



(RESEARCH ARTICLE)



The relationship between nutrition, physical activity, and sleep quality to changes in anemia status in adolescent girls with anemia

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Abstract

Background: Anemia in adolescent girls occurs when blood hemoglobin levels show a value of less than 12 g/dL. The incidence rate of anemia in adolescent girls in Indonesia is still quite high, which is around 41.4%-66.7%

Purpose: This study was to analyze the relationship between nutrition, physical activity, and sleep quality to changes in anemia status in adolescent girls at SMA Negeri 1 Manyar Gresik

Method: This type of research is in the form of quantitative observational analysis with a cross-sectional design. Sampling by the consecutive method. The respondents were 45 adolescent girls aged 16-18 years with a history of anemia. Initial Hb data was obtained from the health center during the September 2023 Hb examination and current Hb data was obtained by examining each respondent using the PCOT method and other data was obtained by distributing questionnaires

Result: From the results of the analysis, it was found that 71.1% still have anemia, and 28.9% no longer have anemia. Nutrient intake was obtained 73.3% undernourished, 20% normal nutrients, and 6.7% overnourished. Physical activity was obtained by 44.4% in the moderate category, 40% in the heavy category, and 15.6% in the low category. Sleep quality was obtained by 77.8% good sleep quality and 22.2% poor sleep quality. The results of the statistical test using the chi-square test found that there was a relationship between changes in anemia status and nutrition (pvalue = 0.017), there was a relationship with physical activity (pvalue = 0.011), and there was a relationship with sleep quality (pvalue = 0.014)

Conclusion: There was a relationship between nutrition, physical activity, and sleep quality to changes in anemia status in adolescent girls at SMA Negeri 1 Manyar.

Keyword: Nutrition; Physical Activity; Sleep Quality; Anemia

1. Introduction

The potential quality of adolescents is indispensable for the development of the country, but the influence of globalization now causes many adolescents to experience health problems caused by changes in life patterns, one of which is anemia. According to the World Health Organization (WHO), anemia is a condition in which a person's body experiences a decrease or the number of red blood cells in the body is below the normal limit [1]. Clinically, anemia is measured by decreased levels of hemoglobin, hematocrit, and red blood cells or erythrocytes. Anemia is a common nutritional problem around the world, both developed and developing countries. According to the World Health Organization (WHO), the groups that are susceptible to anemia are school-age children, and adolescents. This is because

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there is an increase in iron needs in this group. Anemia is considered a mild disease, but it can be fatal if not treated properly.

The incidence of anemia is currently quite high, data in the world shows that the incidence of anemia reaches 561 thousand people with anemia in women with a productive age of 15-49 years [2]. In developing countries, the prevalence of anemia in adolescent girls is around 53.7% of all adolescent girls [3]. According to data from the results of Basic Health Research (Riskesdas) in 2018, the prevalence of anemia among women aged 15-24 years in Indonesia is 32%, which shows that 3-4 out of 10 adolescent girls in Indonesia suffer from anemia. Several studies have shown that around 41.4%-66.7% of adolescent girls in Indonesia experience anemia [4]. Based on data (East Java Provincial Health Office) 50-60% of adolescent girls in East Java experience anemia [5].

Diet is an important behavior that can directly affect the nutritional status, as a result of poor nutritional intake in adolescent girls, it will have an impact on the process of forming hemoglobin levels because it is not able to meet the diversity of nutrients needed. This will occur for a long time so that it causes hemoglobin levels to decrease and cause anemia [6].

The lack of hemoglobin levels that cause anemia is also caused by physical activity. Physical activity is a body movement produced by skeletal muscles that requires an expenditure of energy. Lack and excessive physical activity can cause the body's metabolism to decrease, causing iron metabolism in the body to decrease. Iron is the 3 components of hemoglobin formation, if iron production decreases, it will affect the formation of hemoglobin which will have an impact on decreasing oxygen transport throughout the body so as to cause anemia [6]

Another cause of anemia is sleep quality. In sleep conditions, the body will carry out a recovery process to restore the body's stamina to optimal condition. Lack of sleep time can cause the biosynthesis of body cells, including hemoglobin biosynthesis to be disrupted. Less sleep time will have an impact on the body because the biological processes that occur during sleep will also be disturbed, resulting in the formation of hemoglobin levels also being disturbed so that it becomes lower than its normal value [7].

Research on the relationship between nutrition, physical activity, and sleep quality to changes in anemia status has been widely researched but has not been consistent until now. In addition, because of the prediction of the incidence of anemia that will increase in the following year, researchers will conduct further research related to the relationship between nutrition, physical activity, and sleep quality to changes in anemia status in adolescent girls who are anemic at SMA Negeri 1 Manyar. It is hoped that this research can help all components of society to be more vigilant about anemia cases that occur in Indonesia.

2. Material and methods

The type of research was quantitative analytic observational with a cross-sectional design, sampling using the consecutive sampling method. The respondents were 45 adolescent girls aged 16-18 years with a history of anemia. Initial Hb data was obtained from the health center during the September 2023 Hb examination and current Hb data was obtained by examining each respondent using the PCOT method and other data was obtained by distributing questionnaires. Collected data were recorded for entry and processed using Microsoft Excel and SPSS.

