



## Metabolic Profile of Female Student in Senior High School of Metro City, Lampung, Indonesia

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### ABSTRACT

Adolescent girls are a crucial period in a woman's life. Health and nutritional status during adolescence are important for physical maturity, according to data from Riskesdas (2018) Metro City has a prevalence of very thin 1.2%, underweight 8.9%, normal 88.5, and obese 1.4%. is basic research that produces new theories, methods, or policy principles that are used for scientific development, namely the description of the Metabolic Profile of Young Women Against the Menstrual Cycle at SMA Negeri Metro City. The type of quantitative research with a quantitative research design with a descriptive approach to the population in this study were young women at Senior high school public Metro City. The instruments used in this study were questionnaires and Anthropometric (BMI) examination tools, Hb, Lipid Profile (Triglycerides, HDL, LDL and cholesterol) and GDS, data analysis in this study was a Univariate test. The results showed that there were 28 (18.5%) adolescents with low HB <12 g/dL, 25 (16.6%) adolescents with high cholesterol >200 mg/dL, 25 (16.6%) adolescents with metabolic status. skinny (-3 SD for SD <-2) as many as 51 (33.8%), teenagers with less energy as much as 65 (43.0%), lack of fat as much as 55 (36.4%) lacking protein as much as 5 (33.8 %), and less carbohydrates as much as 26 (17.2%), it is hoped that the school will cooperate with the local Health Office and local health centres to provide counselling about anemia and obesity in order to reduce the prevalence of anemia in adolescent girls and its incidence. obesity and it is necessary to educate adolescents about obesity prevention for reproductive health.

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### INTRODUCTION

Adolescents are a population aged 10-19 years, in the world, especially in Indonesia, there are 17% of Indonesia's population are teenagers, amounting to 46 million spread across all provinces in Indonesia (WHO, 2020). Meanwhile in Indonesia, population census data in 2020, the number of adolescents aged 10-24 years is 67 million people or 24% of the total population of Indonesia. Therefore, adolescents are the focus of attention in national development (BKKBN, 2020). Adolescent girls are a crucial period in a woman's life. Health and nutritional status during the adolescent phase is important for physical maturity, which in turn affects the health of the offspring.

Nutritional status in adolescents is the behavior of adolescents in meeting the need for food which includes attitudes, beliefs and food choices, which are formed as a result of physiological, psychological, cultural, and social

influences. In general, the factors that influence the formation of eating patterns are economic, socio-cultural, religious, educational, and environmental factors. The eating pattern that is formed is closely related to a person's eating habits, to be able to have a good diet, it must start from the selection of the right food ingredients and a balanced diet. A good diet needs to be established as an effort to meet nutritional needs. Teenagers are used to choosing what food they like and not depending on their parents. Lack of knowledge of adolescents about healthy eating behavior also causes adolescents to tend to have bad eating behavior (Sulistyoningsih, 2011).

Adolescent eating behavior is strongly influenced by individual factors and environmental factors. These factors will show the lifestyle of adolescents as indicated by eating behavior which ultimately affects health and nutritional status. In women it is known that body dissatisfaction has a correlation with eating behavior (Dieny, 2014).

Therefore, adolescents are vulnerable to health problems, such as obesity. Hormonal changes during adolescence can affect metabolism which has health impacts. For example, the hormone testosterone has an effect on glucose metabolism. The peak of testosterone at the end of adolescence can have an impact on health development in adulthood (Grossman, 2013). Metabolic syndrome occurs due to the interaction of gut microbiota, diet, and genetics (Usar, 2015). Currently, diet is one of the prevention and management strategies for the metabolic syndrome. Diet influences genes involved in metabolic function (Lin, 2019). Weight loss up to 5-10% through diet and physical activity improves metabolic syndrome (Han, 2016) Changes in adolescence, such as organ maturation, brain plasticity, changes in behavior and social environment in adolescents have an important impact on health as adolescents become adults. Vinner, 2015).

