



Research article

The effect of providing multiple micronutrient supplements and education on increasing hemoglobin levels in adolescent girls

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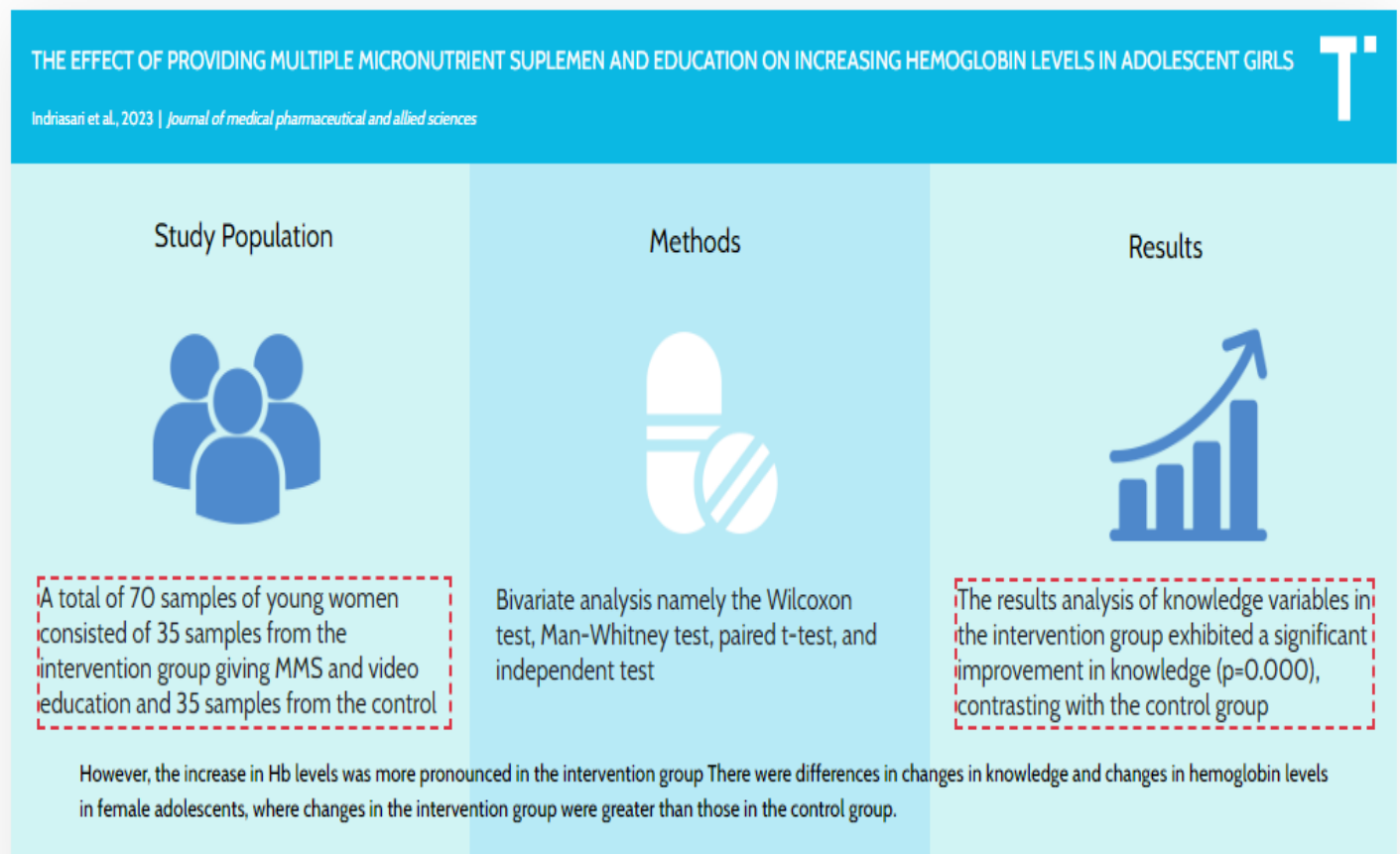
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ABSTRACT

Anemia is a serious global health problem. In Indonesia, anemia is a nutritional problem that must be addressed immediately because its prevalence is quite high. Based on gender, the incidence of anemia in men is 20.3%, and in women, it is 27.2%, so it can be seen from these data that the incidence of anemia is higher in women.



