

Consumption of Iron Supplement and Anemia Among Indonesian Adolescent Girls

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Abstract

Background: Anemia is one of nutritional problem in Indonesia, especially in society with low socioeconomic status. There are many factors that can cause anemia, including poor intake of iron rich food and also iron supplement.

Objective: This study aimed to analyze consumption of iron supplement and anemia among adolescent girls.

Methods: This research used cross sectional design involving 251 adolescent girls in Lamongan District, Indonesia. Data on iron supplement intake was measured using questionnaire, food intake was measured using food record and hemoglobin level measured by Quik-Check hemoglobinmeter (Acon Laboratories.inc). Data were analyzed using Pearson correlation test.

Results: The average hemoglobin level of respondents was 13.43 ± 1.4 g/dl. The prevalence of anemia among adolescent girls was 13.9%. The average student energy intake was still below the normal Nutrition Adequacy Rate for adolescent girl aged 15 – 18 years old (2125 Kcal per day). The test results using the Pearson Correlation test indicate that the only food intake variables that has significant relationship with hemoglobin levels was energy intake ($p=0.02$). Their current practice of consuming iron supplementation from government program as well as voluntary or purchased supplement was lacking. However, they did consume government's iron and folic acid supplement during their junior high school years.

Conclusion: In conclusion, the current practice in taking iron supplement and food intake among adolescent girls in Lamongan district was poor. However, the prevalence of anemia was low and it was thought to be related to the success of the iron supplement program during the participants' junior high school (2-3 years ago).

Keywords: iron supplement, anemia, adolescent girl

1. Introduction

Anemia is one of nutrition problems (Ministry of Health Republic of Indonesia, 2013). Adult anemia could cause physical deterioration that affecting work productivity (Almatsier, 2009). Lower work productivity would lead to lower income (Dewi, 2012). Prevalence of anemia in Indonesia is increased, which in 2007 in the percentage of 14.8% while in 2013 was increased to 21.7% (Ministry of Health Republic of Indonesia, 2007, 2013). Based on the result of Basic Health Survey year 2013, anemia occurrence in Indonesia in women is 23.9%, while in men is 18.4%. When it is compared to neighborhood, the incidence rate of anemia in rural areas is higher with a percentage of 22.8% than in urban with a percentage of 20.6% (Ministry of Health Republic of Indonesia, 2013). The main cause of anemia is iron deficiency (Mastrizal, 2007). Iron deficiency anemia occurs because of iron content in low-consumption foods (Arisman, 2010). In addition to low iron intake, the occurrence of iron deficiency anemia is also caused by a low protein intake (Anggraini, Lestariana, & Susetyowati, 2015). Based on research results Arifin, et al. (2013) showed that low protein intake was 6 times greater risk of anemia compare to adequate protein intake (Arifin, Mayulu, & Julia Rottie, 2013).

Low income is one indicator of low socioeconomic conditions (Muflikhati, Hartoyo, Sumarwan, Fahrudin, &

Puspitawati, 2010). Based on the results of Mariza's research (2016) showed that families with low socioeconomic 12 times more at risk of anemia compared with families with high socioeconomic (Mariza, 2016). Low socioeconomic conditions will affect the lack of consumption of animal foods as a source of protein and iron so that the intake of protein and iron is low (Ermawati, 2011). The decline in the quality of consumption is characterized by low consumption of animal foods as a source of protein and iron because the price is more expensive among staple food; therefore, the fulfillment is not a priority (Almatsier, 2009; Ermawati, 2011). Low protein and iron intake may cause anemia (Masrizal, 2007).

Children and women at childbearing age including adolescent girls were among the high-risk groups for anemia. The prevalence of anemia among under five-year-old children were 42% while the prevalence among women at childbearing age of 15 – 49 years old were 30% (McLean, Cogswell, Egli, Wojdyla, & Benoist, 2008). Based on the Household Health Survey (SKRT) in 2004, almost 40% of adolescent girls aged 2–19 years were anemic. While the Basic Health Research (*Riskesdas*) in 2007 revealed that the prevalence of anemia among adolescent girls (aged ≥ 15 years) in urban cities was 19.7%. The prevalence based on the 2013 *Riskesdas* was 35.3% among women aged 15 – 44 years. To alleviate this problem the Indonesian government through the Ministry of Health delivered iron supplementation program targeting adolescent girl. They were given 60 mg elemental iron in the form of Ferro Sulfat or Ferro Fumarat and 0.400 mg of folic acid (Minister of Health, 2014). Based on our best knowledge, the effectiveness of the program has not been published in a scientific peer reviewed journal. Therefore, our study aimed to analyze consumption of iron supplement and anemia among adolescent girls in Lamongan District, Indonesia.