3. Results and discussion

The research data and analysis are described in the form of tables and narratives. This aims to find out information about the characteristics of anemia status, nutrition, physical activity, and sleep quality in young women in the SMA Negeri 1 Manyar Gresik 2024.

The result of this study showed known that adolescent girls at SMA Negeri 1 Manyar have the most nutrition in the category of less as many as 33 people. More than half (73.3%) of adolescent girls fall into this category. This shows that the respondents in the study have the most nutritional deficiencies. Meanwhile, for the frequency of low nutrition, it is more than 3 people or around 6.7%. It is known that the frequency of adolescent girls is most in the category of moderate physical activity with 20 adolescents. This shows that as many as 44.4% of adolescent girls have moderate physical activity. Meanwhile, adolescent girls with heavy physical activity have the second highest frequency with 18 adolescent girls or 40%. As for the least frequency of adolescent girls, it is in the category of low physical activity, which is as many as 7 people or 15.6%.

Furthermore, for sleep quality variables, the frequency of adolescent girls' sleep quality is the most in the poor category with a total of 35 people. More than half (77.8%) of young women in this category. This shows that the respondents in this study have the most poor sleep quality. Meanwhile, adolescent girls with poor sleep quality have a frequency of 10 people or (22.2%).

The result of this study known that more than half (71.1%) of adolescent female respondents experience anemia. This shows that the number of adolescent girls who experience anemia at SMA Negeri 1 Manyar is relatively high. Meanwhile, for adolescent girls who do not experience anemia, there are 13 people or (28.9%). This means that most adolescent girls have hb levels below *the cutt off point* value set by WHO, which is <12 g/dl.

Table 1 The Characteristics of Respondent

Variable	n	Percentage (%)
Nutrition		
Normal	9	20%
Less	33	73.3%
Over	3	6,7%
Physical Activity		
Low	7	15.6%
Moderate	20	44.4%
high	18	40%
Sleep Quality		
Good	10	22.2%
Bad	35	77,8%
Current Anemia Status		
No Anemia	13	28.9%
Anemia	32	71.1%

Table 2 Relationship between Nutrition to change in anemia status in adolescent Girls

Nutrition	Anemia				Total		Normality	P
	Yes		No		n	%		
	n	%	n	%				
Normal	3	6.68%	6	13.33%	9	20.01%	0.000	0.017
Less	27	60%	6	13.33%	33	73.33%		
Over	2	4.44%	1	2.22%	3	6.66%		
Total	32	71.12%	13	28.88%	45	100%		

The result of this study showed the results of the normality test that the data was not normally distributed because *the P-value* was <0.005, which was 0.00 <0.005, then the chi-square test statistics were carried out using the SPSS *Statistic* 23 program with *the P value* can be seen in the "P" column. With *the chi-square* test , the *P value* was obtained as 0.017. Based on these results, it can be said that nutrition has a relationship with changes in anemia status in adolescent girls who are anemic at SMA Negeri 1 Manyar.

The results of this study are in line with the research conducted by Azizatul (2020) which was conducted on 86 adolescent girls at the Syafi'iyah Sukorejo Islamic Boarding School with *a proportional random sampling* technique. In

this study, a Pvalue of 0.05 was used. A statistical test of Pvalue of 0.029 was obtained so that nutrition was related to the incidence of anemia in adolescent girls [9]

The nutritional content in food, especially iron consumed by adolescent girls, is a factor that affects the increase in the absorption of nutrients, especially iron in the body. Iron is one of the most important components in the formation of hemoglobin or red blood cells in the body. Iron or heme is part of hemoglobin and myoglobin which are both abundant in foods derived from animal proteins which have a lot of nutritional content and easily absorb iron compared to non-heme iron derived from foods that are abundant in vegetable proteins [8]. Foodstuffs include plant-based proteins such as beans, dark green vegetables, and tempe, as well as from animal sources such as fish, meat, chicken, liver, and eggs [9].

Iron is a *trace element* that is needed in small quantities, which is less than 100 milligrams, but is indispensable by the body in the formation of cells in the body, including red blood cells that function to synthesize hemoglobin. Indonesian adolescent girls aged 10-18 years are recommended to consume foods that are sources of iron, which is \pm 8-15 mg per day. The main difficulty in meeting iron needs is due to the low level of iron absorption, especially those sourced from plant foods (absorbed only 1-2%). Low intake of iron-containing nutrients occurs in adolescent women who consume less diverse foods. The habit of consuming foods that can interfere with iron absorption such as coffee and tea consumed at the same time at mealtimes can cause iron absorption to become lower [10]

In addition, when nutrients are deficient, insulin production can be disrupted. Insulin plays a role in glucose metabolism and also affects the metabolism of fats and proteins. Lack of insulin levels can affect the way the body uses glucose and fat, which can lead to metabolic disorders, which means glucose metabolism will be disrupted, causing the energy required for various body processes, including the formation of red blood cells, to be suboptimal [11].