Based on the Basic Health Research (RISKESDAS) data in 2018 seen from their nutritional status by using the calculation of BMI which is grouped by age in the Indonesian population, it is found that adolescents in the age group of 13-15 years are obese as much as 10.8% consisting of 8.3% overweight and 2.5 % obesity. Adolescents aged 16-18 years were 7.3% obese, consisting of 5.7% overweight and 1.6% obese. While in adults (age > 18 years) the overweight rate is 13.5% and obesity is 15.4%. There are more adult women who are obese than adult men, namely 32.4% women and 19.7% men (Riskesdas, 2018).

According to the data from Riskesdas (2018) in Lampung Province, the prevalence of adolescent nutritional status (BMI/U) for 16-18 year olds is 1.3% very thin, 5.1% thin, 92.8% normal, and 0.8% fat. . Meanwhile, Metro City has a prevalence of 1.2% very thin, 8.9% thin, 88.5 normal, and 1.4% obese (Riskesdas, 2018).

The metro city is a city that has very rapid development, especially in education, there are several public high schools in the metro city, namely there are 4 public high schools that are used as research at this time, namely SMA N 5 Metro, SMA N 4 Metro, SMA N 2 Metro, and SMA N 6 Metro, the reason the researchers chose this place was because they saw several phenomena of events in the high school, namely that there were more female adolescents than male adolescents. Besides that, obesity was more common in young women. Therefore, researchers made the high school as a place of research by conducting a GDS examination. , Hb, HDL, lipid profile and nutritional status in adolescent girls as indicators of research on the metabolic profile of adolescent girls.

In accordance with the criteria, for the diagnosis of Metabolic Syndrome, laboratory tests are required, namely blood glucose, triglycerides and HDL cholesterol, plus a physical examination and blood pressure. In addition to these basic examinations, several additional examinations are recommended to further determine the child's health condition. Detection of Metabolic Syndrome in children and proper treatment are expected to reduce the rate of disability and death in adulthood, and help minimize global health problems, especially in the incidence of heart disease and type 2 diabetes (Prodia, 2021).

Previous research conducted by Muhammad, (2016) which aims to determine the relationship between stunted obesity and the incidence of metabolic syndrome in adolescent girls where the result is that the incidence of stunted in adolescent girls reaches 23.35%. Abdominal obesity in stunted adolescent girls reached 11.11%, while non-stunted 8.85%. In the case group there were 5 subjects (23.8%) who had metabolic syndrome. There is a relationship

between stunted obesity and the incidence of metabolic syndrome with a value ( $\rho = 0.057$ ).

The novelty of this study is that one of the risk factors for the occurrence of metabolic syndrome is obesity, especially central/abdominal obesity which requires laboratory tests, namely blood glucose, triglycerides and HDL cholesterol, plus physical examination and blood pressure. The subjects studied were also public high school students in Metro City which were more specific in the metabolic profile of adolescent girls including the characteristics of adolescent girls, anthropometric examination (BMI) in adolescents, Laboratory Examination of Hb, Lipid Profile (Triglycerides, HDL, LDL and cholesterol) and GDS. .

The purpose of the research is to know the description of the Metabolic Profile of Adolescent Women on the Menstrual Cycle at SMA Negeri Metro City.

## METHOD

This type of research is quantitative research using a descriptive approach. The location of this research is SMA Negeri Metro City. The population in this study is young women who attend SMA Negeri in Metro City. The number of samples is 151 respondents in 4 Metro City Senior High Schools. The inclusion and exclusion criteria of this study are: Inclusion criteria: Young women aged 16-18 years, students at SMA Negeri Metro City. Willing to be a respondent.