2. Method

This research was an observational analytic research with case study design involving the largest high school in Lamongan District. The population in this research was over 12 thousand adolescent female students in class 10, 11, and 12 in Lamongan High School (SMA 2 Lamongan). Prior to randomization, list of all female students was obtained from the school's database. Using simple random sampling through lottery, 251 adolescent girls were selected at random to be involved in this study. Data collection was conducted on September to October 2018. Data on iron supplement intake was measured using questionnaire, food intake was measured using food record and hemoglobin level measured by Quik-Check hemoglobinmeter (Acon Laboratories.inc). Data on respondent's characteristics (education, age, number of family members, household income, and household expenditure) was collected using structured questionnaire. The data of protein and iron intake was obtained by self-administered 2x24 hours food record method. Nutrients intake was then analyzed using Nutrisurvey 2007 software with Indonesian food database that was regularly updated by the Nutrient Analysis Laboratory in Department of Nutrition, Universitas Airlangga. Statistical analysis in this study was performed with Pearson correlation test in IBM SPSS version 23.

This research was approved by the Institutional Review Board (IRB) at the Faculty of Public Health, Universitas Airlangga as well as the Lamongan District Review Board in Indonesia. We made sure that potential participants were not pressured to participate and none of their right would be obliterated if unwilling to participate, furthermore, the confidentiality was preserved. Informed consent was obtained prior to data collection. Participants were free to withdraw from the study at any time without negative consequences.

3. Results

The average hemoglobin level of respondents was 13.43 ± 1.4 g / dl. This study revealed that the prevalence of anemia among adolescent girls in one of largest high school in Lamongan District was 13.9%. Since the study was conducted in high school, the age range of the samples was between 15 and 18 years old. Based on the economic level, most of the respondents came from families that had household incomes above IDR 3,000,000 (Table 1).

Table 1. Frequency Distribution of Respondent Characteristics

Variable	n (%)	Mean±SD
Age		15,47±0.69
Allowance (IDR)		17.566±6.879
Expenditure (IDR)		10.080±4.696
Family Type		
Nuclear family	171 (67.3)	
Extended family	83 (32.7)	
Father education		
No schooling	1 (0.4)	
Elementary	10 (3.9)	
Junior High School	21 (8.3)	
Senior High School	115 (45.3)	
Diplome	22 (8.7)	
University	80 (31.5)	
Others	3 (1.2)	
Mother education		
No schooling	1 (0.4)	
Elementary	16 (6.3)	
Junior High School	33 (13)	
Senior High School	121 (47.6)	
Diplome	26 (10.2)	
University	56 (22)	
Others	1 (0.4)	
Father occupation		
Unemployed	8 (3.1)	
Government official	56 (22)	
Private sector	42 (16.5)	
Army/Police	20 (7.9)	
Traders/entrepreneur	80 (31.5)	
Farmer (Land owner)	21 (8.3)	
Farm labor	3 (1.2)	
Service worker	3 (1.2)	
Factory worker	7 (2.8)	
Other	12 (4.7)	
Family income (IDR)		
<500,000	5 (2)	
>500,000 – 1,000,000	20 (7.9)	
>1,000,000 – 1,500,000	23 (9.1)	
>1,500,000 – 2,000,000	29 (11.4)	
>2,000,000 – 2,500,000	20 (7.9)	
>2,500,000 – 3,000,000	43 (16.9)	
>3,000,000	106 (41.7)	

Most of the respondents said they did not know about the existence of the iron supplement program at senior high school. Nevertheless, there were around 22.8% of students who knew about the program, and some of them even reported having received iron supplementation when they were in junior high school (SMP). On the other hand, information from the school and students at SMAN 2 Lamongan itself, the program for giving the iron supplement has not yet proceeded. Almost all respondents reported never having anemia defined as haemoglobin level < 12 mg/dL. However, there were many female students who reported having symptoms related to anemia (95.3%). In this study, we found that the duration of menstruation among respondents was still in the normal period (7.04 ± 1.71 days), and was not started at early age.

Table 2. Knowledge and Practice Related to Iron Supplement Intake

Variable	n (%)
Knowledge of government iron supplementation program	
Yes	58 (22.8)
No	195 (76.8)
Source of information	
School	35 (13.8)
Peer Group	1 (0.4)
Hospital	2 (0.8)
Ministry of Health (Health Office)	2 (0.8)
Others	24 (9.4)
Have you ever bought iron supplement?	
Yes, I have	14 (5.5)
Never	240 (94.5)
Consuming government iron supplement	
Everyday	1 (0.4)
Everyday during menstruation	6 (2.4)
Once a week	3 (1.2)
Once a month	2 (0.8)
Never	218 (85.8)
Consuming purchased iron supplement	
Everyday	4 (1.6)
Everyday during menstruation	3 (1.2)
Once a week	1 (0.4)
Once a month	3 (1.2)
Never	215 (84.6)

The results of their knowledge and patterns of iron folic tablet consumption were depicted in Table 2. Based on the results of the study, most of the protein intake of respondents was inadequate (<77% RDA). Protein sources were consumed mostly from vegetable protein. The average student energy intake was still below the normal Nutrition Adequacy Rate for adolescent girl aged 15 – 18 years old (2125 Kcal per day). The results of the study showed that both the iron and vitamin C intake of the respondents were still in the fewer categories when compared to the nutrients requirements based on the RDA. The statistical analysis test using Pearson Correlation indicated that the only energy intake was significantly associated with hemoglobin levels ($p=0.02$). The observed correlation was negative, which mean as energy intake increase the haemoglobin level was decreased.

