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The Correlation of Food Consumption, Menstruation and Body Mass Index to Haemoglobin Level in Adolescent Girls of Different Economic Statuses in Cianjur Regency, West Java Province-Indonesia

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Abstract

Background: Anemia is a common nutritional problem found in young women. The family economic factor influence the incidence of anemia due to the low food purchasing power by the family. This research aims to analyze the food consumption, BMI and menstruation with young women's haemoglobin levels at different economic statuses. The design for this research was a cross-sectional study design applied with purposive sampling. The subjects were 122 adolescent girls taken from different economic groups. The data collection were consisted of age of respondents, pocket money, education level and occupations from respondents parents, food consumption, BMI, menstruation period and haemoglobin levels in two different economic groups. Later, data were analyzed by Mann-Whitney and Spearman tests. Conclusion: There were no differences in characteristics of the two subject groups, but there were significant differences in the consumption of vitamin B12 and vitamin C in subjects with low and high economic statuses. Body mass index values, haemoglobin levels, iron consumption, folic acid consumption, food diversity and energy density in subjects with low economic status were greater than in subjects with high economic status.

Keywords: BMI; Economic Statuses; Food Consumption; Haemoglobin Level; Menstruation.

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1. Introduction

Adolescence is a transitional period where has the fastest growth pace from childhood to adulthood period. During this time there are biological, cognitive and emotional changes [1]. Various health problems in adolescence period have become one of the government's concern because youth is a nation's asset who will carry on the leadership wheel in future time. One common health problem during this period is the incidence of anemia. WHO statement about worldwide prevalence of anemia in 2015 showed approximate prevalence of 40-88 % in anemia incidence around the world [2]. Indonesia experienced an increase of anemia incident in pregnant adolescents (15 -24 years old) with a prevalence number of 48.9 % where 80.9 % of them have received iron-folic acid (IFA) supplements. Based on the 2017 Indonesian Demographic and Health Survey, the prevalence of anemia among children aged 5-12 in Indonesia was 26% and in adolescent girls aged 13-18 was 23% [3]. Nutrient deficiency anemia is one of the most common types of anemia found in people. The related nutrients to this matter are proteins that act as catalysts in the synthesis of heme in haemoglobin molecules, and iron as one of the nutritional elements that become part of components in the formation of red blood cells. Also, vitamin C that helps the process of absorption of iron in the body, along with vitamin B12 in its cooperation with folic acid in the process of synthesis of haemoglobin [4]. The higher iron demand in young women becomes a priority because they are experiencing a menstruation period every month, thus have a greater risk of anemia. Some studies have found that there is a significant relationship between menstruation period (length) and the incidence of anemia in young women [5]. In addition, a nutritional status is also an important factor in the condition of anemia. The nutritional status for those with severe thin weight category poses a 3.1 times of higher risk to suffer from anemia when compared to adolescents who have a normal nutritional status [6] . In terms of economic status, poverty and low living standards remain as crucial issues faced in most developing countries. Cianjur regency which ranked in fourth position has 207 thousands residents out of 2.244 million people of West Java province. Family economic factor give great impact to the incidence of anemia due to the low purchasing power of food by the family. The higher the family income, the more able they meet its nutritional needs [7]. Hence, the purpose of this research is to analyze food consumption, BMI and menstruation period with young women's haemoglobin levels at different economic statuses.

2. Materials and Methods

2.1. Study Design, Time and Samples

The design study applied in this research was cross sectional observational analytics. The research was held in Cianjur regency, West Java Province. The selection of adolescent respondents were taken from schools that participated in the Weekly IFA (Iron-Folic Acid) Supplementation Program from Cianjur Health Office which conducted by purposive sampling and obtained 12 schools participations. The research was conducted in November 2019 – January 2020. Numbers of subjects in the main study were 122 adolescent girls who received blood supplementation tablets. Then, data were calculated using the formula by Lameshow et.al, 2004 [8], where the minimum number of subjects in the study were 56 adolescent girls.