This research procedure uses the main research materials, namely Anthropometric examination instruments (BMI), Hb, Lipid Profile (Triglycerides, HDL, LDL and cholesterol) and GDS as well as Food Recall 24 Hours research questionnaires made by the research team. Data collection steps are first responders explained to the team about the goals and procedures to be followed by the respondent, then the respondent was subjected to antropometric examination (weight and height) and filling out the Recall questionnaire 24 hours, after which the respondent was examined for Hb Lab, Lipid Profile (Triglyceride, HDL, LDL and cholesterol). ) And GDS by laboratory personnel, after the data has been collected, data analysis is carried out, in this study using univariate analysis. Univariate descriptions were carried out on each variable studied, namely the metabolic profile of female adolescents. This research has been approved by the Health Research Ethics Commission of the Tanjungkarang Health Polytechnic with the letter number No. 200/KEPK-TJK/VII/2021.

## RESULT AND DISCUSSION

**Table 1**  
**Hemoglobin and GDS**

|                        | Frequency | %    |
|------------------------|-----------|------|
| <b>Hemoglobin (HB)</b> |           |      |
| 12-16 gr/dL            | 123       | 81.5 |
| <12 gr/dL              | 28        | 18.5 |
| <b>GDS</b>             |           |      |
| 50-110 mg/dL           | 145       | 96   |
| <50 mg/dL              | 5         | 3.3  |
| >110 mg/dL             | 1         | 0.7  |

Table 1, it is known that adolescents with low HB <12 g/dL are 28 (18.5%) while adolescents with normal HB 12-16 g/dL are 123 (81.5%), while adolescents with fasting blood glucose levels below normal <50 mg /dL as many as 5 (3.3%), Adolescents with a GDS Normal of 50-110 mg/dL as many as 145 (96%), and Adolescents with a GDS Above Normal >110 mg/dL as many as 1 (0.7%).

**Table 2**  
**Profil Lipid**

|                     | Frequency | %    |
|---------------------|-----------|------|
| <b>Kolesterol</b>   |           |      |
| <200 mg/dL          | 126       | 83.4 |
| >200 mg/dL          | 25        | 16.5 |
| <b>Trigliserida</b> |           |      |
| 35-160 mg/dL        | 142       | 94   |
| <35 mg/dL           | 3         | 2.0  |
| >160 mg/dL          | 6         | 4.0  |
| HDL > 40 mg/dL      | 151       | 100  |
| LDL <150 mg/dL      | 151       | 100  |

Based on table 2, It is known that 25 adolescents with high cholesterol >200 mg/dL (16.6%) and adolescents with normal cholesterol <200 mg/dL 126 (83.4%), while adolescents with high triglyceride levels >160 mg/dL 6 (4.0%), Adolescents with Low Triglyceride levels were 3 (2.0%) and Adolescents with normal triglyceride levels were 142 (94%), while adolescents with Normal HDL levels >40 mg/dl were 151 (100%) and adolescents with LDL levels Normal <150 mg/dl as much as 151 (100%).

**Table 3**  
**Adolescent Metabolism**

|  | Frequency | %    |
|--|-----------|------|
| <b>Adolescent Metabolism (Z-score IMT)</b> |           |      |
| Normal (-2 SD s/d 1 SD)                    | 79        | 52.3 |
| Thin (-3 SD s/d <-2 SD)                    | 51        | 33.8 |
| Fat (<1 SD s/d 2 SD)                       | 16        | 10.6 |
| Obesity (>2SD)                             | 5         | 3.3  |

Based on table 3, it is known that teenagers with normal metabolic status (-2 elementary school to 1 elementary school) are 79 (52.3%), teenagers with thin metabolic status (-3 elementary school to <-2 elementary school) as many as 51 (33.8%), Adolescents with metabolically obese status (<1 SD to 2 SD) were 16 (10.6%) and adolescents with metabolic obesity status (>2SD) were 5 (3.3%).

