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THE RISK FACTORS DETERMINING ANEMIA AND ITS EFFECT AMONG SENIOR HIGH SCHOOL STUDENTS IN SAMARINDA, INDONESIA

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Abstract

Background: Anemia in female teenagers need to be prevented. If it happens, it needs to be treated immediately because it can disturb concentration leading to various effects such as decreased educational achievement at school, risk of being attacked by infectious disease, decreased fitness and productivity as well as the risk of having anemia among the pregnant mothers. The present research aimed to know the relationship between the hemoglobin level and Body Mass Index, physical fitness, menstrual cycle, educational achievement, and infectious diseases history on female teenagers.

Method: This research was conducted quantitatively through an analytical study ad cross-sectional design. The sampling was done using total sampling obtaining 97 students who are by the inclusion criteria.

Result: risk factors of anemia on adolescence were Body Mass Index (p-value: 0.0001), menstrual cycle (p-value: 0.0001), and infectious disease history (p-value: 0.005). Anemia itself had a relationship to physical fitness (OR: 7.98 with 95% CI: 2.64 – 24.13), and have no relationship to educational achievement on students (OR: 1.94 with 95% CI: 0.22 – 17.02).

Conclusion: Body Mass Index, menstrual cycle, and infectious disease history are the risk factors for anemia on this study. Meanwhile, anemia can contribute to changes in physical fitness.

Keywords: Anemia, Menstrual Cycle, Body Mass Index, Physical Fitness, Teenagers

1. INTRODUCTION

Anemia still becomes a global health issue, especially in developing countries. Anemia commonly happens more among women and female teenagers compared to men. *World Health Organization* (WHO) proved this through the data indicating that the prevalence of anemia among female teenagers throughout the world was at the range of 40-88%. Also, the case prevalence happens in developing countries was about 53.7% (1).

In 2013, Basic Health Research issued data that female teenager is one of the groups which prone to anemia. Based on the age group, anemia sufferer among the age group of 5-14 years old was 26.4%, while the age group of 15-24 years old was 18.4%. Among those age groups, the woman has the highest risk of suffering from anemia (2).

Regular provision of Blood Booster Tablet on female teenagers until recently was not yet maximal. There were still 23.8% of female teenagers who have not got Blood Booster Tablet. Meanwhile, 98.6% of them obtained Blood Booster Tablet but still less than 52 drugs (3).

There are various risk factors increasing anemia case on teenagers, such as the increase of Body Mass Index spurt, menstruation, low iron food intake, and the habit of being late to eat and irregular eating pattern (4).

Previous research conducted in 2017 by Jayant and Jayshree in India found that 90% of a group of female teenagers studied suffered from anemia. It was mostly caused by the parents' economy-social condition, especially those who had low education (5). Meanwhile, based on another research project that was conducted by Mohamed *et al.* in Damanhur, showed that bad habit of eating and menstrual history caused anemia on a group of female teenagers they studied. Moreover, this condition affected their educational quality (6).

Anemia among female teenagers needs to be prevented. If it happens, it needs to be treated immediately because it can disturb concentration leading to various effects such as decreased educational achievement at school, risk of being attacked by infectious disease, decreased fitness and productivity as well as the risk of having anemia among the pregnant mothers (7).

By paying attention to the issue of anemia on female teenagers, the effect on health, pregnancy, fetus, and new-born baby as well as the importance of comprehensive treatment on female teenagers, then the purpose of this research was to know the

prevalence and factors affecting anemia on female teenagers of high school in Samarinda, East Kalimantan, Indonesia.

2. METHODS

2.1. Research Area

The research was conducted at Senior High School in Samarinda. The study was performed from April to November 2019.

2.2. Research Design

The research was done quantitatively through analytical study and cross-sectional design.

2.3. Population Sample

The research population was all female teenagers of the twelfth class in Senior High School in Samarinda, consisting of 114 students. After sampling, it was obtained 97 students who met the inclusion criteria.

2.4. Ethical Consideration

This study was approved by the Health Research Ethics Committee of the Polytechnic of Health, Ministry of Health in East Kalimantan with the decision number LB.02.01 / 7.1 / 2742/2019.

2.5. Data Collection

The data were collected through a hemoglobin level examination tool to examine the hemoglobin level from capillary blood (finger), questionnaire to collect characteristics of respondents, and observation sheet to observe the physical fitness.

2.6. Data Analysis

Data that have been collected were analyzed using univariate and bivariate manners through the chi-square test to know the relationship between the hemoglobin level and the Body Mass Index, fitness, menstrual cycle, educational achievement, and infectious diseases among the female teenagers of Senior High School in Samarinda.

3. RESULTS

The characteristic of respondents can be seen in table 1. Based on table 1, the prevalence of anemia 23.7% which is 23 teenagers who had anemia from 97 respondents.

