**Original Article** 

# Hubungan Obesitas dengan Kejadian Anemia pada Remaja Putri

The Relationship between Obesity and Anemia among Adolescent Girls

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## ABSTRAK

Masalah gizi yang sering dihadapi remaja adalah obesitas dan anemia. Obesitas pada remaja meningkatkan risiko anemia akibat peradangan. Peradangan yang terjadi pada remaja obesitas akan menyebabkan terganggunya penyerapan zat besi dan penurunan kadar hemoglobin. Penelitian ini bertujuan untuk mengetahui hubungan obesitas dengan kejadian anemia pada remaja di SMK Kota Bekasi. Jenis penelitian ini adalah observasional dengan metode cross-sectional. Variabel bebas dalam penelitian ini adalah obesitas dan variabel terikatnya adalah kejadian anemia. Subjek penelitian ini adalah remaja SMK Kota Bekasi yang memenuhi kriteria inklusi dan eksklusi. Data yang diperoleh dianalisis secara statistik dengan uji chi-square. Hasil penelitian menunjukkan 19,5% remaja berstatus gizi lebih dan obesitas dan 31,4% remaja mengalami anemia. Remaja mengalami anemia pada remaja di SMK Kota Bekasi (p < 0,05). Kesimpulan dari penelitian ini adalah obesitas dapat meningkatkan risiko anemia pada remaja

Kata kunci : Anemia, Obesitas, Remaja Putri

## ABSTRACT

Nutrition problems that are often faced by adolescent are obesity and anemia. Obesity in adolescent increases the risk of anemia due to inflammation. Inflammation that occurs in obese adolescent will cause disruption of iron absorption and a decrease in hemoglobin levels. This research aims to determine the relationship of obesity with the occurrence of anemia in adolescent in SMK of Bekasi City. This type of research is observational analytic with cross sectional method. The independent variable in this research is obseived and the dependent variable is the occurrence of anemia. The subjects of the research are adolescent of SMK of Bekasi City who met the inclusion and exclusion criteria. The data obtained were statistically analyzed by chi-square test. The results of this research indicate 19.5% of adolescent have a status nutrition overweight and obesity and 31.4% of adolescent experiencing anemia. Adolescent are anemic obesity amounted to 12.5% and shows there is a connection between obesity with the incidence of anemia in adolescent in SMK Kota Bekasi (p < 0.05). The conclusions of the research are obesity can increase the risk of anemia in adolescent.

Keywords : Anemia, obesity, adolescent.

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# **INTRODUCTION**

Obesity and anemia were often occurred on girl's population. Obesity is an abnormal accumulation of body fat that can pose a risk to health <sup>(1)</sup>. Obesity can occur when there is an imbalance between calorie intake and energy expenditure in an individual. According to WHO, there are more than 39% of the world's population who are overweight and more than 13% are overweight <sup>(2)</sup>. The incidence of obesity in Indonesia in the age category of 16-18 years is 7.3% being overweight, while in the age category 18 years there are 28.9% experiencing obesity (3). The prevalence of obesity in adolescent girls tends to be higher at 32.9% compared to adolescent boys only at 19.7% <sup>(4)</sup>. In West Java, the incidence of obesity in the age category 16-18 years is 7.6%. The highest prevalence of obesity in the age category 18 years is in Bekasi City as much as 23.4% <sup>(5)</sup>. The prevalence of obesity in adolescents aged 15 years in Indonesia is 31% <sup>(6)</sup>.

In other hand, anemia is also a common nutritional problem in the world. The incidence of anemia in adolescent girls in developing countries is around 40-88% <sup>(1)</sup>. The prevalence of anemia in Indonesia is 21.7%, in which female adolescents have a higher prevalence of 23.9% compared to male adolescents with a prevalence of 18.4% <sup>(4)</sup>. Several studies conducted in Bekasi stated that the prevalence of anemia in adolescent girls at SMK Bekasi City was 38.3% according to Briawan <sup>(7)</sup> and 78.4% according to Ginting <sup>(8)</sup>. The criteria for anemia according to WHO for age 15 years are if the hemoglobin level is <13 g/dL in men and <12 g/dL in women who are not pregnant <sup>(9)</sup>.