Based on table 4, It is known that adolescents with sufficient energy are 77 (51.0%), adolescents with less energy are 65 (43.0%), and adolescents with more energy are 9 (6.0%), then adolescents with sufficient fat are 66 (43.7%), adolescents with Less fat is 55 (36.4%), and adolescents with more fat are 30 (19.9%), while adolescents with sufficient protein are 94 (62.3%), adolescents with less protein are 5 (33.8%), and adolescents with more protein are 6 (4.0%), while adolescents with sufficient carbohydrates were 68 (45.0%), adolescents with less carbohydrates were 26 (17.2%), and adolescents with more carbohydrates were 57 (37.7%).

**Table 4**  
**Nutrition Status**

|                     | Frequency | %    |
|---------------------|-----------|------|
| <b>Energi</b>       |           |      |
| Enough 80-110% AKG  | 77        | 51.0 |
| Not Enough <80% AKG | 65        | 43.0 |
| More >110% AKG      | 9         | 6.0  |
| <b>Lemak</b>        |           |      |
| Enough 80-110% AKG  | 66        | 43.7 |
| Not Enough <80% AKG | 55        | 36.4 |
| More >110% AKG      | 30        | 19.9 |
| <b>Protein</b>      |           |      |
| Enough 80-110% AKG  | 94        | 62.3 |
| Not Enough <80% AKG | 5         | 33.8 |
| More >110% AKG      | 6         | 4.0  |
| <b>Karbohidrat</b>  |           |      |
| Enough 80-110% AKG  | 68        | 45.0 |
| Not Enough <80% AKG | 26        | 17.2 |
| More >110% AKG      | 57        | 37.7 |

## DISCUSSION

### Hemoglobin and GDS

Based on table 1, it is known that adolescents with low HB <12 g/dL are 28 (18.5%) while adolescents with normal HB 12-16 g/dL are 123 (81.5%), while adolescents with fasting blood glucose levels below normal <50 mg /dL as many as 5 (3.3%), Adolescents with a GDS Normal of 50-110 mg/dL as many as 145 (96%), and Adolescents with a GDS Above Normal >110 mg/dL as many as 1 (0.7%).

In line with the research of Hartati, et al (2020) the frequency of anemia in adolescents with anemia was 28 respondents (50.9%) and at least 27 respondents did not experience anemia (49.1%). This is in line with Fajriah's research (2015) that based on the results of the analysis there is a significant relationship between diet and the incidence of anemia in adolescent girls with a p-value of 0.0000 <0.05.

Anemic adolescents who experience pregnancy will be at risk for giving birth to babies with low birth weight (< 2500 grams) (Maryam S, 2016).

In line with zuraidah's research (2020) regarding adolescent blood glucose levels in this study, the glucose level values in obese adolescents were obtained mostly normal, but there were still abnormal glucose levels. In this study, the character of obese adolescents in SMAN 6 Pematangsiantar City ranged in age from 17-18 years with a BMI value > 30. This normal glucose value indicates that there is no glucose metabolism disorder in obese adolescents.

Abnormal glucose results in obese adolescents in this study mean that there is a glucose metabolism disorder. In this study, abnormal glucose was defined as glucose values exceeding normal values. Impaired glucose metabolism is a chronic disorder of carbohydrate metabolism in which the condition is caused by a lack of insulin or due to non-optimal insulin action (Shim et al, 2011).

Impaired Glucose Tolerance and Fasting Glucose Disorders are prediabetic conditions, which are conditions before being diagnosed with diabetes. It is important to prevent diabetes from occurring at an early age. Diabetic disease is one of the metabolic syndromes that can affect the reproduction of adolescent girls, which is associated with the role of insulin and glucose metabolism as a mediator of

ovarian function and human fertility (Mustaqeem et al, 2015).

Researchers believe that adolescents with low HB levels and excessive blood glucose can have a bad attitude on the metabolic system of adolescents and will affect the reproduction of adolescent girls, which is associated with the role of insulin and glucose metabolism as mediators of ovarian function and human fertility, and anemia in adolescents can have an impact on decreased work productivity, stunted growth, the body is easily infected, resulting in reduced body fitness, enthusiasm for learning and decreased achievement. At the time of becoming a prospective mother, she will become a prospective mother who is at high risk for pregnancy and childbirth, the impact of anemia on pregnant women includes bleeding during childbirth so that it can cause maternal death.