2.2. Data Collection

The inclusion criteria in this research were consisted of: grade XI students, getting blood-supplementation tablets from the Cianjur Health Office and willing to sign informed consent. The exclusion criteria were adolescent girls who did not take blood-supplementation tablets during the administration of Iron-Folic Acid (IFA) supplementation at the schools. Of the total adolescents who participated in the supplementation program, students were grouped into two groups based on economic status, namely the low economic group and the high economic group that was seen from the income of both parents and adjusted to the Cianjur's Regional Minimum Wage. Meanwhile, the data collected were included respondents' age, pocket money, mother and father education levels, nutrient intake, food diversity, energy density, menstruation, BMI and haemoglobin levels. The nutrient intake data (protein, iron, vitamin C, vitamin B12, and folic acid) were collected through a 2x24-hour recall questionnaire on the day and not in sequentially order to prevent the occurrence of bias data. The instruments employed for this research are Individual-Dietary Diversity which shows the number of food groups consumed by the individual. Anthropometry data is obtained through direct measurements to see the nutritional status of subjects which cover the weight and height data. Weight measurement used digital scales, while for height measurement used Microtoise device. Blood haemoglobin level examination was conducted by Health Laboratory officers in Cianjur Regency by using Hemocue 301 device.

2.3. Statistical Analysis

Data obtained during the research will be processed and analyzed using Microsoft Excel 2019 and SPSS version 25.0 programs. Then, Mann-Whitney test was conducted to see differences in variable values while Spearman correlation test was conducted to see any relationships between variables.

2.4. Ethnical Approvals

The Ethical clearance Number 004/I/2020/Bioethics Commission obtained from the Bioethics Commission of Medical/Health Research of Sultan Agung Islamic University of Semarang.

3. Result and Discussion

3.1. Subject Characteristics

Table 1 showed the average age of most respondents was 16 years in both groups. Age of adolescent defines as population in the age range from 10 to 19 years according to WHO [9]. This age is prone to nutritional problems because it requires more nutrients to help its growth and development. Adolescents with a pocket money of less than 1.05 USD in high economic group were amounted to 76.4%. The pocket money has an influence on one's consumptive behavior. The bigger the family income, the greater the pocket money received by the adolescents [10]. Whereas, the education level from the mother amounts to 62.7% and father's education amounts to 64.2%. The parents education affects the family economic status, where families with low level of education will find it more difficult to get a decent occupation to meet their families needs [11].

Table 1: The Distribution of Respondent Characteristics

Variables	Low Economic Group n (%)	High Economic Group n (%)
Age		
15-17 year	65 (97)	54 (98.2)
18-21 year	2 (3.0)	1(1.8)
Mean±SD	16±0.6	16±0.5
Pocket Money		
<1.05 USD	38 (56.7)	42 (76.4)
>1.05 USD	29 (43.3)	13 (23.6)
Mean±SD	14.000±60	19.000±85
Mother's Education		
Not attended school	2(3.0)	0 (0)
Elementary school	42(62.7)	15 (27.3)
Junior high school	13 (19.4)	9 (16.4)
Senior high school	7 (10.4)	18 (32.7)
College	3(4.5)	13 (23.6)
Father's Education		
Not attended school	1 (1.8)	1 (1.8)
Elementary school	43 (64.2)	10 (18.2)
Junior high school	12 (17.9)	10 (18.2)
Senior high school	10 (14.9)	21 (38.2)
College	1 (1.8)	13 (23.6)
Mother's Occupation		
Unemployed	47 (70.2)	33 (60)
General employe	3 (4.5)	3 (5.5)
Self-employed/Traders	6 (9)	5 (9.1)
Labor	0	0
ETC	11 (16.4)	14 (25.5)
Father's Occupation		
Unemployed	0	8 (14.5)
General employee	6 (9)	8 (14.5)
Self-employed/Traders	16 (23.9)	20 (36.4)
Labor	30 (44.8)	0
Etc.	13 (19.4)	19 (34.6)

According to the parent's occupation, this table shows that mothers who has no work in both groups are the same. While the fathers' occupation in low economic group are mostly work as laborers (64.2%) and fathers' occupation in high economic group are mostly work as a self employed (traders) (36.4%). From this research it

is shown that mothers with no work are found more in the low economic (status) group. The majority of jobs in low economic group were labourer and the incomes earned are only enough to meet or even less to meet the family daily needs.

