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Analysis of Determinant Factors for Anaemia Status among Adolescent Girls in Cigalontang Sub-District, Tasikmalaya District, Indonesia

Nenden Ayu Mutiara Fauziyah[1], Hamam Hadi[1,2,*], Effatul Afifah[1,3], Arif Sabta Aji[1,3]

[1]Alma Ata Graduate School of Public Health, Faculty of Health Sciences, Universitas Alma Ata Yogyakarta 55183, Indonesia
[2]Alma Ata Center for Healthy Life and Foods (ACHEAF), The Universitas Alma Ata Yogyakarta 55183, Indonesia
[3]Department of Nutrition, Faculty of Health Sciences, Universitas Alma Ata Yogyakarta 55183, Indonesia

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Abstract More than 30% of adolescents (15-24 years) have anaemia and problems in growth, development, and cognitive abilities, as well as susceptibility to infectious diseases due to anemia. The purpose of this research is to determine the prevalence of anaemia among adolescent girls in Cigalontang, Tasikmalaya, and to discover determinant variables, such as protein, iron, and vitamin C consumption, for anaemia status. The Cigalontang high school and vocational school female population was employed for this cross-sectional investigation. The cyanmethemoglobin test was used to detect Haemoglobin (Hb) levels, and the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) was distributed to estimate food consumption levels. To determine which factors had the most impact on a person's anaemia, the researcher used STATA's Fisher exact test and logistic regression analysis. A total of 13.33% of adolescent girls have anaemia. Adolescent girls' anaemia status is substantially related to their protein and iron consumption ($p<0.05$), but not to their vitamin C intake ($p>0.05$). Among the several factors that determine whether or not teenage females have anaemia, iron consumption stands out as the most significant (OR: 12.59; 95% CI: 1.60 - 99.24; p=0.016). Prevention programmes for anaemia in students should be promoted jointly by schools and puskesmas.

Keywords Anemia, Protein Intake, Iron Intake, Determinant Factor, Adolescent Girl

1. Introduction

Anemia is a medical disorder characterised by a deficiency in the number of red blood cells or a lower-than-usual quantity of haemoglobin inside them [1]. Lower hemoglobin concentration can cause a decrease in the function of body tissues with some symptoms such as reduced concentration and lack of fitness for activities, fatigue, weakness, dizziness, and shortness of breath [1,2]. The World Health Organisation (WHO) said that the worldwide occurrence of anaemia in women between the ages of 15 and 49 has reached a prevalence rate of 29.9%. In 2019, the occurrence of anaemia among women of childbearing age (WUS) in Southeast Asia was recorded as 46.6% [3]. According to the findings of the Basic Health Research (Riskesdas), 32% of teenage girls (aged 15-24) were found to have anaemia in 2018 [4]. The occurrence rate of anaemia among teenage females in Tasikmalaya District is 32.4%, with 22.2% specifically suffering from iron deficiency anaemia [5].

Anemia status in adolescent girls can affect memory and academic achievement [6]. Anaemia leads to a weakened

immune system, making the body more vulnerable to infections. Additionally, it causes a decline in cognitive function owing to diminished oxygen supply to the brain [2,7]. Anaemia is more common among teenage females due to the recurrent blood loss they undergo during menstruation [8]. Anaemia has a lasting effect on the readiness for pregnancy. Consequently, it is imperative to enhance health conditions throughout this period. Nevertheless, the proportion of women within the reproductive age group who possess adequate nutritional readiness for pregnancy is exceedingly limited. None of them can fulfil 10 markers of preconception nutritional preparedness as only 26% of them fulfil two signs[9].

