


The Impact of Directly Observed Therapy of Weekly Iron Supplementation Program in Female Adolescent Hemoglobin Status

Lilin Turlina¹, *Amrina Nur Rohmah²

^{1,2}Faculty of Health Sciences, Universitas Muhammadiyah Lamongan, Indonesia
Authors E-mail: turlinalmg@gmail.com¹, amrinanurrohmah12@gmail.com²

Article Info	ABSTRACT
<p>Article history: Received July 05, 2024 Revised July 28, 2024 Accepted August 12, 2024</p> <hr/> <p>Corresponding Author: Amrina Nur Rohmah Faculty of Health Sciences, Universitas Muhammadiyah Lamongan, Indonesia Email: amrinanurrohmah12@gmail.com</p>	<p>In adolescents, nutrition is an important factor in the growth and development process, especially during the growth spurt period that occurs in early adolescence and is characterized by physical, cognitive, and reproductive organ growth and maturation of reproductive organs. Inadequate nutrition during adolescence will cause various problems, one of which is anemia. Anemia has negative impacts, including impaired growth and development, decreased learning achievement, and impaired immunity, thus increasing the occurrence of infections and reproductive disorders. This research is quasi-experimental with a one-group pretest-posttest approach. The research was conducted at Muhammadiyah I Lamongan Vocational School with a total of 44 female students. The sampling technique used in this research was total sampling. Research data analysis was carried out using the paired T-test statistical test. The results of the study showed that carrying out Directly Observed Therapy (DOT) while administering Fe tablets for 12 weeks was able to significantly increase Fe levels in adolescents, with a p-value of 0.000 ($p < 0.05$).</p> <p>Keywords: Adolescent, Anemia, Directly Observed Therapy</p> <p>This article is licensed under a Creative Commons Attribution 4.0 International License.</p> 

1. INTRODUCTION

According to WHO, adolescents are defined as people aged 10-19 years [27]. The number of teenagers worldwide is estimated to reach 1.2 billion people; in some countries, the teenage population is almost a quarter of the total population [26]. Adolescence is a transition period between childhood and adulthood, and it is crucial because changes occur in various areas of growth and development, including biological, cognitive, psychosocial, and emotional aspects (Best & Ban, 2021). Adolescents are at risk because they experience significant changes in various aspects.

There are various health problems that teenagers may experience, including anemia. Anemia is a condition where the hemoglobin level in the blood is below normal limits [30]. When hemoglobin concentration decreases, the blood's capacity to carry oxygen to tissues is impaired, resulting in symptoms such as fatigue, reduced physical work capacity, and shortness of breath [25]. 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 [28]. In 2018, 32% of teenagers in Indonesia experienced anemia. Therefore, it can be concluded that approximately 7.5 million Indonesian teenagers are at risk of experiencing obstacles in their growth and development, cognitive abilities, and susceptibility to infectious diseases [19]. Based on data from the East Java health service, the prevalence of anemia in adolescents is stated to be 42% [14].

The group of teenagers at risk of developing anemia includes those with malnutrition problems, insufficient food intake for daily nutritional needs [2], obesity caused by poor food choices that do not prioritize macro and micro nutrient content [11], chronic diseases [18], poor hygiene [15], and teenage pregnancy [4].

Anemia in adolescents can negatively impact several aspects, including stunted growth [21], reduced focus during school activities, poor school performance [23], decreased immunity, and increased infection rates [1]. Menstrual disorders can also be experienced [6]. If teenagers experience pregnancy accompanied by anemia, there is a possibility of IUGR, LBW, which can even increase perinatal morbidity and mortality [24]. This will directly or indirectly impact the national economy and national growth.

Efforts to overcome anemia, according to WHO recommendations in 2011, focused on promotive and preventive activities, including increasing the consumption of iron-rich foods, supplementing iron tablets, and increasing the fortification of foods with iron and folic acid (World Health Organization, 2024). In Indonesia, the prevention of anemia is regulated in the Minister of Health of the Republic of Indonesia Regulation Number 88 of 2014 concerning Standards for Blood Supplement Tablets for Women of Childbearing Age and Pregnant Women. Additionally, there are prevention activities through a Blanket Approach, meaning all program targets are covered. In this case, all young women are required to take Fe tablets or blood supplement tablets (TTD) to prevent anemia and increase iron reserves in the body without initial screening in the target group [14].

Adolescents' compliance with consuming Fe tablets remains a challenge in sustaining the government's program to reduce anemia. Previous research conducted in Denpasar showed that 58.4% of teenagers were inconsistent in consuming Fe tablets [20]. Several factors influence adolescent compliance in consuming Fe tablets, including insufficient knowledge about anemia, side effects of nausea after consuming Fe tablets, forgetting to consume them, lack of motivation and support from those around them, and incorrect methods of consuming Fe tablets [12].