3.2. Food Consumption

Table 2 shows overall results of no significant difference (p=0.375) between the energy and protein consumption (p=0.213) in both groups. This result indicates that both economic statuses have equivalent levels of protein energy consumption. The supporting research is the affordability of food access to protein energy sources by both groups [12]. By Indonesian cconsumption patterns of rice and side dishes as the key of getting full makes the research result showing no difference [13].

Table 2: The Energy and Protein Adequacy based on Economic Status

Nutrient Intake	Low Economic Group	High Economic Group	p
Energy			
Intake (kcal)	1178	1302	0.375
RDA (kcal)	1101	1129	
%RDA	112	118	
Protein			
Intake (g)	37.9	41.9	0.213
RDA (g)	41.3	42.4	
%RDA	96	101	

**Mann-Whitney test*

The iron and other nutrients intake is one of the factors causing anemia incidence. Table 3 shows that there was no significant difference between iron intake (p=0.513) and folic acid intake (p=0.270) in both groups. Consumption of iron and folic acid in both groups of economic statuses is the same. This result is in line with other studies that showing no difference in micronutrient consumption to the different economic status [14]. This research showed that there is a significant difference between vitamin B12 (p=0.051) and vitamin C (p=0.021) intake in both groups. One causal factor is the difference in economic status because B12 vitamin sources of food such as meat, fish and eggs are relatively expensive, therefore, for someone with low income will allocate his or her money more to high carbohydrate source of food [15].

Table 3: Mineral and Vitamin Intakes based on Economic Status

Variables	Low Economic Group	High Economic Group	P
Iron (mg)	5.3±4.7	5.4±3.6	0.513
Vitamin B12 (mcg)	1.9±2.4	2.6±3.6	0.051*
Vitamin C (mg)	18.2±21.4	31.1±48.8	0.021*
Folic Acid (mg)	83.6±47.4	88.1±59.8	0.270

**Mann-Whitney test*

3.3. Menstruation, Food Diversity and Energy Density

Menstruation is a periodic and cyclic bleeding from the uterus accompanied by endometrial discharge. Table 4 shows that there is no significant difference (p=0.737) between the length of menstruation and the menstrual cycle (p=0.614) with the different economic status. Both groups have the same menstrual condition in which both groups felt ashamed to explain any menstrual irregularities during interview [16]. Most respondents (adolescent girls) have a moderate score of food consumption diversity category or consume three to five types of food. Test results showed no significant difference between the food diversity score (p=0.065) and the energy density (p=0.677) found in both groups. The higher energy density value indicates the better quality of the consumed food, and the calculation of energy density from Indonesia's adolescent girls resulted in needing improvement status to make more better density value [17].

Table 4: Menstruation, food Diversity and Energy Density on Economic Status

Variables	**Low Economic Group n (%)**	**High Economic Group n (%)**	**P**
Menstrual Period			
Normal (4-7 days)	61 (91)	51 (82.7)	0.737
Abnormal <3 or >8 days)	6 (9)	4 (7.3)	
Menstrual Cycle			
Regular	42 (62.7)	32 (58.2)	0.614
Irregular	25 (37.3)	23 (41.8)	
Dietary Diversity			
Less (<3 types)	4 (6)	4 (7)	
Moderate (3-5 types)	55 (82.1)	45 (82)	0.065
well (>6 types)	8 (11.9)	6 (11)	
Energy Density			
Deficit (<1.6 kcal/g)	14 (20.9)	13 (23.6)	
Moderate (1.5-2.0 kcal/g)	8 (11.9)	7 (12.7)	0.677
High (>2.0 kcal/g)	45 (67.2)	35 (63.6)	

**Mann-Whitney test*

3.4. Haemoglobin Level and Nutritional Status

According to haemoglobin levels and nutritional status results shows in table 5, there is no difference in the two economic status groups, though other studies suggest that anemia in adolescents is associated with economic conditions. Parents economic state is not a direct factor of anemia incindence, but parents economic state can have impact to the purchasing power of the family. Thus, by this ability, it will affect the daily intake of adolescent girls, in which able to bring impact to a good or bad nutritional status of those adolesncents [18].