Adolescents experience physiological and psychological growth as a basic foundation for adulthood. Biological well-being in adolescents requires increased nutrition. The theory states that insufficient intake of micronutrients such as iron, zinc and vitamin A for a long time has a negative impact on the growth and well-being of adolescents. It has been reported that anemia among adolescents is associated with their habit of skipping breakfast, consuming fruit, vegetables and milk every day, thereby reducing their food intake. Adolescents with such eating patterns show deficiencies in micronutrients such as iron, calcium, zinc, folic acid, and vitamins A, D, and C, necessary for hemoglobin production [10–12]. Furthermore, adolescents tend to do with a wrong diet in order to lose weight such that they have insufficient intakes of protein vitamin C, and iron, and hence they may experience a greater risk of anemia [13–16]. The lack of knowledge on the importance of iron pills associated with a low level of education has also been reported to have contributed to the higher prevalence of anemia [17,18]

Cigalontang, one of the sub-districts in Tasikmalaya District, has a low socioeconomic status where 53% of the population completed only elementary school, 46.8% of them were laborers, and 20.11% of them were farmers [19]. It is unknown whether a low socio-economic status in this population is associated with a greater prevalence of anemia. More importantly, there has been no conclusive report on the determinants of anemia among teenage girls in Indonesia. Hence, it is crucial to examine the determining variables contributing to anaemia among adolescent girls in Cigalontang Sub-district, Tasikmalaya District, in order to mitigate the occurrence of anaemia among adolescent girls.

2. Materials and Methods

2.1. Design Study

This cross-sectional study was conducted in three high schools in Cigalontang Sub-district, namely State Senior High School 1 Cigalontang, Islam Tenjonagara Vocational School, and Daarul Hidayah Vocational School. Data were collected in August-September 2023. The researcher collected data on anemia status by checking hemoglobin levels, sociodemographic data (knowledge of anemia and Blood Supplement Tablets intake) nutritional status data, and food intake data (protein intake, iron intake, vitamin C intake, and breakfast habits).

2.2. Study Subjects

The survey encompassed the whole female student population of one senior high school and two private vocational high schools in Cigalontang Sub-district, totaling 582 individuals. The study comprised a sample of 150 female students who were selected as respondents using a basic random sampling technique. The study included teenage females aged 15-18 years from three schools (one state senior high school and two private vocational schools) in Cigalontang Sub-district. The girls that had to be in grades X, XI, and XII, have had menstruation, and be willing to participate in the study. Meanwhile, those who were menstruation at the time of haemoglobin level testing and those who did not complete the SQ-FFQ questionnaire interview were excluded from the study.

2.3. Data Collection

Respondents were asked to fill out an informed consent to indicate their willingness to participate in the study. Each respondent had an identity number which can be kept confidential in detail and is only known by the researcher. After the respondents sign the informed consent, they have their blood samples taken. Then, it was continued by collecting sociodemographic data and anthropometric measurements. The blood samples were taken by nurses working at a private hospital. Then the blood samples were taken to the Tunas Bhakti Husada University Laboratory to check hemoglobin levels using the Photometer WapLab 9200 with the cyanmethemoglobin method. In addition, information about protein, iron, and vitamin C consumption was gathered through the use of the SQ-FFQ questionnaire. Interviews regarding food intake were conducted by enumerators with a nutritional background who had competence in gathering information about food intake. This study has obtained ethical clearance from the Research Ethics Committee of Alma Ata University (No: KE/AA/III/101096/EC/2023)

2.4. Instruments

The study examined the relationship between protein, iron, and vitamin C consumption (independent variables) and anaemia status (dependent variable). Haemoglobin (Hb) levels were measured using a Waplab WP-9200 photometer to examine the state of anaemia. The analysis was conducted at the laboratory of Bakti Tunas Husada University. Anaemia is defined as a haemoglobin (Hb) level below 12 g/dL, whereas a Hb level of 12 g/dL or more

is classified as non-anemia. The data on blood supplement intake were acquired using the semi-quantitative food frequency (SQ-FFQ) questionnaire and analysed using Nutrisurvey software. The nutritional intake findings are compared to the Nutritional Adequacy Rate (AKG), which is categorised as either insufficient (<80%) or sufficient (≥80%).

2.5. Data Analysis

Data were analyzed using STATA software to estimate the prevalence of anemia with a Confidence Interval (CI) of 95%. To determine if there was a correlation between the two sets of data, the Fisher exact test was used. Meanwhile, multivariate logistic regression analysis was utilised to identify the most important contributors to anaemia prevalence.