One solution to increase treatment adherence is to use the DOT (Directly Observed Therapy) technique, known in Indonesian as PMO (Medicine Taking Monitor). This direct therapeutic assistance program was initially used to treat TB (Tuberculosis) patients and HIV/AIDS patients requiring ARVs. The DOT program involves appointing someone to supervise patients taking medication according to the doctor's recommendations. Implementation varies, with patients visiting health institutions, home visits by companions/health workers, or supervision by family, friends, or teachers at school [10]. Based on this explanation, efforts are needed to overcome anemia, one of which is by carrying out Directly Observed Therapy to help control teenagers' consumption of Fe tablets.

2. METHOD

This research is quantitative with a quasi-experimental design using a one-group pretest-posttest approach. It will be conducted at Muhammadiyah I Lamongan Vocational School from January 2023 to March 2023. The population consists of all female students in classes I and III, totaling 44 female students. The sampling technique is total sampling, so the entire population will be used as the sample. The instruments include an observation sheet to record hemoglobin levels, body weight, height (to calculate BMI), and Fe tablet consumption by female students weekly. Tools include weight scales, stature meters, and the EasyTouch Hb hemoglobin check tool.

The research process will be conducted in collaboration with UKS officers, guidance and counseling teachers, and homeroom teachers. At the initial meeting, the research team will gather all potential respondents, explain the activities, and provide informed consent. At the second meeting, initial data will be collected, followed by the first week of Fe tablet consumption. Fe tablets will be administered once a week for three months, consumed directly in front of the researcher, and recorded on the observation sheet. The Fe tablets used are Neo Kimia Farma Blood Enhancing Tablets containing 60 mg Ferrous Fumarate and 0.40 folic acid. If a student is absent, Fe tablets will be given to the homeroom teacher for immediate consumption by the student. At week 12, the last Fe tablet will be administered, followed by the second hemoglobin level data collection. If a student is menstruating during hemoglobin assessment, data collection will be delayed by one week. Data analysis will use a paired T-test, after testing for data normality.

3. RESULT AND DISCUSSIONS

Results

Data Analysis

Table 1. Characteristics of Research Respondents

		n	%
Age	16 years	19	43.2
	17 years	7	15.9
	18 years	18	40.9
	Total	44	100.0
BMI	Underweight	8	18.2
	Normal Weight	27	61.4
	Overweight	3	6.8
	Type 1 obesity	5	11.4
	Type 2 obesity	1	2.3
	Total	44	100.0
Parental Income	>1,500,000	4	9.1
	1,500,000 - 2,500,000	24	54.5
	2,500,000 - 3,500,000	8	18.2
	>3,500,000	8	18.2
	Total	44	100.0

Source: Primary Data

Based on Table 1, it shows data on the characteristics of research respondents. In the youth data, the majority were 16 years old, 19 female students (43.2%). Meanwhile, for the BMI category, the majority of teenagers fall into the normal category, 27 female students (61.4%), however there are 8 teenagers in the underweight group, 8 female students (18.2%) and the remaining 9 female students (20.3%) are included in the overweight group. In terms of characteristics, parental income is dominated by 24 people (54%) in the range of 1.5-2.5 million.

Table 2. Frequency distribution of differences in anemia status in the pretest and posttest groups

Anemic status	Pre-Test		Post Test	
	n	%	n	%
Not Anemic	34	77.3%	41	93.2%
Anemia	10	22.7%	3	6.8%
Total	44	100.0	44	100.0

Source: Primary Data

Table 2 shows that there are differences in anemia status before and after intervention. Before administering Fe tablets, there were 10 female students (22.7%) who experienced anemia, while there were 34 female students (77.3%) who did not experience anemia. After administering Fe tablets once a week for 12 weeks, there was a change in the proportion of anemia status. Adolescents who experienced anemia decreased quite significantly, leaving only 3 female students (6.8%), while adolescents who were not anemic increased to 41 female students (93.2%).

Table 3. Analysis of differences in mean hemoglobin levels in the pretest and posttest groups

	N	Mean	St. Deviation	Min	Max	P - value
Pre-Test	44	12.4614	1.03547	9.70	14.20	0,000
Post Test	44	13.8386	1.05879	11.00	15.60	

Source: Primary Data

Based on Table 3, it can be concluded that there was a change in the average hemoglobin level before and after the intervention. Before the intervention the average hemoglobin level was 12.4614 while after intervention there was an average increase of up to 13.8386 . Apart from that, there was a difference in the minimum score between the two groups which changed from 9.70 to 11.00 . Likewise, the maximum score has changed from 14.20 in the pre-test group it was 15.60 in the post test group. Based on statistical analysis tests, there was a significant increase in hemoglobin levels after assistance with iron tablet administration for 12 weeks with a *P-value* of 0.000 (<0.05). This proves that the implementation of *Directly Observed Therapy* in providing adolescent supplementation for 12 weeks is able to effectively increase hemoglobin levels in adolescents.