Table 3 Relationship between physical activity to change in anemia status in adolescent Girls

Aktivitas Fisik	Anemia				Total		Normality	P
	Yes		No		n	%		
	n	%	n	%				
Low	2	4.44%	5	11.11%	7	15.55%	0.000	0.011
Moderate	14	31.11%	6	13.33%	20	44.44%		
High	16	35.57%	2	4.44%	18	40.01%		
Total	32	71.12%	13	28.88%	45	100%		

The results of the statistical test using *the chi-square test*, obtained a Pvalue value of 0.011 (Pvalue value < 0.05), so it can be concluded that there is a relationship between physical activity and changes in anemia status in adolescent girls at SMA Negeri 1 Manyar.

The results of this study are in line with Yulita's (2022) research on 67 adolescent girls at MA Pondok Pesantren with a sampling technique using *stratified random sampling* and using *the chi square test*. In this study, a statistical value of *the chi square test* of 0.000 was obtained so that it was found that physical activity had a relationship with changes in anemia status in adolescent girls at the Assalam Islamic Boarding School [12]

Physical activity patterns in adolescent girls at SMA Negeri 1 Manyar mostly have moderate to severe physical activity patterns. Active adolescent girls need a lot of energy, so their nutritional needs increase. Severe physical activity requires a lot of energy from adolescents so that it absorbs many needs of adolescents which if not enough can cause adolescents to be malnourished so that anemia occurs [13]

In addition, maximum physical activity can trigger an imbalance between free radical production and the body's antioxidant defense system, known as oxidative stress. Under oxidative stress conditions, free radicals will cause peroxidation of cell membrane lipids and damage the organization of cell membranes. Peroxidation of cell membrane lipids makes it easier for erythrocyte cells to undergo hemolysis, which is the occurrence of lysis of erythrocyte membranes which causes hemoglobin to be released and ultimately causes hemoglobin levels to decrease [14].

Table 4 Relationship between sleep quality to change in anemia status in adolescent Girls

Sleep Quality	Anemia				Total		Normality	P
	Yes		No		n	%		
	n	%	n	%				
Good	4	8.9%	6	13.33%	10	2.23%	0.000	0.014
Bad	28	62.22%	7	15.55%	35	77.77%		
Total	32	71.12%	13	28.88%	45	100%		

The results of the statistical test using *the chi-square test* obtained a pvalue of 0.014 (pvalue < 0.05), so it can be concluded that there is a relationship between sleep quality and changes in anemia status in adolescent girls at SMA Negeri 1 Manyar.

The results of this study are in line with Nirmala's (2024) research on 100 adolescent girls with *random sampling* techniques. This study uses a *chi-square* correlation test. In this study, a pvalue of 0.000 was obtained which showed that there was a relationship between sleep quality and the incidence of anemia in adolescent girls [15]

The normal sleep duration for adolescents and young adults is 8 hours, in this study many respondents had a sleep quality of less than 8 hours. Sleep disorders experienced by adolescents are one of the factors that affect hemoglobin levels in the blood [16]

Young women often sleep at night because they often find it difficult to sleep so that the number of sleepers decreases. Adolescent girls with poor sleep patterns tend to experience anemia. In contrast, adolescent girls with good sleep patterns are less likely to experience anemia. Adolescent girls who experience anemia with poor sleep patterns are caused by lack of sleep time so that it has an impact on body health. This is because the biological processes that occur during sleep will also be disturbed, one of which is the formation of hemoglobin levels that are disturbed so that they become lower than their normal values [17]

Sleep quality is one of the important aspects for every individual to maintain their sleep quality. When a person experiences insomnia or poor sleep quality, it will trigger oxidative stress. If oxidative stress occurs for more than 12 hours, it will cause red blood cells to break down faster. As a result, red blood cells decrease and hemoglobin levels in the blood decrease, causing anemia. Sleep functions to restore energy, restore and maintain the health of the body, if sleep is not enough properly, it will interfere with the body's ability to carry out its functions optimally. This has a direct impact on hemoglobin function, which acts as an oxygen carrier from the lungs to the rest of the body. Low oxygen in the body causes red blood cells that bind to oxygen to not form completely, so hemoglobin in the blood becomes low [15].

4. Conclusion

This research draws the conclusion that 71.1% were diagnosed with anemia, and 28.9% were not diagnosed with anemia. The category of nutrition was found 20% normal category, 73.3% less category and 6.7% over category. Physical activity was found 15.6% Low category, 44.4% low category and 40% high category. Sleep quality was found 22.2% good category and 77.8% bad category. The results of statistical using the chi-square test in analyzing the relationship between Nutrition to change in anemia status obtained pvalue 0,017. Physical activity to change in anemia status obtained pvalue= 0.11, and sleep quality to change in anemia status obtained pvalue=0.14. There was a relationship between nutrition, physical activity and sleep quality to changes in anemia status in adolescent girls who were anemic at SMA Negeri 1 Manyar Gresik.

Compliance with ethical standards

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Disclosure Conflict of interest

No conflict of interest to be disclosed

Statement of ethical approval

This study was approved by the health research ethics committee of faculty of medicine, Airlangga University (57/EC/KEPK/FKUA/2024) on February 29th 2024.

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