3. Results

3.1. Respondents' Characteristics

Adolescent females in the Cigalontang Sub-district had an anaemia prevalence of 13.33% and a mean haemoglobin level of 13.9 1.7 g/dL. Table 1 shows that most responses are between the ages of 15 and 18, with the largest share coming in at 16. A total of 60% of the respondents are from State Senior High School 1 Cigalontang. Meanwhile, a total of 23.3% and 16.7% are from Islam Tenjonagara Vocational School and Daarul Hidayah Vocational School respectively. This study involved 150 respondents from all grades in high school and vocational schools, namely 40.67% from Grade XI, 36% from Grade X, and 23.33% from Grade XII. Most of the respondents' parents have a low education level (90%) with an average income of IDR 1,769,667 (84%).

Table 1. Respondents' Characteristics

Respondents' Characteristics	n	%	Mean (SD)
Hb level			13,9(1,7)
Status of Anemia			
Anemia	20	13,33	
Non-anemia	130	86,67	
Age			16 (0,95)
15 years old	39	26	
16 years old	58	38,67	
17 years old	36	24	
18 years old	17	11,33	
School			
State Senior High School 1 Cigalontang	90	60	
Islam Tenjonagara Vocational School	35	23,3	
Daarul Hidayah Vocational School	25	16,7	
Grade			
Grade X	54	36	
Grade XI	61	40,67	
Grade XII	35	23,33	
Parents' Education Level			
Low (Not attending school/Elementary School/Junior High School)	135	90	
High (Senior High School/University)	15	10	
Parents' Income			1.769.667 (934.335,7)
Low < 2.499.954 (District Minimum Wage)	126	84	
High ≥2.499.954 (District Minimum Wage))	24	16	
Knowledge			
Poor (<75% of correct answer)	106	70,67	
Good (≥75% of correct answer)	44	29.33	
Blood Supplement Intake			
Insufficient (consuming <2 tablets/month)	102	68	
Sufficient (consuming ≥ 2 tablets/month)	48	32	

3.2. Respondents' Nutritional Status

Anthropometric data, including weight, height, and mid-upper arm circumference (MUAC), are presented in Table 2. The respondent's nutritional status is calculated using their height and weight using the body mass index for their age (BMI/A). Meanwhile, the MUAC is used to determine the presence or absence of chronic energy insufficiency (CEC). Based on Table 2, the average body weight is 46.9 kg with an average height of 151.1 cm. The majority of the respondents have good nutritional status (47.33%). However, some are obese (21.33%), malnourished (20%) and 11.33 more nutrients. In addition, 64% of respondents experienced chronic energy deficiency with an average MUAC value of 22.3 cm.

3.3. Status of Nutrient Intake

Table 3 shows the respondents' nutrient intake, where the majority of respondents' nutrient intake is considered insufficient such as protein (69.33%), iron (63.33%), and vitamin C (58.67%). The majority of respondents are still eating less than what they need to maintain their health, with an average consumption of 80% of the RDA. The average daily requirements for protein are 45 gramms, iron is 11.2 milligramms, and vitamin C is 57.09 milligramms. Table 3 also reveals that eighty percent of respondents eat breakfast on a regular basis (between five and seven times a week).

Table 2. Respondents' Nutritional Status

Nutritional Status	n	%	Mean (SD)
Body weigh			46,9(8,12)
Body height			151,1(5,5)
Mid-upper arm circumference (MUAC)			22,3(2,47)
Z-Score			0,27 (2,59)
Nutritional status of BMI/A			
Undernourished (-3SD sd <-2SD)	30	20	
Well-nourished (2SD sd +1SD)	71	47,33	
Overweight (+1SD sd +2SD)	17	11,33	
Obese (>+2SD)	32	21,33	
Status of chronic energy deficiency			
Chronic Energy Deficiency (MUAC <23.5 cm)	96	64	
Non-Chronic Energy Deficiency (MUAC≥23.5cm)	54	36	

