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Research Article

Haemoglobin Levels of Adolescent Girls Aged 11-19 Years in North Sumatera are Correlated with Socio-Economic Status and Menstrual Cycle Duration

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Abstract

Background and Objective: Anaemia is a public health problem in developing countries. Adolescent girls are at risk of anaemia due to the increased need for iron at that age. Adolescent girls with anaemia have haemoglobin levels below the normal value limit, which is influenced by many factors, including socio-economic status and menstruation. The purpose of this study was to determine the correlation of haemoglobin levels of girls aged 11-19 years with socio-economic status and menstrual cycle duration. **Materials and Methods:** This was an analytic study with a cross-sectional approach. The total sample was 300 adolescent girls aged 11-19 years who were enrolled from February-July 2018. Data were collected by using the Food Frequency Questionnaire (FFQ), an anthropometric assessment and a haemoglobinometer tool. A chi-square analysis was used to find the correlation of haemoglobin levels with socio-economic status and menstrual cycle duration. **Results:** This study indicated that there were no significant correlations of mother's education or tofu-tempe consumption and anaemia in adolescent girls aged 11-19 years ($p > 0.05$); however, there were significant correlations of father's education, income, menstrual cycle duration and meat consumption with anaemia in adolescent girls aged 11-19 years ($p < 0.05$). **Conclusion:** Factors that correlated with anaemia in adolescent girls were father's education, income, menstrual cycle duration and meat consumption. It is recommended to focus in those factors to prevent anaemia in adolescent girls.

Key words: Anaemia, adolescence girls, haemoglobin levels, menstrual cycles, socio-economic status, food habits

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Anaemia is still a global problem worldwide, especially in Indonesia, anaemia also has been suggested to be a public health problem affecting low-, medium- and high-income countries and has significant adverse health consequences that are detrimental to social and economic development¹⁻³. Anaemia occurs due to a number of causes; the most important contributor is iron deficiency and anaemia affects half a million women of reproductive age worldwide⁴⁻⁶. In 2011, 29% of non-pregnant women aged 15-49 years were anaemic and more than 50% of girls aged 12-15 years are reported to have anaemia¹.

The results of a study conducted by Stevens *et al.*⁷ showed that the prevalence of anaemia in Asia's highest continent in Uzbekistan was 51.7% and the lowest prevalence, in Vietnam, was 14.1%. The prevalence rates of anaemia in Southeast Asian countries such as Malaysia, Thailand and the Philippines were 20.7, 23.8 and 25.4%, respectively and the highest prevalence was in Cambodia, with a prevalence of 43.8%. The prevalence of anaemia in Australia was 17.5%. The prevalence of anaemia in Indonesia, according to Indonesia Basic Health Research in 2013, was 21.7%, with the second highest prevalence, 26.4%, among children and adolescents aged 5-14 years⁸.

Anaemia generally affects women because they menstruate every month, and their iron levels must be balanced with nutrient intake in food. Studies linking eating habits with the incidence of anaemia, reported that iron deficiency, folic acid, vitamin B12, low-meat diets and menstruation were associated with anaemia in adolescents⁹⁻¹³.

Many factors influence nutritional status that will affect anaemia in adolescences, such as breakfast habit, education of adolescent and food consumption^{14,15}. Therefore, another factor that influences the incidence of anaemia in adolescents is socio-economic status; many socio-economic status influence the selection of foods consumed daily, such as the education of the fathers and mothers of adolescent girls, income, meat consumption and tofu-tempe consumption¹⁶⁻¹⁸. Therefore, this study aimed to examine the correlation of anaemia with socio-economic status and menstrual cycle duration in adolescent girls aged 9-11 years.

MATERIALS AND METHODS

This study was an analytic survey with a cross-sectional study design. Total samples of 400 adolescent girls aged 11-19 years coming from four areas: Junior High School (JHS) Al Uswah, Senior High School (SHS) AlUswah from Langkat Regency and JHS No. 41 Medan and JHS Santo Yoseph from Medan City, North Sumatera Province. Data were collected from February-July 2018.