The study aimed to assess the effect of providing MMS (Multi Micronutrient Supplement) and video education on increasing Hb (Hemoglobin) levels in adolescent girls. The research was conducted at MA Muhammadiyah Bontorita and MA Babussalam Takalar Regency. With a Quasi-Experimental research design. A total of 70 samples of young women consisted of 35 samples from the intervention group giving MMS and video education and 35 samples from the control group giving MMS without education. Bivariate analysis namely the Wilcoxon test, Man-Whitney test, paired t-test, and independent test. The results analysis of knowledge variables in the intervention group exhibited a significant improvement in knowledge ($p=0.000$), contrasting with the control group ($p=0.060$), where the change was not significant. Regarding Hb levels, the intervention group displayed a significant increase ($p=0.043$), and similarly, the control group also showed a notable rise ($p=0.000$). However, the increase in Hb levels was more pronounced in the intervention group. There were differences in changes in knowledge and changes in hemoglobin levels in female adolescents, where changes in the intervention group were greater than those in the control group.

Keywords: Anemia, Adolescent Girls, Knowledge, Hemoglobin Levels.

INTRODUCTION

Anemia is a health problem throughout the world, especially in developing countries where it is estimated that 30% of the world's population suffers from anemia. In 2019, the global prevalence of anemia was 29.9% in women of childbearing age, equivalent to more than half a billion women aged 15-49 years^[1]. In Indonesia, anemia is a nutritional problem that must be addressed immediately because its prevalence is quite high. Based on gender, the incidence of anemia in men is 20.3%, and in women, it is 27.2%, so it can be seen from these data that the incidence of anemia is higher in women^[2].

Adolescents do not yet know and fully understand that anemia can have negative impacts such as stunted growth, easy infection, and almost all adolescents do not even know that anemia as a teenager carries a risk of experiencing anemia during pregnancy^[3]. Adolescent girls who suffer from anemia and it is not treated immediately and continues during pregnancy will experience poor reproductive function, high maternal mortality rates, and increased the risk of giving birth to low birth weight (LBW) babies^[4].

The Indonesian government is trying to reduce the prevalence of anemia by implementing an iron nutritional supplementation (TTD) program which was initially only given to pregnant women during their pregnancy with a minimum of 90 Blood Additive Tablets (TTD), but is currently being developed for adolescent girls and WUS through supplementation containing at least 60 mg elemental iron and 400 mcg folic acid^[5]. Giving TTD to adolescent girls is quite good because there is a change in increasing hemoglobin levels in teenagers who regularly consume TTD, but this change is not optimal. The content in TTD is incomplete and teenagers do not have sufficient knowledge about the importance of preventing anemia, so optimal changes are needed.

MMS is a multi-micronutrient supplement consisting of 15 vitamins and minerals including Vitamins A, C, D, E B1 (thiamine), B2 (riboflavin), B3 (niacin), B6, B12 and folic acid and Fe (iron). MMS are tablets that can replace TTD because the composition of MMS is more complete than TTD which only contains iron and folic acid^[6]. Giving MMS is more effective in improving iron status compared to just giving iron supplementation in the form of a single

dose because the vitamin C contained in MMS can increase iron absorption in the body so that the increase in hemoglobin levels will be faster^[7]. Thus, it can be estimated that giving MMS to adolescent girls can accelerate the increase in hemoglobin levels in adolescent girls.