Table 3. Status of Nutrient Intake

Nutrient Intake	n	%	Mean (SD)
Protein Intake (g)			45(12,5)
Insufficient (<80% of RDA)	104	69,33	
Sufficient (≥80% of RDA)	46	30,67	
Iron Intake (mg)			11,2(2,29)
Insufficient (<80% of RDA)	95	63,33	
Sufficient (≥80% of RDA)	55	36,67	
Vitamin C Intake (mg)			57,09(9,8)
Insufficient (<80% of RDA)	88	58.67	
Sufficient (≥80% of RDA)	62	41,33	
Breakfast habit			
Never (0)	8	5,33	
Rarely (1-2 times/week)	13	8,67	
Sometimes (3-4 times/week)	9	6	
Frequently (5-7 times/week)	120	80	

3.4. The Relationship between Nutrient Intake and Anemia

Table 4 shows the results of a bivariate study (using the Fisher Exact test) between dietary consumption and the prevalence of anaemia. The p-value for this analysis is less than 0.05. This indicates that dietary factors contribute to the development of anaemia. Protein consumption, iron intake, and vitamin C intake all have P-values of 0.008, 0.001, and 0.05, respectively. It follows that there is a strong correlation between anaemia and both protein and iron consumption.

3.5. Determinant Factors of Anemia

According to the Multivariate Analysis findings (table 5), the biggest OR value among iron intake factors was 12.59, indicating that this factor was the most influential in determining the prevalence of anaemia in teenage females. So, compared to respondents with enough iron consumption, those with inadequate iron intake are 12.59 times more likely to develop anaemia.

4. Discussion

This study establishes a correlation between the occurrence of anaemia and the consumption of essential nutrients, including protein, iron, and vitamin C. The association between nutritional consumption and the occurrence of anaemia was evaluated by bivariate analysis, yielding a p-value of <0.05. There is a correlation between nutritional consumption and the occurrence of anaemia. The p-value for protein consumption is 0.008, indicating a significant correlation between protein intake and the occurrence of anaemia. The findings of this study align with Hidayati, et al (2023) in establishing a correlation between protein consumption and the prevalence of anaemia among teenage females in Padang[16]. Protein is a vital component that contributes to the formation of haemoglobin. The respondent's protein consumption level remains below the Recommended Dietary Allowance (RDA). The respondents' average protein consumption is 80% of the Recommended Daily Allowance (RDA), namely 45g per day. In addition, 69.33% of the participants had inadequate protein consumption, which is below 80% of the recommended daily allowance (RDA). The occurrence of anaemia in respondents is attributed to a deficiency in the diversity of protein-rich dietary sources ingested by respondents. Chicken flesh is the primary source of animal protein commonly ingested.

Table 4. The Relationship between Nutrient Intake and Anemia

Nutrient Intake	Status of Anemia				Total	*P Value*
	Anemia		Non-Anemia			
	n	%	n	%		
Protein						
Insufficient	19	18,27	85	81,73	106	0.008
Sufficient	1	2,17	45	97,83	44	
Iron						
Insufficient	19	20	76	80	95	0,001
Sufficient	1	1,82	54	97,18	55	
Vitamin C						
Insufficient	16	18,18	58	81,82	62	0,050
Sufficient	4	6,45	72	93,55	88	

Table 5. Determinant Factors of Anemia

Variable	*OR*	95% CI
Protein Intake	8.51	1.065 - 68.06
Iron intake	12.59	1.60 - 99.24