### Profil Lipid

Based on table 2, It is known that 25 adolescents with high cholesterol >200 mg/dL (16.6%) and adolescents with normal cholesterol <200 mg/dL 126 (83.4%), while adolescents with high triglyceride levels >160 mg/dL 6 (4.0%), Adolescents with Low Triglyceride levels were 3 (2.0%) and Adolescents with normal triglyceride levels were 142 (94%), while adolescents with Normal HDL levels >40 mg/dl were 151 (100%) and adolescents with LDL levels Normal <150 mg/dl as much as 151 (100%).

The results of this study are in line with research conducted by Claudi (2020) with the title The relationship between fiber intake and body mass index with total cholesterol levels in students majoring in biology at the University of Lampung, with the results showing that the average fiber intake of respondents was 4.20 grams/ day; mean body mass index 21,719; the average total cholesterol level is 180.4 mg/dl. There was a significant relationship between fiber intake and total cholesterol levels with a moderate correlation ( $r=-0.470$ ,  $p = 0.001$ ).

Children's habit of consuming fast food can be one of the causes of increasing cholesterol levels in children. According to Junaidi (2016) the frequency of children and adolescents consuming fast food is on average 1-2 times a week, with the types of fast food that are often consumed are fried chicken, french fries, burgers and soft drinks.

Obesity in adolescents can affect lipid profiles, namely a decrease in high density lipoprotein (HDL) and an increase in low density lipoprotein (LDL) which can cause dyslipidemia (Zamani et al, 2012). if this continues, it causes adolescents to experience stress which can change the increase in eating patterns so that adolescents increasingly experience weight gain. Adolescents who are obese at level II or more easily suffer from diseases such as high blood pressure, diabetes, coronary heart disease, liver and gallbladder (Marmi, 2013).

The opinion of the researcher is that young women with high cholesterol levels and experiencing disturbances in their lipid profile have overweight hormones that cause an increase in blood loss during menstruation, while when there is an egg (ovum) maturation disorder, adolescents feel pain during menstruation, so cholesterol levels and lipid profile will affect adolescent reproductive health.

### Adolescent Metabolism

Based on table 3, it is known that teenagers with normal metabolic status (-2 elementary school to 1 elementary school) are 79 (52.3%), teenagers with thin metabolic status (-3 elementary school to <-2 elementary school) as many as 51 (33.8%) , Adolescents with metabolically obese status (<1

SD to 2 SD) were 16 (10.6%) and adolescents with metabolic obesity status (>2SD) were 5 (3.3%).

The results of a study by Abdela et al (2016) entitled "The Body Mass Index and Menstrual Problems among Adolescent Students" in Egypt showed that there was a statistically significant relationship between body mass index and the type of menstrual cycle. The highest prevalence causes of irregular menstruation are obesity as much as 65.9% and overweight as much as 51.4%, while normal weight affects 41.7%

Low nutritional status (underweight) can be caused by inadequate food intake, including iron. Meanwhile, overweight status can also cause dysmenorrhea because there is excessive fat tissue which can lead to hyperplasia of blood vessels by fatty tissue in the female reproductive organs, so that the blood that should flow during the menstrual process is disrupted and causes pain during menstruation. So that abnormal nutritional status has the possibility of dysmenorrhea. This may occur due to other factors (Sofia, 2017), and overweight and obesity in early adulthood increase the risk of menstrual disorders, hypertension in pregnancy and subfertility. BMI in childhood has a strong enough influence on the reproductive health of a woman in the future (Aldini, 2012).