Even though the composition of MMS is more complete and MMS can increase hemoglobin levels, education is still needed for adolescent girls. In this era of globalization, the use of smartphones and social media applications plays quite an important role in human life, one of which is targeting teenagers who currently find it difficult to escape from using gadgets. The TikTok application is a medium that is currently viral and is in great demand at the moment. TikTok users range from children to adults. Currently, TikTok is the most downloaded application, namely 45.8 million times. Judging from the 625 million active TikTok users, TikTok is currently a means of providing fast and interesting information^[8].

This number beats other applications such as What Sapp, YouTube, Facebook and Instagram. Meanwhile, in Indonesia alone, TikTok has 10 million active users every month. TikTok is a short video creation application with several interesting, unique effects accompanied by music and to capture and present creativity, knowledge and other moments. TikTok itself also contains a lot of education created by several agencies, health workers and so on in the form of interesting videos^[9].

Based on research regarding balanced nutrition in elementary school students. The research shows that students do not know what balanced nutrition, obesity and nutritious food are after being given counseling through TikTok media. Students' knowledge increases to know what balanced nutrition and nutritious food are^[10].

Based on the description above and based on several studies, especially regarding the prevention of anemia in adolescent girls who still use TTD with less than optimal results and the use of MMS which is only intended for pregnant women in increasing Hb levels and the lack of knowledge in adolescent girls. Therefore, researchers are interested in conducting research on the effect of giving

MMS and education on increasing hemoglobin levels in adolescent girls.

METHODS

This study is a Quasi-Experimental research with a pretest-posttest control group design. The population in this research were Class X and XI students in these two schools. The samples in this study were 70 samples consisting of 35 in the intervention group (giving MMS and education) and 35 samples in the control group (giving MMS without education). Data collection on sample characteristics was obtained by distributing questionnaires to adolescent girls, data on teenagers' knowledge about anemia and MMS was obtained through pre-test and post-test and data on sample hemoglobin levels was obtained from checking Hb using the Easy touch tool. Bivariate analysis, namely Wilcoxon to determine the average difference between pre and post-test knowledge and the Man Whitney test to determine changes in knowledge before and after the intervention (Wilcoxon and Man Whitney tests were used because the data were not normally distributed). Then use the paired t-test to determine the difference in changes in Hb levels in the intervention and control groups. And use the independent t-test to determine the pre and post-average of Hb levels (the paired t test and independent t-test are used because the data is normally distributed)

RESULTS AND DISCUSSION

Based on table 1, it shows that of the 35 respondents in each group obtained in the intervention group, the highest age of adolescent girls was in the 16 year old category at 48.6% and in the control group the highest age of adolescent girls was 15 years old at 62.9%, while the lowest age was in the intervention and control groups, namely in the 14 year age category, only 11.4% in the intervention group and 17.1% in the control group.

The highest education level of fathers in the intervention group was the high school category at 45.7% and in the control group the highest was the elementary school category at 31.4%. Meanwhile, the education level of mothers in the intervention group and control group was the highest, namely the junior high school category, 42.9% in the intervention group and 34.3% in the control group.

Table 2: Frequency Distribution of Anemia in Adolescent Girls

Anemia Category	Interventions				control				P-Value
	Pre		Post		Pre		Post		
	n	%	n	%	n	%	n	%	
Normal	0	0	31	88.6	0	0	15	42.9	0.000
Light	19	54.3	4	11.4	18	51.4	15	42.9	
Medium	16	45.7	0	0	17	48.6	5	14.3	
Total	35	100	35	100	35	100	35	100	

Source: Primery data, 2023

Based on table 2, it shows that before treatment in the intervention group the anemia categories were mild (54%) and moderate (45.7%), while in the control group they were mild (51.4%) and moderate (48.6%). Then, after treatment, the intervention group showed normal (88.6%) and mild (11.4%) anemia categories, while