4.1. The Relationship between Levels of Iron Intake and the Incidence of Anemia

The research indicates a significant association between iron consumption and the occurrence of anaemia, as evidenced by a p-value of <0.05, specifically 0.001. Consistent with the findings of Jumiyati et al. (2022) and Fithria et al. (2021), there is a notable correlation between iron consumption and the occurrence of anaemia [20,21]. Nevertheless, it contradicts the findings of a prior study conducted by Lestari et al (2018), which concluded that there is no substantial correlation between iron consumption and the occurrence of anaemia in teenagers [22]. The study findings indicate that a significant proportion of the participants (63.33%) had inadequate iron consumption, namely below 80% of the Recommended Daily Allowance (RDA). On average, the participants consume 11.27 mg of iron per day, which is lower than the recommended intake of 15 mg per day [23]. This is because of the lack of consumption of a variety of foods. Besides, respondents do not routinely take Blood Supplement Tablets (TTD) due to a lack of awareness of the importance of consuming the tablet and a lack of knowledge about the dangers and impacts of anemia. Iron plays an important role in the body such as forming hemoglobin which is responsible for binding oxygen in the blood to be distributed throughout the body. An adolescent who consumes insufficient iron has a 3.09-fold increased likelihood of developing anaemia compared to those who consume adequate amounts of iron [24].

4.2. The Relationship between Levels of Vitamin C Intake and the Incidence of Anemia

The RDA for vitamin C intake in adolescents aged 15 years and 16-19 years is 65 mg and 75 mg per day respectively [23]. According to the research, the p-value for vitamin C consumption is 0.05, indicating that there is no correlation between vitamin C intake and the occurrence of anaemia. Consistent with the findings of Sadrina and Nunung (2022), it was shown that there is no significant correlation between vitamin C consumption and the occurrence of anaemia among female students in Aceh [25]. This can be due to other factors such as a history of diseases that can cause anemia such as worms, tuberculosis, malaria, thalassemia, and others. The medical history of respondents is identified only based on direct interviews with respondents and school data without direct clinical examination. Another factor contributing to the lack of correlation between vitamin C intake and anaemia incidence is the consumption of foods containing inhibitory substances that can impact the effectiveness of vitamin C and the absorption of iron in the body. These substances include phytic acid, oxalic acid, and polyphenols such as tannins.

The results of this study challenge the earlier findings by Pibriyanti, et al (2020) which suggested a strong correlation between vitamin C consumption and the occurrence of anaemia in teenage girls aged 15-19 years. In addition, teenage females who do not consume enough vitamin C have a 1.73 times higher likelihood of developing anaemia compared to those who consume enough vitamin C [24]. According to the findings from interviews conducted using the SQ-FFQ, most of the participants have inadequate protein consumption, with an average intake value of 57.09 mg/day. The consumption of Vitamin C with iron affects iron status because Vitamin C enhances the absorption of iron. Vitamin C facilitates the conversion of ferric iron to its ferrous form, enhancing the body's ability to absorb it. This helps counterbalance the inhibitory effects of phytates and tannins on iron absorption [26].

4.3. The Most Dominant Factors Associated with the Incidence of Anemia

The multivariate analysis revealed that iron consumption (p-value = 0.016) had the strongest correlation with the occurrence of anaemia, as shown by an odds ratio (OR) of 12.59. Therefore, it may be inferred that those who do not consume enough iron have a 12.59 times higher likelihood of developing anaemia. Consistent with Zakiah's (2022) findings, iron emerges as the primary determinant linked to the prevalence of anaemia among teenage females attending Tanjung Sari Vocational School in Lampung [27].

Iron is an important element needed to form red blood cells (hemoglobin). Adolescent females are more susceptible to anaemia owing to monthly blood loss during menstruation. Therefore, they require increased iron consumption from dietary sources and blood supplement pills[8]. The primary risk strongly linked to the occurrence of anaemia in teenage females is inadequate iron consumption, both from dietary sources and iron supplement tablets. The level of iron intake from food and blood supplement tablets is 63.33% and 68% respectively which is insufficient. Adolescent girls' compliance with taking the blood supplement tablet influences hemoglobin levels in their bodies. The more compliance in taking the tablet, the higher the Hb levels[28]. The average iron intake of respondents is 11.2 mg/day which does not meet the minimum iron requirements according to the RDA. The results of the SQ-FFQ questionnaire show that the food sources of iron consumed by respondents are less varied, especially food sources of animal iron (heme) which have high bioavailability. Chicken meat and eggs are the primary sources of heme iron that are commonly ingested.