Table 5: Haemoglobin Level and Nutritional Status on Economic Status

Variables	Low Economic Group	High Economic Group	P
Haemoglobin levels (g/dL)	13.3±1.5	13.4±1.4	0.696
Weight (kg)	48.6±8.3	49.3±6.7	0.297
Height (cm)	153.1±6.5	152.1±4.1	0.153
BMI/U (z-score)	20.9±2.7	21.4±3.1	0.607

**Mann-Whitney test*

3.5. The Relationship of Haemoglobin Levels with Other Variables

Table 6: The Relationship of Other Variables with Haemoglobin Level

Variables	<12 g/dL	>12 g/dL	R	p-value
Nutritional Status				
Severe thinness	0 (0)	1 (100)		
Thinness	0 (0)	1 (100)	-0.080	0.380
Normal	14 (12.8)	95 (87.2)		
Overweight	1 (10)	9 (90)		
Obesitas	0 (0)	1 (100)		
Iron				
Deficit (<77%)	14 (12.4)	99 (87.6)	-0.038	0.678
Normal (>77%)	1 (11.1)	8 (88.9)		
Vitamin B12				
Deficit (<77%)	13 (12.7)	89 (87.3)	0.086	0.347
Normal (>77%)	2 (10)	18 (90)		
Vitamin C				
Deficit (<77%)	15 (13.4)	97 (86.6)	0.074	0.417
Normal (>77%)	0 (0)	10 (100)		
Folic Acid				
Deficit (<77%)	15 (12.4)	106 (87.6)	0.066	0.473
Normal (>77%)	0 (0)	1 (100)		
Menstrual Period				
Normal (4-7 days)	15 (13.4)	97 (86.6)	-0.112	0.220
Abnormal (<3 or >8 days)	0 (0)	0 (0)		
Menstrual Cycle				
Regular	10 (13.5)	64 (86.5)	-0.046	0.614
Irregular	5 (10.4)	43 (89.6)		
Dietary Diversity				
Less (<3 types)	1 (16.7)	5 (83.3)	0.027	0.771
Moderate (3-5 types)	12 (12.2)	86 (87.8)		
Well (>6 types)	2 (11.1)	16 (88.9)		
Energy Density				
Deficit (<1.6 kcal/g)	4 (14.8)	23 (85.2)	0.086	0.348
Moderate (1.5-2.0 kcal/g)	3 (20)	12(80)		
High (>2.0 kcal/g)	8 (10)	72 (90)		

**Spearman test*

Table 6 shows no relationship between research variables to haemoglobin levels. The nutritional status was not related to haemoglobin levels because the nutritional status and haemoglobin levels from subjects were good [19]. Whereas iron and other nutrients intake was believed to be a contributing factor to anemia although it was not proven in this research due to inadequacy level of nutrients such as protein, vitamin C, folic acid and vitamin

B12 that classified as deficit state [20]. The insignificant results in this research suspected to happen because the average consumption of vitamin C food sources such as fruits and vegetables in most respondents is classified as inadequate (lacking). However, some studies showed that there is no relationship between vitamin C intake and haemoglobin levels due to the habit of subjects who consume a food source of vitamin C without accompanied by a food source containing iron so that it does not have a significant impact [21]. The absence of a relationship between vitamin B12 to haemoglobin levels is possible due to the disruption of vitamin B12 absorption which fails to produce a normal gastric secret [22].

4. Conclusion

There were no differences in characteristics of the two subject groups, but there were significant differences in the consumption of vitamin B12 and vitamin C in subjects with low and high economic statuses. Body mass index values, haemoglobin levels, iron consumption, folic acid consumption, food diversity and energy density in subjects with low economic status were greater than in subjects with high economic status. Economic status can be a factor in the incidence of anemia. Further research on the influence of economic factors on the incidence of anemia in the long term can be an interesting further research topic.

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5. Conflict of Interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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References

[1]. S.D. Gunarsa . Adolescent Psychology. Jakarta: Mount Mulia, 2005, pp.100-95.

[2]. World Health Organization. The Global Prevalence of Anaemia In 2011. Geneva, 2015.

[3]. Ministry of Health of the Republic of Indonesia. “National health research report 2018,” Jakarta (ID), 2018.

[4]. Y. Astuti. “The relationship between Protein Intake, Iron and Vitamin C with Hb Levels in Children Aged (7-15) years in Sidoharjo Village Samigaluh, Kulon Progo,” Journal of Medicine and Health., vol.10, no.2, pp.172-179, 2010.