Researchers argue that adolescents who have a metabolic status of fat or obesity greatly affect their reproductive health, where adolescents can experience the risk of menstrual disorders, hypertension in pregnancy and subfertility, while adolescents with insufficient metabolic intake or adolescents with underweight nutritional status can result in reproductive health, namely Irregular menstruation and menstrual pain.

### Nutrition Status

Based on table 4, It is known that adolescents with sufficient energy are 77 (51.0%), adolescents with less energy are 65 (43.0%), and adolescents with more energy are 9 (6.0%), then adolescents with sufficient fat are 66 (43.7%), adolescents with Less fat is 55 (36.4%), and adolescents with more fat are 30 (19.9%), while adolescents with sufficient protein are 94 (62.3%), adolescents with less protein are 5 (3.8%), and adolescents with more protein are 6 (4.0%), while adolescents with sufficient carbohydrates were 68 (45.0%), adolescents with less carbohydrates were 26 (17.2%), and adolescents with more carbohydrates were 57 (37.7%).

In a study conducted by Amelia, Syam, & Fatimah, (2013) that energy intake for young women in the Hidayatullah Islamic boarding school in Makassar is in the poor category (87%), and protein intake for young women is in the sufficient category (66%). Nutrients are an important component in realizing human resources, while a young woman requires energy intake for growth and three stages of development, from this study and research conducted by Amelia, et al (2013) it appears that young women are still not optimally consuming food intake. energy nutrients. Though this period is closely related to the period of physiological growth, not age.

Various factors that trigger the occurrence of nutritional problems in adolescence include: poor eating habits, wrong understanding of nutrition, preference for certain foods, excessive promotion through mass media. These disorders trigger the occurrence of several health problems that are often found in adolescents such as obesity, CED, and anemia. Based on the results of Riskesdes (2018), the prevalence of SEZ risk nationally reaches 24.2%. Lack of nutrient intake will lead to poor nutrition, chronic lack of energy, lack of protein energy and anemia can occur. These problems will have a

negative impact on the level of public health, for example there is a problem of decreased concentration in learning, at WUS the risk of giving birth to babies with low baby weight (LBW) and decreased physical fitness.

The results of this study also found that obese adolescents with high visceral fat values were followed by low subcutaneous fat. Excess visceral fat is considered a marker of hormonal disturbances that will affect regional fat distribution and cardiometabolic risk. Increased visceral fat is also associated with the incidence of hyperandrogenemia in patients with polycystic ovary syndrome (PCOS). (Segula, 2014). Important in detecting obesity in children, especially adolescent girls. It is associated with preparation for reproduction. Visceral fat indicates diabetes and prediabetes. (Jung et al, 2016). Insulin resistance is a common denominator for the incidence of metabolic and cardiovascular complications. (Gungor, 2014).

The researcher believes that one of the determinants of the quality of human resources is the state of good nutrition. In adolescence, adequate nutrition is needed, especially for the period of growth and development. In adolescent girls nutritional status can affect their reproductive health, because a young girl always experiences a menstrual cycle every month and will enter a period of pregnancy and breastfeeding. A person's nutritional status is a picture of what he/she consumes for a long period of time and is reflected in the value of his/her nutritional status

## CONCLUSION AND RECOMMENDATIONS

The results showed that there were 28 (18.5%) adolescents with low HB <12 g/dL, 25 (16.6%) adolescents with high cholesterol >200 mg/dL, 25 (16.6%) adolescents with thin metabolic status (-3 SD to <- 2 SD) as many as 51 (33.8%), adolescents with less energy as much as 65 (43.0%), lack of fat as much as 55 (36.4%), protein lacking as much as 5 (33.8%), and carbohydrates lacking as much as 26 (17.2%).

The school collaborates with the local Health Service and local health centers to provide counseling about anemia and obesity in order to reduce the prevalence of anemia in adolescent girls and the incidence of obesity and it is necessary to provide counseling to adolescents about obesity prevention for reproductive health

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## Conflict of Interest statement

The author declares that there is no conflict of interest.

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