Given that anemia in reproductive women is associated with a greater low birth weight, the present study provides strong support for implementing a more effective iron supplementation program for teenage girls in Indonesia. It is important to note that this study sample was obtained from a small sample of teenage girls of the Cigalontang subdistrict in West Java, it may not be representative of all teenage girls in Indonesia. In addition, the cross-sectional

study design of this study is another limitation of this study from which we are not able to examine a causative association between anemia and all determinants identified in this study. A preferable design would be a cohort study to test the association between poor iron consumption and other determinants and anemia in teenage girls.

5. Conclusion

The study findings indicate that the occurrence rate of anaemia in teenage females is 13.33%. Anaemia occurrence is linked to the consumption of protein and iron. Conversely, there is no correlation between the consumption of vitamin C and the occurrence of anaemia in teenage girls. The primary factor strongly linked to nutritional status in this study is iron consumption. Adolescent females who do not consume enough iron are 12.59 times more likely to develop anaemia compared to those who have a suitable intake of nutrients.

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Conflict of Interest Statement

All authors have no conflict of interest in this study.

REFERENCES

[1] WHO. Haemoglobin Concentration of The Diagnosis of Anemia and Assessment of Severity. WHO. Haemoglobin Conc. diagnosis anaemia Assess. Sev. Vitam. Miner. Nutr. Inf. Syst. Geneva, World Heal. Organ. 2011 (http//www.who.int/vmnis/indicators/haemoglobin. pdf. 2019.

[2] Kementerian Kesehatan Republik Indonesia. Pedoman Pencegahan dan Penanggulangan Anemia pada Remaja Putri dan Wanita Usia Subur (WUS). Jakarta: Kementerian Kesehatan RI; 2018.

[3] World Health Organization. World health statistics 2023: monitoring health for the SDGs, sustainable development goals. Milbank Mem. Fund Q. 2023.

[4] Kemenkes RI. Hasil Riset Kesehatan Dasar Tahun 2018. Kementrian Kesehat RI. 2018;53:1689–99.

[5] Rahfiludin MZ, Arso SP, Joko T, Asna AF, Murwani R, Hidayanti L. Plant-based Diet and Iron Deficiency Anemia in Sundanese Adolescent Girls at Islamic Boarding Schools in Indonesia. J Nutr Metab. 2021;2021.

[6] Teni M, Shiferaw S, Asefa F. Anemia and Its Relationship with Academic Performance among Adolescent School Girls in Kebena District, Southwest Ethiopia. Biotechnol Heal Sci. 2017;4.

[7] World Health Organization, Stoltzfus R, Dreyfuss M. Prevention of iron deficiency anaemia in adolescents role of weekly iron and folic acid supplementation [Internet]. Role Wkly. Iron Folic Acid Supl. 2016. p. 50. Available from: http://www.searo.who.int/entity/child_adolescent/documents/sea_cah_2/en/.

[8] Cusick SE, Kuch AE. Determinants of undernutrition and overnutrition among adolescents in developing countries. Adolesc Med State Art Rev. 2012;23:440–56.

[9] Paratmanitya Y, Helmyati S, Nurdiati DS, Lewis EC, Hadi H. Assessing preconception nutrition readiness among women of reproductive age in Bantul, Indonesia: findings from baseline data analysis of a cluster randomized trial. J Gizi dan Diet Indones (Indonesian J Nutr Diet. 2021;8:68.

[10] Al-Jawaldeh A, Taktouk M, Nasreddine L. Food consumption patterns and nutrient intakes of children and adolescents in the eastern mediterranean region: A call for policy action. Nutrients. 2020;12:1–28.

[11] Ranjan R, Sahu UP, Chaudhary AK. Iron, Vitamin B12 And Folate Deficiency In Adolescents Havingnutritional Anaemia : A Hospital Based Study. IOSR J Dent Med Sci e-ISSN [Internet]. 2018;17:15–7. Available from: www.iosrjournals.org

[12] Wiafe MA, Ayenu J, Eli-Cophie D. A Review of the Risk Factors for Iron Deficiency Anaemia among Adolescents in Developing Countries. Anemia. 2023;2023.