Research conducted by Indriantika and Moesjianti (10) stated that obese adolescent girls with anemia had a prevalence of 57%. According to Lopez et al. (11) obese adolescent girls who suffer from iron deficiency have a higher prevalence of 51.6% compared to female adolescents who have normal weight of only 38.8%. In line with research conducted by Kapil and Sareen <sup>(12)</sup> stated that obesity is associated with hemoglobin levels in adolescents as evidenced by the high prevalence of anemia that occurs in obese adolescents by 15.5%. According to Shara et al <sup>(13)</sup> it was found that 25% of respondents with obese nutritional status were anemic. Obesity and anemia affect each other because someone with more nutritional status has an excess fat percentage so that it can slow down the absorption of iron as

the main ingredient for forming hemoglobin<sup>(14)</sup>.

Obesity is often associated with anemia which is characterized by increased levels of several inflammatory markers in the blood, namely pro-inflammatory cytokines and acute phase proteins such as interleukin (IL-6) and Creactive protein (CRP). The average levels of IL-6 (5.22 pg/mL > 2.42 pg/mL) and CRP (1.72 mg/L > 0.7 mg/L) in obese adolescents were higher than adolescents with body weight. normal<sup>(15)</sup>. The increase in IL-6 and CRP causes the production of hepcidin in the liver and adipose tissue to also increase which will cause inhibition of iron absorption by the small intestine, decreased circulating iron levels, and increased release of iron from its storage area so that iron levels in the body decrease and decrease in hemoglobin levels. The increase in hepcidin results in disruption of iron metabolism in obese adolescent girls <sup>(16)</sup>.

Vocational High School (SMK) is a school where graduates are prepared to be ready to work. The work productivity of each teenager is different based on the availability of nutrients in the body. Workers with good nutritional status will have an influence on their body condition so that work productivity will also be better <sup>(17)</sup>. Improving nutritional status also has an influence on increasing intellectuality, work productivity, learning achievement and sports achievement <sup>(18)</sup>. Adolescent girls are also a population that has a high enough risk for anemia. Anemia in adolescent girls has an impact on decreasing work or academic productivity at school due to decreased concentration in learning. The need for iron tends to increase gradually as young girls enter puberty (19).

This study aims to determine the relationship between obesity and the incidence of anemia in adolescent girls.

# **METHOD**

This study used a cross sectional design with the independent variable being obesity and the dependent variable being anemia.

The population in this study were all students of SMK Bekasi. Sampling using purposive sampling technique by considering inclusion and exclusion criteria. The inclusion criteria are as follows: (i) students at SMK Bekasi City who are willing to take part in the study until the end, (ii) Age 14-18 years, (iii) physically and mentally healthy, (iv) students who have a BMI of -2 SD up to > +1 SD. The

exclusion criteria were if at the time of the study they were menstruating.

Data collection for parents' occupation and education, age, nutritional status, and anemia status was obtained from the respondent's characteristics questionnaire. Obesity data was obtained from anthropometric measurements, namely weighing weight and measuring TB directly. Assessment of nutritional status of respondents aged 14-18 years using BMI according to age with nutritional status categories underweight for z-score <-2SD, normal for -2SD to 1 SD, and obese for >1SD. The anemia status of the respondent is determined by the hemoglobin (Hb) level, i.e. young women with anemia have hemoglobin <12 g/dl. Hb data was obtained by taking blood using the cyanmetthemoglobin method with a hematology analyzer carried out by health professionals.

Data on respondent characteristics, nutritional status, and anemia status were collected and then inputted into SPSS software for analysis. Univariate data will be presented based on data distribution. Then a bivariate test using chi-square was performed to determine the relationship between obesity and anemia status.

# RESULT

Based on the characteristics, 43% of respondents have a father's occupation as an entrepreneur, and father's last education was high school (52.7%) as well as mother's last education was high school (45.7%). Most of the respondents are 15-17 years old.