4. Discussion

This study highlighted that the current practice in taking iron supplement and food intake among adolescent girls in Lamongan district was poor. Despite the fact that there were many female students reported having symptoms related to anemia (95.3%), their average haemoglobin level was above minimum standard of 12 mg/dL to be

classified as anemic. The prevalence of anemia was relatively low (13.9%) compare to the national prevalence of anemia which reached 21.7% (Ministry of Health Republic of Indonesia, 2013). Anemia can be caused by many reasons, one of which is the duration of menstruation and the age of menarche. In this study, we found that the duration of menstruation of respondents was still in the normal period (7.04 ± 1.71 days), and not started too early. Respondents who were still students caused a fairly homogeneous age distribution. It is known that all respondents have an age range between 15 and 18 years. This age group can be categorized as late adolescents. In this phase, the iron needs of young women will tend to increase compared to other adolescent phases, because young women have experienced menarche for quite a long time (Aigner et al. 2014). Gupta et al. in 2017 explained there was a positive correlation between the age of early menarche and the incidence of anemia. Having younger age of menarche, the risk for adolescent girls to suffer from anemia increased (Gupta, Parashar, Thakur, & Sharma, 2012). Besides these factors, the incidence of anemia can actually be prevented by consuming more blood tablets. Since 2010, the Government of the Republic of Indonesia has made a commitment with 4 ministers (Minister of Health, Education, Religion, and Domestic Affairs) to organize the administration of tablets for blood additions to adolescent.

Protein is an important substance in the body because it has special functions that can not be replaced by other nutrients that build and maintain cells and tissues (Diana, 2009). Our study showed that the adolescent girls were having low level of protein intake and most of the protein was coming from plant based protein. Plant-based protein had a lower bioavailability compare to the animal-based protein (Hardinsyah, Riyadi, & Napitupulu, 2012). Vegetable proteins are usually low in one or more of the essential amino acids so that diverse food consumption is required in order to have better protein quality and can support growth (Indonesian Nutrition Expert, 2017). The average student energy intake in this study was below the normal Nutrition Adequacy Rate for adolescent girl aged 15 – 18 years old (2125 Kcal per day), but their protein intake was sufficient. Proteins are important compounds that have a key role in the formation of red blood cells and prevention of anemia (Kokubo et al., 2016; Wu, 2016). Adequate protein intake ensures that the hormones that play a role in the formation of hemoglobin are available in sufficient quantities.

In addition to macronutrients, micronutrients also have an important role in the formation of hemoglobin. Two popular nutrients whose functions in the prevention of anemia are closely related are iron and vitamin C. The results of this study showed that both the iron and vitamin C intake was insufficient. If this condition persists, respondents could be at risk of developing anemia in the future. The test results using the Pearson Correlation test indicate that the only food intake variables significantly associated with hemoglobin levels was energy intake. However, the observed association was negative which contrary to several other studies which stated that energy and hemoglobin levels have a positive association. This could be attributed to an increase in fat intake along with increasing energy intake. Increased fat consumption could inhibit the expression of hepcidin, a hormone that holds the key to absorption of iron in the gastrointestinal tract.

Even with poor current iron supplement intake, poor protein, iron and vitamin C intake, the mean hemoglobin level in this study was in the normal range. We believed that this could be related to the success of the iron supplement program during the participants' junior high school which taken place in 2-3 years prior to the data collection of this study. The high deposits of iron stored in muscle and liver from those years might not be completely depleted even the current intake was poor.

Several limitations of this study include the 2 days self-administered dietary food records that might introduce recording bias. Participants might forget to write food and beverage intake that contributed to the energy input. Our study adds the weight in the importance of iron supplementation towards adolescent girls as their current food intake was low in iron protein and vitamin C, all of which are the building block to prevent anemia.

5. Conclusion

In conclusion the current practice in taking iron supplement among adolescent girls in Lamongan district was poor. Despite the fact that there were many female students reported having symptoms related to anemia, their average haemoglobin level normal. The prevalence of anemia among female adolescent in this study was lower than the national prevalence. The fact that the current intake of iron, protein, and vitamin C from food as well as iron supplement is low, it is believed that The Lamongan District Health Office has successfully prevented the current anemia by giving the provision of iron supplement during the participants' junior high school few years prior to this study.

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Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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