[13] Sari P, Judistiani RTD, Hilmanto D, Herawati DMD, Dhamayanti M. Iron Deficiency Anemia and Associated Factors Among Adolescent Girls and Women in a Rural Area of Jatinangor, Indonesia. Int J Womens Health. 2022;14:1137–47.

[14] Ekasanti I, Adi AC, Yono M, Nirmala G F, Isfandiari MA. Determinants of Anemia among Early Adolescent Girls in Kendari City. Amerta Nutr. 2020;4:271.

[15] Hardianti A, Paratmanitya Y, Nurunniyah S, Jannah M, Hamdani R. Correlation between knowledge about anemia, iron, and folate consumption with anemia status among premarital women in bantul regency, yogyakarta. J Nutr Sci Vitaminol (Tokyo). 2020;66:S376–9.

[16] Hidayati. Y, Sulastri. D UBI. Hubungan Asupan Protein dan Zat Besi dengan Kejadian Anemia. 2023;46:385–93.

[17] Handayani EY, Sepduwiana H. Hubungan Pengetahuan Remaja dan Pendidikan Ibu terhadap Kejadian Anemia Pada Remaja Putri Di SMPN 02 Rambah Hilir Kabupaten Rokan Hulu. J Martenity Neonatal [Internet]. 2019;7:466–74. Available from: http://e-journal.upp.ac.id/index.php/akbd/article/view/1912

[18] Boli EB, Al-faida N, Ibrahim NSI. Konsumsi Tablet Tambah Darah , Kebiasaan Minum Teh. J Hum Care [Internet]. 2022;7:141–5. Available from:http://dx.doi.org/10.32883/hcj.v7i1.1617

[19] Kementrian Kesehatan. Profil Kesehatan UPTD Puskesmas Cigalontang. 2016;100.

[20] Fithria F, Junaid J, Sarmin WOS. Hubungan Antara Asupan Zat Gizi Dengan Kejadian Anemia Pada Remaja Putri Sma Negeri 1 Barangka Tahun 2019. (Jurnal Ilm Mhs Kesehat Masyarakat). 2021;6.

[21] Jumiyati J, Wahyu W T, Krisnasary A, Yulianti R. Anemia among Adolescent Girls: Its Association with Protein and Iron Intake. Media Gizi Indones. 2023;18:14–20.

[22] Lestari P, Paratmanitya Y, Suliyah S. Intake of iron and inhibitor are not related with anemia on the premarriage women. J Gizi dan Diet Indones (Indonesian J Nutr Diet. 2018;6:99.

[23] Kementerian Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Nomor 28 Tahun 2019 tentang Angka Kecukupan Gizi yang Dianjurkan untuk Masyarakat Indonesia. Αγαη 2019 p. 55.

[24] Pibriyanti K, Zahro L. Relationship between micronutrient and anemia incidence in adolencents at Islamic boarding school. Hafidhotun Nabawiyah [Internet]. 2020;8:130–5. Available from: http://dx.doi.org/10.21927/ijnd.2020.8

[25] Sadrina CN, Mulyani NS. Asupan Protein, Zat Besi, Dan Vitamin C Dengan Kejadian Anemia Pada Mahasiswi Gizi Poltekkes Kemenkes Aceh. Gizido. 2021;13:33–41.

[26] Krisnanda R. Vitamin C Membantu dalam Absorpsi Zat Besi Pada Anemia Defisiensi Besi. J Penelit Perawat Prof. 2020;2:279–86.

[27] Zakiah. Analisis Faktor-Faktor yang Berhubungan dengan Perilaku Asupan Sumber Zat Besi pada Remaja Putri Anemia di SMKN Tanjung Sari Kabupaten Lampung Selatan. Universitas Lampung; 2022.

[28] Savitri MK, Tupitu ND, Iswah SA, Safitri A. Hubungan Kepatuhan Konsumsi Tablet Tambah Darah Dengan Kejadian Anemia Pada Remaja Putri: a Systematic Review. J Kesehat Tambusai. 2021;2:43–9.