In this study, primary data were collected using questionnaires, anthropometry measurements and haemoglobin examinations. Interviews with structured questionnaires were used to collect the socio-demographic data, diet and risk factors for anaemia. WHO² reported that anthropometric measurements include height, weight and body mass index (BMI) were collected. Anaemia was diagnosed at a haemoglobin level of less than 12 g dL⁻¹. The level of haemoglobin (Hb) was measured using a HemoCue blood photometer⁷.

The collected data were analyzed included univariate and bivariate analyses. A univariate analysis was used to describe the severity of anaemia and age range in the adolescent girls. The bivariate analysis used was a chi-square test to see the association of anaemia with dietary habits. Data were analysed using SPSS 11.5 Statistical Software Program (SPSS Version 11.5; SPSS Inc, Chicago, Illinois, USA).

RESULTS

A total of 400 adolescent girls were invited to participate in the present study. The average age of the respondents was 13 years old; the average weight was 46.03 kg, height was 150.81 cm, body mass index was 20.25 kg m⁻² and haemoglobin level was 12.49 g dL⁻¹ (Table 1).

Table 2 shows that in every age group, the normal condition was more common than the anaemic condition. The 13-15 year (mid) age group of adolescent girls suffered more anaemia than the 11-12 year (early) and 16-19 year (late) age groups.

In this study, based on the bivariate analysis, mother's education or tofu-tempe consumption were not significantly correlated with anaemia in adolescent girls aged 11-19 years

Table 1: Summary of weight, height, body mass index and haemoglobin levels of the respondents

Variables	Minimum	Maximum	Mean	Standard deviation
Aged	11.00	20.00	13.4600	1.34100
Weight	19.00	95.00	46.0320	10.61220
Height	123.00	165.00	150.8100	6.31600
Body mass index	13.08	43.38	20.2445	3.93421
Haemoglobin Level	6.00	18.00	12.4900	2.01700

Table 2: Cross-distribution between age and severity of anaemia

Age groups	Anaemia		Normal		Total
	No.	Percentage	No.	Percentage	
11-12 years (early)	24	6.0	51	12.8	75
13-15 years (middle)	100	25.0	195	48.8	295
16-19 years (late)	7	1.8	23	5.8	30

Table 3: Bivariate analysis of factors correlated with anaemia

Variables		Anaemia		Normal		p-value
		No.	Percentage	No.	Percentage	
Father education	PS-JHS	63	15.8	87	21.8	0.0020
	SHS-College	68	17.0	182	45.5	
Mother education	PJ-JHS	56	14.0	87	21.8	0.0360
	SHS-College	74	18.5	182	45.6	
Income	<RMW	101	25.3	123	30.8	0.0001
	≥RMW	30	7.5	146	36.5	
Menstrual cycle duration	<7 days	41	10.3	178	44.5	0.0010
	≥7 days	90	22.5	91	22.8	
Meat consumption	Seldom	90	22.5	155	38.8	0.0030
	Every day	41	10.3	114	28.5	
Tofu-tempe consumption	Seldom	81	20.3	132	33.0	0.0160
	Every Day	50	12.5	137	46.8	

PS: Primary school, JHS: Junior high school, SHS: Senior high school, RMW: Regional minimum wage

($p > 0.05$), father's education, income, menstrual cycle duration and meat consumption were significantly correlated with anaemia in adolescent girls aged 11-19 years ($p < 0.05$) (Table 3).

DISCUSSION

In adolescent girls, there is a significant increase in the need for iron. Deficiency of iron intake in this period will lead to anaemia^{1,19}. Anaemia in adolescent girls should be a concern because they have menstrual cycles every month and anaemia can have an impact on women's long-term lives²⁰. The prevalence of anaemia in adolescent girls in this study was higher in the 13-15 year age group (mid) (25.0%) than in the 11-12 year (early) (6.0%) and 16-19 year (late) (1.8%) age groups.