[5]. Febrianti, W.B. Utomo, and Adriana. Long Menstruation and Incidence of Anemia in Young Women. Journal of Reproductive Health, vol. 4, no. 1, pp. 11-15, 2013.

[6]. Martini. Factors Related to Anemia Incidence in Young Women in MAN 1 METRO. Sai Mawai Metro Health Journal, vol. 8, no. 1, pp 10-12, 2015.

[7]. Oktaviani. Iron intake and socioeconomic factors with the incidence of anemia in pregnant women. Journal of Health Scales, vol. 9, no. 1, pp. 9-15, 2018.

[8]. S. Lemeshow, J. D. W. Hosmer, J. Klar, S.K. Lwanga. Adequacy of Sample Size in Health Stud ies. Adequacy of Sample Size in Health Studies. New York: WHO, 1990.

[9]. World Health Organization. Quality of Life. Geneva, 2012.

[10]. Prabandari. "Comparative study of nutritional behavior of majors of Nutrition Sciences". Major of Food Technology and Major of Statistics of Bogor Agricultural University, Bogor Agricultural University, Bogor, 2010.

[11]. S. Kolodziej and K. Lato, "The Role of Parental influences on the economic socialization of children," Problems of education in the 21stcentury, vol. 58, no. 1, pp. 99-107, 2014, Available: www.scientiasocialis.lt/pec/node/files/pdf/vol58/99-107.Kolodziej_Vol.58.pdf.

[12]. L.N. Dapi, A. Hornel, U. Janlert, H. Stenlund and C. Larsson. "Energy and Nutrient intakes in relation to sex and socio-economic status among school adolescents in urban Cameroon, Africa," Public Nutrition Journal, vol. 14, no. 5, pp. 904-13, 2011, doi: 10.1017/S1368980010003150.

[13]. C. Spence. "Comfort food: A review," International Journal of Gastronomy and Food Science, vol. 9, pp. 105-109, 2017, https://doi.org/10.1016/j.ijgfs.2017.07.001.

[14]. M.L. Purwaningtyas and G.N. Prameswari. "Anemia incidence factor in pregnant women". Journal of Public Health, vol. 1, no. 3, 2017.

[15]. S.G. Matayane, A.S. Bolang and Kawengian, "Relationship Between Protein And Iron Intake With Haemoglobin Levels Students Doctor Education Study Program Class 2013," Journal of E-Biomedicine, vol. 2, no. 3, 2013.

[16]. Y. Kwak, Y. Kim, K.A. Baek, "Prevalence of irregular menstruation according to socioeconomic status: a population-based nationwide cross-sectional study," Plos one, vol. 14, no. 3, 2019, doi: doi.org/10.1371/journal.pone.0214071.

[17]. C. Shashi, K. Anuradha, "Influence of micronutrient status and socioeconomic gradient on growth indices of 2–18-year-old Indian girl," Journal Pediatriendocrinol Metabolism, vol. 26, pp. 9-10, 2013, doi: 10.1515/jpem-2013-0106.

[18]. M.O. Jalambo, A. Hamad and Y. Abed, "Anemia and risk factors among female secondary studentsin the Gaza Strip," Journal Public Health, vol. 21, pp. 271-278, 2013, doi: 10.1007/s10389-012-0540-9.

[19]. M. Amarnath and N. Lakshmanrao, "Anemia among Adolescent Girls in Tribal Area of Visakhapatnam District in Andhra Pradesh," Indian Journal of Public Health Research & Development, vol. 4, no. 2, 2013, doi:10.5958/j.0976-5506.4.2.003.

[20]. JY. Kim, S. Shin, K. Han, K.C. Lee et al., "Relationship between socioeconomic status and anemia 33 prevalence in adolescent girls based on the fourth and fifth Korea National Health and Nutrition Examination Surveys," Eur J Clin Nutr, vol. 68, no. 2, pp. 253-258, 2014. doi: 10.1038/ejcn.2013.241.

[21]. Oktaviani, "Iron and socioeconomic intake factors with the incidence of anemia in pregnant women," Health Scale Journal, vol. 9, no. 1, 2018.

[22]. Fatimah. Anemia in Nutrition and Public Health. Jakarta: PT Raja Grafindo Persada, 2012, pp.85-80.