Table 1: Table of characteristics of respondents

Characteristics	Intervension		Control		P-Value
	N (n=35)	%	N (n=35)	%	
Age					0.042
14	4	11.4	6	17.1	
15	14	40.0	22	62.9	
16	17	48.6	7	20.0	
Father's education					0.421
No school	1	2.9	2	5.7	
Elementary School	7	20.0	11	31.4	
Junior High School	8	22.9	6	17.1	
Senior high school	16	45.7	10	28.6	
D3/S1/S2/S3	3	8.6	6	17.1	
Mother's education					0.417
No school	1	2.9	2	5.7	
Elementary School	8	22.9	9	25.7	
Junior High School	15	42.9	12	34.3	
Senior high school	10	28.6	7	20.0	
D3/S1/S2/S3	1	2.9	5	14.3	
Father's occupation					0.777
Workers/farmers	24	68.6	21	60.0	
Self-employed	6	17.1	5	14.3	
private employees	2	5.7	5	14.3	
Civil servants/military/police	2	5.7	3	8.6	
Other	1	2.9	1	2.9	
Mother's occupation					0.116
Housewife	28	80.0	25	71.4	
Self-employed	6	17.1	6	17.1	
private employees	0	0	2	5.7	
Civil servants/military/police	1	2.9	20	57.0	
Other	0	0	0	0	

The employment level of the respondents' parents was obtained, for fathers' occupations in the intervention group and the control group, the majority worked as laborers/farmers, 68.6% in the intervention group and 60.0% in the control group. Meanwhile, maternal employment in the intervention and control groups was the highest, namely housewives at 80.0% in the intervention group and 71.4% in the control group.

In the homogeneity test of the characteristics of father's education, mother's education, father's occupation and mother's occupation, the two groups were equal with a p value of > 0.05, however for the age characteristics of the two groups they were not equal, where the p value = 0.042, p < 0.05.

the control group showed normal (42.9%), mild (42.9%) and moderate (14%) anemia categories, based on the chi-square test, the p value =0.000, where p <0.05, this shows that there is a difference in the anemia category between the intervention and control groups.

Source: Primary data, 2023

Based on Table 3, it shows that of the 35 respondents, 29 people (82.9%) complied with watching educational videos and 6 people (17.1%) did not comply.

Table 3: Frequency distribution of adherence to watching videos of adolescent girls

Video Watching Compliance	n	%
Obedient	29	82,9
Not obey	6	17,1
Total	35	100

Table 4: The influence of TikTok video education on increasing the knowledge of adolescent girls

Knowledge	N	Mean ± SD		Mean Difference	P-Value
		Pre	Post		
Intervention	35	37.00±17.995	71.14±14.402	34.14	0.000 ^a
Control	35	34.29±13.940	39.43±12.413	5.14	0.060 ^a
P-Value		0.759 ^b	0.000 ^b	0.000	

Wilcoxon ^a, Mann Whitney ^b**Source: Primary data, 2023**

Based on the data in table 4, after the Wilcoxon test was carried out, in the intervention group it can be seen that the mean difference before and after giving the TikTok video education was 34.14 with a value of $p=0.000$, where $p<0.05$ shows that there was an increase in the knowledge of adolescent girls after being given treatment on intervention group. Meanwhile, in the control group, it can be seen that the mean difference before and after was only 5.14 with a value of $p=0.060$, where $p>0.05$, this shows that there was no significant change in knowledge after treatment in the control group.

It can be seen in table 4 that after carrying out the Mann

Whitney test, the pre-test score between the intervention group and the Control group was $p=0.759$, where $p>0.05$, this shows that there was no significant difference in the pre-test results between the two groups. . Meanwhile, the post-test value between the intervention and control groups was 0.000, where $p>0.05$, this indicates there was a significant difference in the post-test results between the two groups. This is the same as the results of the Man Whitney test on the difference between the mean values before and after treatment in the two groups, with a value of $p=0.000$, where $p>0.05$, this shows that there is a significant difference in changes in knowledge between the control group and the intervention group.

