

BODY MASS INDEX AND ITS CORRELATION TO BIOMARKER SIGNS OF METABOLIC SYNDROME

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Abstract Metabolic syndrome is one of risk factor of non-communicable disease, such coronary heart disease (CHD) and Diabetes mellitus (DM). Metabolic syndrome characterised by appearance minimum 3 of these symptoms: high blood pressure, low HDL-cholesterol level, high LDL-cholesterol level, high triglyceride level, high fasting glucose level, high waist-hip ratio. Metabolic syndrome is often related to obesity. Adolescent with obesity has higher risk to be suffering from metabolic syndrome and have degenerative disease. This research aimed to identify correlation between Body Mass Index (BMI) and some biomarker signs of metabolic syndrome in adolescences. This was an observational research conducted in Junior High School in Jember. Twenty three High School students were participated as subjects in this research. They were conducted in measurement of BMI/Age, and biomarker signs (HDL-cholesterol level, LDL-cholesterol level, triglyceride level, and fasting glucose level) measured by laboratory. Prevalence of overweight in male and female adolescents are 13.3% and 18.4% respectively. Prevalence of obesity in male and female adolescents are 11.2% and 7.2% respectively. There is correlation between BMI and HDL-cholesterol level ($p=0.043$), but there are no correlation between BMI and other three biomarker : LDL-cholesterol level ($p=0.380$), triglyceride level ($p=0.253$), and fasting glucose level ($p=0.253$).

1. INTRODUCTION

Metabolic syndrome is one of risk factor of non-communicable disease, such coronary heart disease (CHD) and Diabetes mellitus (DM).¹ Metabolic syndrome is generally experienced by elderly,² it is a result of organ function decrease and lack of physical activity in old age.³ Metabolic syndrome is characterized by the emergence of minimum three of the following conditions, high blood pressure, low HDL cholesterol levels, high LDL cholesterol levels, high triglyceride levels, high fasting blood glucose levels, and upper normal values waist circumference ratio.⁴

Metabolic syndrome mostly associated with obesity condition.⁵ Recently obesity is not only experienced by adults but it has been experienced by adolescence as well. Obesity in adolescent will persist until they are in adulthood and old age. The prevalence of overweight in children and adolescents in East Java, based on Riskesdas 2007, was 17.6%, while in Jember it was 13.5%. Unless any health action, this condition will cause health risk in the later life stage.

Early detection of metabolic syndrome signs in adolescence is very crucial action to prevent the occurrence of coronary heart disease, diabetes mellitus, and other non-communicable diseases. Early detection of the risk of metabolic syndrome can be done by assessing the nutritional status of adolescents. HDL-cholesterol level, LDL-cholesterol level, triglyceride level, and fasting glucose level are indicator that can be used to assess metabolic syndrome in adolescence.

This study aimed to identify correlation between Body Mass Index (BMI) and some biomarkers signs of metabolic syndrome (HDL-cholesterol level, LDL-cholesterol level, triglyceride level, and fasting glucose level) in adolescences.

2. METHOD

This was an observational research using cross-sectional design. This research was conducted to twenty three Junior High School students who were recruited by total sampling technique.

Body weight, and height were measured to be calculated into BMI. Body weight was measured using bathroom scale with precision 0,1 kg, height was measured using stature meter with precision 0,1 cm, BMI was calculated based on formula: $\text{weight (kg)/height (m)}^2$, and BMI/Age were calculated based on anthropometric standard of BMI/Age for age 2-18 years for each sex. Nutritional status were categorized based on BMI/Age Z-Score : Severe thin (<-3 SD), Thin (-3 - -2 SD), Normal (-2 – 1 SD), Overweight (1 – 2 SD), Obese (> 2 SD). Blood sample of subjects were collected and sent to laboratory to assess HDL-cholesterol level, LDL-cholesterol level, triglyceride level, and fasting glucose level.

3. RESULT AND DISCUSSION

In general, HDL cholesterol, LDL cholesterol, triglycerides, and fasting blood glucose levels indicate the risk of the occurrence of metabolic syndrome in adolescents. Many medical experts have confirmed that teenagers are an age where the growth period of a human being is running optimally. Consequently, an unhealthy lifestyle, including consumption patterns and eating habits, could impact their nutritional status. Teenagers with more nutritional status and obesity are conditions that allegedly occur due to these lifestyles. Teenagers who experience nutritional status are considered vulnerable to the risk of metabolic syndrome. To understand these risks, we need to know the triggering factors of metabolic syndrome that exist in adolescents with over nutritional status and obesity.

a. Distribution of adolescent dietary status.

Based on the data of this study, from 32% of adolescents who have abnormal nutritional status, it was found that the prevalence of over nutritional status in adolescent boys and girls was 13.3% and 18.4%, which was mostly in teenage girls. Meanwhile, teenage boys tend to become obese by 11.2%.

b. Frequency Distribution of HDL Cholesterol Levels

The analysis of HDL cholesterol levels in adolescent subjects shows that the majority of adolescents had normal HDL levels of 78.3%, while those who had low HDL levels were only 21.7%. When considered in terms of nutritional status, normal HDL levels (52.2%) were found in conditions of adolescents with Overweight (BBL), while low HDL levels (17.4%) occurred in adolescent condition with Obesity. Below is the table of the frequency distribution of HDL cholesterol levels in adolescents.

