect of Fastfood Consumption Patterns, Visceral Fat and Physical Activity on Blood Cholesterol Levels

Based on the results of multivariate analysis of 4 variables with a p-value <0.25 in bivariate analysis that has been done, it shows that fast food consumption patterns, visceral fat and physical activity are variables associated with cholesterol levels. According to the regression equation that has been formed, it can be interpreted that an increase in fast food consumption by one unit will cause an increase in cholesterol by 0.09 mg/dl, an increase in visceral fat by one unit will cause an increase in cholesterol levels by 3.22 mg/dl, and an increase in physical activity by one unit will reduce cholesterol levels by 0.04 mg/dl. Fast food consumption patterns and visceral fat have positive coefficients so they provide positive changes. Physical activity has a negative coefficient, indicating that the variable is a protective factor against blood cholesterol levels.

Previous research on 200 adults in Isfahan Iran found that increased consumption of fast food and low physical activity can increase the risk of dyslipidemia [34]. The results of another study of respondents aged ≥18 years in Bangladesh showed that obesity was one of the factors that could increase the risk of dyslipidemia by 3.28 times higher with markers of total cholesterol levels. These results support the findings in this study which show that the combination of variables of fastfood consumption patterns, visceral fat and physical activity together can affect blood cholesterol levels.

High consumption of fast food is believed to cause an increase in body weight [35]. A previous study also added that fast food consumption ≥1 time per week can increase adiposity and trigger an increase in LDL and inflammation with an increase in IL-6 which is positively

correlated with the incidence of metabolic syndrome [36]. In addition, respondents in this study described low levels of physical activity with less than 30 minutes per day. Such low physical activity leads to a decrease in HDL which helps in lowering LDL levels resulting in higher cholesterol [33].

E. Conclusion

There is an association between percent body fat, visceral fat, fast food consumption patterns and physical activity with blood cholesterol levels. Multivariate analysis shows that visceral fat and fastfood consumption patterns are factors that have a positive effect on increasing blood cholesterol levels, while physical activity is a factor that has a negative effect or becomes a protective factor against increasing blood cholesterol. Based on the results of this study, individuals among young adults are expected to pay attention to fast food consumption behavior, nutritional status and physical activity carried out to reduce the risk of non-communicable diseases.

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