Table 5: Differences in Hb levels in the intervention group and control group

Variable	Pre		P value*		Difference	
	Mean	Min-Max	Mean	Min-Max		
Intervention(n=35)	10.9	9.6-11.9	12.5	11.3-13.3	1.6	0.043*
control(n=35)	10.86	9.4-11.9	11.9	10.6-13.5	1.04	0.000*
P Value**	0.599**		0.002**		0.007	

Source: Primary data, 2023**Uji Paired T test*****Dependent sample test****

Based on table 5, it can be seen that the average Hb levels of female adolescents in the intervention group before and after giving MMS and Education showed values of 10.9 g/dL and 12.5 g/dL respectively or an increase of 1.6 g/dL. dL with a value of $p = 0.043^*$, where ($p < 0.05$) this shows that there was a significant change in the Hb levels of female adolescents after treatment in the intervention group, while the control group before and after administration of MMS showed a value of 10 respectively. 0.8 g/Dl and 11.9 g/dl or 1.04 g/dL with a p value = 0.000*, where ($p < 0.05$) indicates there was a significant change after treatment in the control group.

It can be seen in table 5 that the pre-test results between the intervention and control groups were $p = 0.599^{**}$, where $p > 0.05$, this shows that there is no significant difference in the pre-test results between the 2 groups, while the post results -test between the intervention and control groups, namely $p = 0.002^{**}$, where $p < 0.05$, this shows that there is a significant difference in the post-test results between the 2 groups. This is the same as the results of the difference between the mean values before and after treatment in the two groups, with a value of $p=0.007$, where $p<0.05$ indicates that there is a

significant difference in changes in Hb levels between the control and intervention groups.

DISCUSSION

Based on the study results, it shows that there is no change in increasing knowledge before and after in the control group, whereas in the intervention group it is statistically significant, namely there is a change in increasing knowledge before and after treatment in the intervention group.

The results of this research are in line with research which states that there is an influence of nutrition education using the TikTok Application Media on knowledge of balanced nutrition in adolescent girls. The current TikTok trend is more effective than other video media in increasing the knowledge of teenagers in the millennial era. [11].

One of the current approaches to providing nutrition education is by involving social media such as the TikTok application. Audio-visual learning media that can support learning according to the characters and features offered, the TikTok application can accommodate these audio-visual needs. Even with the duet feature, it can provide cooperative listening learning [12].

Videos added to verbal messages can increase motivation to receive messages and remember them better because video media

offers more interesting and non-watching counseling by displaying movements, images and sounds so that teenagers are curious about the content of the video. Who are expected to be able to absorb information and implement it in daily behavior and lifestyle in accordance with nutritional messages to improve nutritional status and healthy lifestyles in the future ^[13].

Knowledge about health aims to change individual behavior and quality of life as well as increase understanding of efforts to prevent disease and health care ^[14]. The formation of a person's actions is influenced by the knowledge they possess. The better a person's knowledge, the better the attitude that will be formed to create good actions. Adolescent girls with good knowledge about the importance of iron and the consequences of iron deficiency will tend to form a positive attitude towards compliance, resulting in compliant actions in consuming supplements. The knowledge given to adolescent girls as an effort to increase Hb levels includes knowledge about what anemia is, normal Hb levels, symptoms of anemia, the impact of anemia, foods that contain iron, nutrients that speed up iron absorption and those that slow down iron absorption as well as supplements that can increase Hb levels.

Regarding knowledge of anemia and compliance with consuming blood supplement tablets for adolescent girls at shows that there is a significant relationship with a value of $p = 0.000$ where $p < 0.05$, which means that knowledge about anemia influences compliance with consumption of supplement tablets blood ^[15].

Based on the results of the study, it showed that there was a significant change in the increase in hemoglobin levels in female adolescents before and after treatment in the intervention group and in the control group.

This research is in line with research which showed a significant reduction in anemia among adolescent girls in rural Bangladesh this is similar to research where giving MMS to adolescent girls can significantly reduce the prevalence of anemia, iron and folic acid deficiencies and can improve micronutrient status. These results are supported by high compliance and supervision in consuming MMS so that it can reduce the prevalence of anemia ^[16, 17].