Table 1.
The Characteristics of Female Teenagers of High School in Samarinda

Respondents' Characteristics	Frequency (n = 97)	Percentage (%)
Mothers' Education		
Uneducated	2	2.1
Primary School/Equal	38	39.2
Secondary School/Equal	19	19.6
High School/Equal	34	35.1
Undergraduate/DIV	4	4.1
Fathers' Education		
Uneducated	32	33.0
Primary School/Equal	16	16.5
Secondary School/Equal	39	40.2
High School/Equal	1	1.0
DIII/ Equal	8	8.2
Undergraduate/DIV	1	1.0
Graduate/Others		
Mothers' Occupation		
Farmer/laborer	1	1.0
Private Worker	2	2.1
Civil Servant	3	3.1
Entrepreneur	8	8.2
Housewife	83	85.6
Fathers' Occupation		
Farmer/laborer	34	35.1
Private Worker	24	24.7
Civil Servant	12	12.4
Entrepreneur	16	16.5
Does not work	11	11.3
Family Income		
Low	76	78.4
Medium	21	21.6
Age		
14 to 16 years old	14	14.4
17 to 19 years old	83	85.6
Menarche Age		
10 to 12 years old	44	45.4
13 to 14 years old	50	51.5
15 to 16 years old	3	3.1
Dietary Program History		
Ever	21	21.6
Never	76	78.4
Blood Booster Drug History		
Regular	3	3.1
Irregular	94	96.9
Body Mass Index		

Thin	11	11.3
Normal	82	84.5
Fat	4	4.1
<hr/>		
Fitness		
Fit	56	57.7
Unfit	41	42.3
<hr/>		
Educational Achievement		
Satisfying	90	92.8
Adequate	7	7.2
<hr/>		
Menstrual Cycle		
< 21 days	31	32.0
21-35 days	58	59.8
> 35 days	8	8.2
<hr/>		
Infectious Disease History		
Ever	39	40.2
Never	58	59.8
<hr/>		
Anemia		
Yes	23	23.7
No	74	76.3

¹³ The risk factors of Anemia among high school students in this study were Body Mass Index status, menstrual cycle, and the history of infection disease on teenagers. It can be seen on this following table 2:

Table 2
The Risk Factors of Anemia among the High School Teenagers in Samarinda

Risk Factors	Haemoglobin Level				Total (n=97)		p value	OR
	Anemia		Does not Have Anemia					
	n	%	n	%	n	%		
Body Mass Index								
Thin	9	81.8	2	2.1	11	100.0	0.001	OR1 = 23.3
Normal	12	14.6	70	85.4	82	100.0		OR2 = 5.8
Fat	2	50.0	2	50.0	4	100.0		
Menstrual Cycle								
Shorten	12	38.7	19	61.3	31	100.0	0.049	OR1 = 3.4
Normal	9	15.5	49	84.5	58	100.0		OR2 = 1.8
Extended	2	25.0	6	75.0	8	100.0		
Infectious Disease History								
Ever	15	38.5	24	61.5	39	100.0	0.005	3.96
Never	8	13.8	50	86.2	58	100.0		

Based on table 2, the risk factors of anemia on high school students are Body Mass Index status ($p = 0.001$), menstrual cycle ($p = 0.049$), and infectious disease history ($p = 0.005$) on teenagers. On Body Mass Index status, Odds Ratio (OR1) is 23.3 which means that thin teenagers are 23.3 times higher risk to anemia than normal. Meanwhile, the Odds Ratio (OR2) is 5.8 which means that fat teenagers are 5.8 times greater risk to anemia than normal. Teenagers with a shortened period of the menstrual cycle had more risk to anemia, it was 3.4 times higher than teenagers with a normal period. Meanwhile, for the history of infectious disease, teenagers who had infectious diseases before will have a 3.96 times higher risk to anemia.

Table 3
The Effects of Anemia among the High School Female Teenagers in Samarinda

Variables	Educational Achievement				Fitness				OR (95% CI)
	Satisfying		Adequate		Unfit		Fit		
	n	%	n	%	n	%	n	%	
Haemoglobin Level									OR1 = 1.94 (0.22 – 17.01)*
Anemia	22	95.7	1	4.3	18	78.3	5	21.7	OR2 = 7.98
Not Anemia	68	91.9	6	8.1	23	31.1	51	68.9	(2.64 – 24.13)**

**significance on level 0.05

According to table 3, there was a statistically significant relationship between anemia and the fitness of teenagers. The odds ratio showed that the teenagers with anemia were 7.98 times higher risk than the teenagers who had a normal hemoglobin level (OR2). Meanwhile, the hemoglobin level has no statistical relationship to educational achievement on teenagers.

4. DISCUSSION

Anemia still becomes a primary public health issue especially among female teenagers at the age group of 10-19 years old (1). This is due to various reasons, starting from the Body Mass Index spurt, menstruation, low iron food intake, and habit of being late in eating and irregular eating pattern (4).