Based on table 1. the results of the chisquare test show that there is a relationship between obesity and the incidence of anemia in adolescent girls (p<0.05). Adolescent girls with normal nutritional status who experienced anemia were 95 respondents (36%), while adolescent girls with normal nutritional status who did not experience anemia were 169 respondents (64%). There were 8 respondents (12.5%) with obese nutritional status, while 56 respondents (68.6%) with obese nutritional status who did not experience anemia.

Table 1. The Relationship between Obesity and Anemia					
Obesity	Anemia		Non - Anemia		Duulu
	Ν	%	Ν	%	- r value
Normal	95	36%	169	64%	
Obesity	8	12,5%	56	87,5%	0,000
Total	103	31,4%	225	68,6%	

# DISCUSSION

Based on table 1, it shows that there is a relationship between obesity and the incidence of anemia in adolescent girls at SMK Bekasi City, as indicated by the results of the chisquare test (p<0.005). The results of this study are in line with research conducted by Lopez et al <sup>(11)</sup>, where obese adolescent girls with a prevalence of 51.6% in Mexico experienced a decrease in iron levels as a sign of anemia. This study is also supported by research from Kapil and Sareen <sup>(12)</sup> that there is a relationship between obesity and anemia. Factors that cause anemia in adolescent girls with obesity are genetic influences, low physical activity that can reduce myoglobin so that the amount of iron released into red blood cells decreases, unbalanced diet such as consumption of fast food, alcohol, high-calorie diet, and the intake of iron-rich nutrients is limited.

This is in accordance with research conducted by Azizah<sup>(20)</sup>, which states that there is a relationship between obesity and anemia. where as many as 35% of adolescent girls with overweight nutritional status experience anemia. Anemia can occur due to various factors, including nutritional deficiency anemia, especially protein and iron, chronic and acute inflammation, parasitic infections, and also a history of diseases that can interfere with hemoglobin synthesis, which will reduce red blood cell production <sup>(21)</sup>. In adolescent girls who have overweight nutritional status, and experience anemia associated with systemic inflammation.

Systemic inflammation can occur as a result of obesity affecting iron regulation <sup>(22)</sup>. The inflammatory process in obesity can interfere with the absorption of iron in the gastrointestinal tract and the release of iron into the plasma is inhibited, which can lead to iron deficiency <sup>(22)</sup>. This inflammatory process is caused by the infiltration of macrophages into the adipose tissue that undergoes hyperplasia and hypertrophy. This situation will trigger the formation of proinflammatory cytokines, namely interleukin (IL-6), interleukin 1, and TNF- so that their plasma levels become high. Increased levels of proinflammatory cytokines associated with iron regulation. are Proinflammatory cytokines, especially IL-6, which is high in plasma will trigger iron regulators, namely hepcidin. Hepcidin production will increase if there is an excess of iron reserves in the body, so that it can inhibit the absorption of iron in the gastrointestinal tract and inhibit the release of iron from macrophages into the plasma<sup>(23)</sup>.

In the case of a person with iron overload, the liver will secrete hepcidin which interacts with ferroportin molecules on the basolateral membrane, so that ferroportin is endocytosed and degraded. The export of iron from erythrocytes decreases and the cells are filled with iron. Second, erythrocytes filled with iron will be released into the intestinal lumen. The hepcidin-feroportin interaction also reflects the regulation of iron recycling in macrophages, and is responsible for the inflammatory state in which iron-containing macrophages are abundant and hepcidin production is high. In the presence of hepcidin, ferroportin is internalized, iron export is inhibited, and iron is trapped in macrophages (24).

Based on research conducted by Aeberli et al <sup>(25)</sup>, the prevalence of iron deficiency in red blood cells was significantly higher in someone who was obese by 20% compared to someone who had a normal nutritional status of 6%. This is because there is a reduction in the availability of iron for red blood cells in obese adolescents, not because of low iron intake, but because of reduced iron absorption due to high levels of hepcidin or an increase in iron absorption barriers <sup>(26)</sup>.

# CONCLUSION

Based on the results of the chi-square test, it shows that there is a relationship between obesity and the incidence of anemia in adolescent girls at SMK Bekasi City with a pvalue <0.05. Adolescent girls who are overweight can increase the risk of anemia. It is recommended that young women can maintain nutritional status and apply healthy lifestyle and balanced nutrition.

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