In this study, compliance with consuming MMS among adolescent girls was included in high compliance, namely 100%, with high compliance among adolescents in consuming MMS, it can guarantee the effectiveness of MMS in increasing Hb levels, however, high compliance is also caused by researchers directly controlling adolescents who want to consume MMS and the possibility of There can still be differences if the remja is not directly controlled, for example if it is only given and taken home for individual consumption at home. Researchers also assume that a decrease in the prevalence of anemia can be influenced by adolescent compliance in consuming

MMS. If adolescents consume MMS regularly, hemoglobin levels will also increase, conversely, if adolescent compliance is less, hemoglobin values will also decrease. This is proven by the table of anemia frequency distribution results, where before treatment the adolescent anemia category was in the mild and moderate anemia category, but after treatment it could change to the normal and mild category. The better compliance a teenager has, the more optimal the increase in Hb levels will be, but increasing compliance also requires supervision and support from people around him.

Adolescent girls have an obligation to consume iron, this is because the loss of blood volume every month due to menstruation ranges from 30-50cc which is equivalent to iron loss of 12.5-15mg per month or 0.5mgFe/ml ^[18]. This puts adolescent's girl at risk of experiencing anemia. The results of research on female students from the Faculty of Medicine at the Indonesian Muslim University show that the length of menstruation is related to the hemoglobin levels of adolescent girls ^[19]. So by drinking MMS the body's iron needs can be met.

Women need a minimum of 60 ml of additional blood every month, which can be in the form of supplements and if converted it is equivalent to 30 mg of iron. By consuming additional iron, a teenage girl can avoid or even treat anemia ^[20]. This need can be achieved if teenagers consume MMS which also contains 30 mg of iron.

From several existing things, an assumption can be made that hemoglobin levels can be influenced by a person's awareness regarding iron consumption, which can be in the form of MMS or from foods that contain iron. Apart from that, there is still a need for support and supervision from various parties, both from the family and the school environment, to produce a good influence so that adolescent girls can be obedient in consuming supplements for their body's iron needs.

CONCLUSION

Based on the results of research, it can be concluded as follows:

There was an increase in knowledge among adolescent girls after being given education on anemia and balanced nutrition via TikTok videos for 2 months. There was an increase in the Hb levels of adolescent girls after being given 9 tablets of MMS for 2 months. There is a difference in changes in knowledge of adolescent girls who were given MMS and education compared to adolescent girls who were given MMS without education, where the increase in knowledge in the intervention group was greater than the control. There is a difference in changes in Hb levels in adolescent girls who were given MMS and education compared to adolescent girls who were given MMS without education, where the increase in Hb levels in the intervention group was greater than the control.