4.1. Body Mass Index towards Anemia

Based on the analysis results, it was obtained that female teenagers who had BMI in the thin category were 81.8%, female teenagers who had BMI in the normal category was 14.6%, while female teenager who had BMI in the fat category with anemia was 50.0%.

Analysis result using the chi-square test obtained a p-value of 0.001 which means that there was a relationship between the female teenagers' Body Mass Index and anemia incident. The prevalence of this research is in line with the previous research conducted by Kaur, *et al.* in India which found that anemia was mostly suffered by female teenagers at a thin category by 66.7% (8). Other research project conducted by Gedefaw, *et al.* also stated that nutritional status has a significant relationship with anemia incident (9). This is because if the nutritional intake in the body is not fulfilled especially iron which is one of the most important components in forming hemoglobin, it will cause the lack of red blood cells. Therefore, the red blood cell cannot carry out its duty in supplying oxygen which eventually causes anemia.

A previous study conducted by Jayant and Jayshree in India found that most of anemia cases were affected by the parents' socio-economy condition, especially the parents who had low education (5). Meanwhile, based on another research project that was conducted by Mohamed *et al.* in Damanhur, showed that bad habit of eating and menstrual history caused anemia on a group of female teenagers they studied. Moreover, this condition affected their educational quality (6). Adequate nutritional intake is needed during the teenagers' Body Mass Index. Partial parents think that food that is rich in nutrition is expensive. Whereas, there are so many nutritional foods around them, especially those which are rich in iron are not always expensive.

4.2. Menstrual cycle with Anemia

This research found that there was a relationship between the menstrual cycle and anemia. Female teenagers who had a shortened menstrual cycle with anemia was 38.7%, normal menstrual cycle with anemia was 15.5%, and extended menstrual cycle with anemia was 25.0%.

This result is in line with the previous research result conducted by Basith, Agustina, dan Diani, (2017) stating that the length of the menstrual cycle which is abnormal can cause anemia because the blood released will be more than normal ones (10). This is also supported by the result of the research done by Sumarlan, Windiastuti, and Suhartono (2018) stating that the length of menstruation, the amount of blood loss, and menstrual frequency are the risk factors of anemia (11). Such conditions can occur due to the abnormal length of the menstrual cycle causing the female teenager to lose more blood compared to the teenagers who have normal menstrual cycle (12).

Hasyim stated that the need for iron on teenagers increases due to menstrual cycle change. Such change is included in the amount of menstrual blood loss which can affect the increase of iron need. The cycle and length of menstruation also affect the need for iron. Female teenagers who do not fulfill their iron need will experience iron deficiency which eventually will cause anemia iron deficiency (13).

4.3. Infectious disease history on Anemia

According to the result of this study, it found that the female teenagers who had infectious disease history in the last three months and suffered from anemia were 38.5% while the teenagers who did not have infectious disease history but suffered from anemia was 13.8%. The analysis result using the chi-square test obtained $p\text{-value} = 0.005$ which means that there was a relationship between infectious disease and anemia incident.

This research result is in line with the research conducted by Annisa, Rahfiludin, and Fatimah (2018) in Semarang, which stated that there was a relationship between infectious disease and anemia incident on female teenagers (14). Furthermore, research conducted by Yasemin *et al.* on female teenagers in Turkey obtained that infectious disease is a factor affecting anemia (15).

Relationship between infectious disease history and anemia on this research also affected by other factors supporting the infectious disease such as influenza. Factors causing the occurrence of infection are environment, socio-economy, community poor behavior on self or public health, immunity comprehensiveness, and the low level of nutrition intake (16).

4.4. Effects of Anemia on Students

Anemia is a condition where there is a deficiency of red blood cells in the body. Red blood cells function to transport oxygen in the blood to all cells and tissues in the body. If anemia occurs, it will affect the supply of oxygen throughout the body. This condition can affect adolescent fitness, thus reducing student activity. Based on previous research it was found that hemoglobin levels can affect physical fitness and decrease VO₂Max (17).

Besides, the condition of anemia can also affect adolescent learning achievement. This can be caused by a lack of oxygen supply to the brain tissue so that adolescents become difficult to concentrate and affect the speed of understanding lessons. This is in line with the results of previous studies, found that academic achievement has decreased due to anemia (18).

5. CONCLUSION

The research result showed that anemia prevalence of female teenagers needs to be concerned. Among 97 high school students in Samarinda, 23 students still suffered on anemia. The risk factors affecting the occurrence of anemia are Body Mass Index, menstrual cycle, and infectious disease history.

Anemia will become worse if it is not treated immediately, one of them is affecting the students' fitness and educational achievement. So, nurses need to understand the causes and effects of anemia to provide health education to adolescents to always pay attention to the nutrients consumed so that anemia does not occur in adolescents.

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