Table 1. HDL Cholesterol Levels

Nutritional Status		Normal HDL	Low HDL	Total	p*
Normal	Number of teenagers	1	0	1	0.043
	Percentage of the total amount	4,3%	0	4,3%	
Overweight	Number of teenagers	12	1	13	
	Percentage of the total amount	52,2%	4,3%	56,5%	
Obesity	Number of teenagers	5	4	9	
	Percentage of the total amount	21,7%	17,4%	39,1%	
Total	Number of teenagers	18	5	23	
	Percentage of the total amount	78,3%	21,7%	100%	

* Interval by Interval Pearson's R

c. Frequency Distribution of LDL Cholesterol Levels

The study also found that LDL cholesterol levels in majority of adolescents with overweight (BBL) and obesity are still in the normal category that is equal to 43.5% and 30.4%. Whereas in normal adolescents, LDL cholesterol levels are in the high category (4.3%).

Table 2. LDL Cholesterol Levels

Nutritional Status		Normal LDL	Low LDL	Total	p*
Normal	Number of teenagers	0	1	1	0.380
	Percentage of the total amount	0	4,3%	4,3%	
Overweight	Number of teenagers	10	3	13	
	Percentage of the total amount	43,5%	13%	56,5%	
Obesity	Number of teenagers	7	2	9	
	Percentage of the total amount	30,4%	8,7%	39,1%	
Total	Number of teenagers	17			
	Percentage of the total amount	73,9%	26,1%	100%	

* Interval by Interval Pearson's R

d. Distribution of Fasting Blood Glucose Frequency

Blood glucose is one of the variables measured to determine risk factors for metabolic syndrome in adolescents. Based on the analysis, all adolescents with normal nutritional status, over nutrition, and obesity are still in the normal category. Obesity status tends to have higher levels compared to adolescents with normal nutritional status, which is equal to 4.3%.

Table 3. Fasting Blood Glucose Levels

Nutritional Status		Normal Blood Glucose	Low Blood Glucose level	Total	p*
Normal	Number of teenagers	1	0	1	0.253
	Percentage of the total amount	4,3%	0	4,3%	
Overweight	Number of teenagers	13	0	13	
	Percentage of the total amount	56,5%	0	56,5%	
Obesity	Number of teenagers	8	1	9	
	Percentage of the total amount	34,8%	4,3%	39,1%	
Total	Number of teenagers	22	1	23	
	Percentage of the total amount	95,7%	4,3%	100%	

* Interval by Interval Pearson's R

e. Relationship of nutritional status with HDL cholesterol, LDL cholesterol, triglycerides, and fasting blood glucose levels

Cholesterol is a substance found in blood fats (lipids), and its levels in blood believed have related to a person's nutritional status. HDL cholesterol is referred to as good cholesterol while LDL is bad cholesterol. The higher the level of good cholesterol or HDL, the better it will be for health since HDL helps prevent heart disease. An HDL level of at least 60 mg / dL or more can help reduce the risk of heart disease. Conversely, HDL levels less than 40 mg / dL increase the risk of heart disease. HDL has severe chemical properties, so it is not easy to stick to the walls of blood vessels. LDL consists of fat and a little protein and is responsible for transporting 60-80% of the body's cholesterol into the blood. LDL is an unstable chemical package that quickly dispersed. Once it enters the arterial wall and disperses, unused cholesterol is released and builds up in vulnerable blood vessels.

HDL cholesterol in adolescents with normal nutritional status is in the healthy category as much as 4.3% of the total, and none are in low HDL levels. This study shows that there is correlation between BMI and HDL cholesterol level ($p=0.043$). Whereas in adolescents with over nutritional status, the number of those who have good HDL cholesterol is 52.2%, and those who have low cholesterol HDL are 4.3%. It indicates that there are still those who have low HDL cholesterol levels. For obese adolescents, normal HDL levels are 21.7%, but those with low HDL were far more than overweight adolescents, which amounted to 17.4%. This shows a sign for adolescents who are obese and over-nourished at low HDL levels.

LDL cholesterol in adolescents with normal nutritional status is in the low category of 4.3%, and there is no normal category. In adolescents with more nutritional status, normal categorized LDL cholesterol is higher than low LDL cholesterol, which is 43.5%. Although there is no correlation between BMI and LDL cholesterol level ($p=0.380$), we can say that more low cholesterol levels in adolescents more nutritional status than in normal nutritional status,. The nutritional status of obesity also has normal

and low LDL levels, but normal LDL (30.4%) more than low LDL (8.7%). When compared with normal nutritional status, shows that adolescents with more nutritional status and obesity have more normal LDL levels than normal adolescent nutritional status.

Triglyceride levels in majority of adolescents with normal, over nutritional, and obesity are at normal levels, but in some cases of adolescents obesity, there some who have low triglyceride levels. The result of this study shows that there is no correlation between BMI and triglyceride level ($p=0.253$)

Fasting blood glucose levels indicate that the majority of glucose levels in adolescents with normal, over nutritional status, and obese are at normal levels. However, there is a tendency in adolescents with more nutritional status and obesity to have higher glucose levels than normal ones, even though there is no correlation between BMI and LDL cholesterol level ($p=0.253$).

4. CONCLUSION

The results showed no relationship between nutritional status in adolescents with metabolic syndrome. But there is a tendency for adolescents with more nutritional status and obesity a decrease HDL cholesterol levels, increase LDL cholesterol levels, decrease triglyceride levels, and higher glucose levels compared to teens with normal nutritional status.

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