REFERENCE

1. Juffrie M, Helmyati S, Hakimi M, 2020. Nutritional anemia in Indonesia children and adolescents: diagnostic reliability for appropriate management. *Asia pacific journal of clinical nutrition*, 29 (1), Pages 18-31. Doi: 10.6133/apjcn.202012_29 (S1).03.
2. Bull Fc, Al-Ansari Ss, Biddle S, et al, 2020. World health organization guidelines on physical activity and sedentary behaviour. *br j sports med*. 54(24), Pages 1451–62. Doi: <https://doi.org/10.1136/bjsports-2020-102955>.
5. Zhang YX, Chen J, Liu XH, 2021. Profiles of anemia among school-aged children categorized by body mass index and waist circumference in Shandong, China. *Pediatr Neonatol*. 62(2), Pages 165–171. Doi: <https://doi.org/10.1016/j.pedneo.2020.11.002>.
6. Fortanier AC, Venekamp RP, Boonacker CWB, et al, 2014. Pneumococcal conjugate vaccines for preventing acute otitis media in children. *John Wiley and Sons Ltd*. 4(2), Pages 1480 - 1488. Doi: <https://doi.org/10.1002/14651858.cd001480.pub4>.
7. Kesehatan K, Kesehatan P, Jurusan S. 2016. Pengaruh mengkonsumsi multiple micro nutrient (mmn) terhadap peningkatan berat badan ibu hamil. 1(2), Pages 114–148. Doi: <https://doi.org/10.37341/jkkt.v1i2.82>.
8. Shadrina Nasution N, Budi Musthofa S, Shaluhiah Z, et al. 2021. Edukasi pencegahan covid-19 dalam media sosial: gambaran konten video tiktok. 9(2), Doi: <https://doi.org/10.14710/jkm.v9i2.29434>.
9. Nurdiansyah F, Suhartini T., 2021. Nilai edukasi pada aplikasi tiktok di kalangan remaja kota bandung. *komunikasiana: journal of communication studies*. 3(2), Pages 138-46. <https://doi.org/10.24014/kjcs.v0i0.14212>.
11. Risa Pamilasari, Desi Desi, Jonni Syah R Purba Purba, 2022. Pengaruh Edukasi Gizi Media Tik Tok Terhadap Pengetahuan Gizi Seimbang Pada Remaja Putri. *Pontianak nutrition journal* Doi: <https://doi.org/10.30602/pnj.v2i1.477>.
13. Hanifah DL, Kristien Andriani SK, Soviana E, et al, 2015. Differences in teenagers' knowledge before and after being given counseling about balanced nutrition using Media Video di SMP Negeri 2 Kartasura, Universitas Muhammadiyah Surakarta. Doi: <https://doi.org/10.56127/jukeke.v1i2.251>.
14. He Z, Cheng Z, Shao T, et al, 2016. Factors influencing health knowledge and behaviors among the elderly in rural China. *International journal of environmental research and public health*. 13(10), Pages 975-980. Doi: <https://doi.org/10.3390/ijerph13100975>.
15. Wahyuningsih A, Uswatun A. Hubungan, 2019. pengetahuan tentang anemia dengan kepatuhan mengkonsumsi tablet tambah darah remaja putri di SMA Negeri 1 Karanganyar. *Involusi: Jurnal Ilmu Kebidanan*. 9(1), Pages 1-2. Doi: <https://doi.org/10.61902/involusi.v9i1.102>.
16. Ahmed F, Khan MR, Akhtaruzzaman M, et al, 2005. Efficacy of twice-weekly multiple micronutrient supplementation for improving the hemoglobin and micronutrient status of anemic adolescent schoolgirls in Bangladesh. *The American journal of clinical nutrition*. 82(4), Pages 829-835. Doi: <https://doi.org/10.1093/ajcn/82.4.829>.
17. Ahmed F, Khan MR, Akhtaruzzaman M, et al, 2012. Effect of long-term intermittent supplementation with multiple micronutrients compared with iron-and-folic acid supplementation on Hb and micronutrient status of non-anaemic adolescent schoolgirls in rural Bangladesh. *British journal of nutrition*. 108(8), Pages 1484-1493. Doi: <https://doi.org/10.1017/s0007114511006908>.
18. Fitriany J, Saputri AI, 2018. Anemia defisiensi besi. *Averrous: Jurnal Kedokteran dan Kesehatan Malikussaleh*. 4(2), Pages 1-4. Doi: <https://doi.org/10.29103/averrous.v4i2.1033>.
19. Tualeka JN, Aziza W, Fasiha F. 2023. Hubungan lamanya menstruasi dengan kadar hemoglobin pada mahasiswi d-iii teknologi laboratorium medis politeknik kesehatan kementerian kesehatan maluku. *Jurnal Kebidanan*. 3(1), Pages 51-57. <https://doi.org/10.32695/jbd.v3i1.455>.
20. Sulistiyanti A, Yuliana A, Veranita W, 2022. The relationship between consumption fe tablets during menstruation with the incidence of anemia in adolescent girls in wirengan masaran village, sragen. *indonesian journal on medical science*. Pages 91-97. Doi: <https://doi.org/10.55181/ijms.v9i1.358>.