The average haemoglobin level in this study was 12.49, with a minimum level of 6 and a maximum level of 18. Based on Table 1, it can be seen that the average haemoglobin level of the respondents was 12.49 g dL⁻¹; based on WHO² classification aged 11-19 years haemoglobin levels in adolescent girls is 11.5-12, so the average haemoglobin level of the respondents in this research is in the normal category. Studies linking eating habits with the incidence of anaemia were performed and found that iron deficiency, folic acid, vitamin B12, low-meat diets and menstruation were associated with anaemia in adolescents^{4,10,11}.

Father's education was classified as elementary or junior high school and high school to college; among the respondents whose father's education was elementary or junior high school, 15.8% had anaemia and 21.8% were normal; among the respondents whose father's education was high school to college, 17.0% had anaemia and 45.5% were normal. Mother's education was classified as elementary or junior high school and high school to college; among the respondents whose mother's education was elementary or junior high school, 14% had anaemia and 21.8% were normal; among the respondents whose mother's education was high school to college, 18.5% had anaemia and 45.6% were normal. Education can encourage someone to use their knowledge related to choosing food needs to achieve better food quality. Parents who have a high level of education will be better able to adjust their children's intake, which, in turn, will affect children's nutritional status; however, parents who have a low level of education will have low knowledge and can cause health problems. The education of the father had a significant correlation with anaemia ($p < 0.05$) and a low education of the mother had no significant correlation with anaemia ($p > 0.05$).

The monthly income of the parents also influenced food consumption; of the respondents with parent income lower than regional minimum wage per month, 25.3% had anaemia and 30.8% had a normal condition, which differed from the respective proportions among respondents with parent

income higher than regional minimum wage per month. The parental income of the respondents had a significant correlation with anaemia ($p < 0.05$).

Anaemia generally affects adolescent girls because they menstruate every month; therefore, their iron levels must be balanced with nutrient intake in food²⁰⁻²². Based on this research, among the respondents who had a menstrual cycle duration < 7 days, 10.3% were anaemic and 44.5% had a normal condition; among the respondents who had a menstrual cycle duration ≥ 7 days, 22.5% were anaemic and 22.8% had a normal condition ($p < 0.05$). This is consistent with some previous studies^{10,23,24} who found that iron deficiency, folic acid, vitamin B12, low-meat diets and menstruation were associated with anaemia in adolescents. The menstruation duration of the respondents was significantly correlated with anaemia ($p < 0.05$).

The results of this study indicated that young adolescent girls who rarely consume meat sources of iron heme, such as meat, chicken and fish, suffered more anaemia (22.5%). There was no significant correlation between meat consumption and anaemia in adolescent girls ($p < 0.05$) but there was a significant correlation between tofu-tempe consumption and anaemia in adolescent girls ($p > 0.05$). This result was in line with previous research conducted by Lestari *et al.*²⁵ in North Sumatera Province, who found an influence of food consumption from heme and non-heme sources on the incidence of anaemia. Iron absorption is influenced by two factors, namely, the absorption of heme iron and non-heme, which indicates the existence of two different types of iron in food. The sources of heme in human food are meat, fish and poultry, whereas non-heme sources are cereals, nuts, vegetables and fruits²⁶. Study conducted by Mikki¹⁹ in adolescent girls in Palestine also showed a clear relationship between meat consumption and anaemia. These results were supported by some previous studies^{9,11,27,28}, who found an association of meat, fish and egg consumption with haemoglobin concentrations in women. Zuffo *et al.*²⁹, found a strong association between the consumption of food sources of heme (meat) and anaemia in school children.

CONCLUSION

The results of this study indicated that mother's education or tofu-tempe consumption and anaemia were not significantly correlated in adolescent girls aged 11-19 years ($p > 0.05$); however, father's education, income, menstrual cycle duration and meat consumption were significantly correlated with anaemia in adolescent girls aged 11-19 years ($p < 0.05$).

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