Discussion

A. Research Characteristics

Anemia is the most common nutritional problem in the world. The body uses iron to produce hemoglobin, a protein that transports oxygen from the lungs to the rest of the body via the bloodstream. Anemia is a condition where the hemoglobin level in the blood is below a certain amount (less than 12 g/dl in non-pregnant women and less than 10 g/dl in pregnant women) [9]. Adolescents are included in the vulnerable age group category for experiencing nutritional problems. This is because, during adolescence, there is a phase of rapid growth and development where nutritional needs are relatively high. Adolescent girls are more susceptible to anemia or iron deficiency because, during puberty, the reproductive organs mature, leading to menarche [16]. Interviews conducted in Surabaya with 10 teenagers who experienced anemia revealed that the causes of anemia included a lack of knowledge about anemia and balanced nutrition, choosing food that does not meet the body's needs, skipping breakfast, the habit of consuming tea and coffee which can inhibit iron absorption, and not regularly consuming Fe tablets among young women [7].

The characteristics of BMI (Body Mass Index) also have a relationship with the incidence of anemia. Previous research conducted in Probolinggo, East Java, found that anemia was more common in women who were underweight at 48.1% compared to women who were overweight or obese at 28.4%. Underweight conditions and malnutrition are closely related, as malnutrition means nutritional intake does not meet the body's daily needs (Sumarmi et al., 2016). In cases of obesity and anemia, previous research indicates that obesity can disrupt iron homeostasis, causing anemia due to chronic inflammation, which increases hepcidin levels. Hecpidin is a compound that can inhibit iron absorption [3].

One component that can influence the fulfillment of daily nutritional needs is the family's purchasing power for quality food sources with high nutritional value. Additionally, teenagers whose parents have higher incomes tend to choose more nutritious foods [13].

B. The Effect of DOT on Increasing Hemoglobin Levels in Adolescents

The supplementation tablet program is conducted according to the Guidelines for Providing Blood Supplement Tablets for Rheumatism and WUS. This supplementation activity is a specific intervention aimed at reducing stunting by preventing anemia in adolescents. Supplementation involves all teenagers consuming Fe tablets. Additionally, there are several other programs, such as consuming balanced nutritious food (Fill My Plate), consuming enough fruits and

vegetables, regularly consuming one blood supplement tablet every week, maintaining cleanliness, engaging in regular physical activity, and periodically checking hemoglobin levels [17]. The government program related to periodic Fe tablet supplementation has been proven to increase hemoglobin levels in adolescents, as shown by our research results, which indicated an increase in the average hemoglobin level from 12.4614 in the pre-test group to 13.8386 in the post-test group.

The successful implementation of Fe supplementation to increase Hb levels can be attributed to the assistance provided during the program, which increased adolescent compliance in consuming Fe tablets. Previous research conducted in Bantul, Yogyakarta, compared assistance in consuming Fe pills by teachers and peers. The results showed that compliance was better in the group accompanied by teachers compared to peers. This also affected hemoglobin levels, with the teacher-accompanied group having higher hemoglobin levels compared to the peer-accompanied group [10]. This aligns with our research, where assistance provided by researchers for 12 weeks increased adolescents' compliance in consuming iron tablets, thus increasing hemoglobin levels.

CONCLUSION

Based on the research results, it can be concluded that providing assistance to teenagers through Directly Observed Therapy by administering Fe tablets for 12 weeks significantly increases hemoglobin levels in teenagers. The role of companions in implementing DOT is crucial for the successful implementation of government programs to prevent anemia using Fe supplementation. This role can be fulfilled not only by health workers but also by parents, teachers, cadres, or peers to increase adherence to consuming Fe tablets.

ACKNOWLEDGEMENTS

We would like to express our deepest gratitude to Universitas Muhammadiyah Lamongan, Indonesia, whose support made this research possible. We also thank our colleagues at Universitas Muhammadiyah Lamongan, Indonesia, who provided valuable insights and expertise that greatly assisted the research. Special thanks go to my team for their guidance and encouragement throughout the study. We are also grateful to the participants who took part in this research and shared their time and experiences. Lastly, we would like to acknowledge the unwavering support of our families, without whom this work would not have been possible.

REFERENCES

- [1] Abuga, K. M., Nairz, M., MacLennan, C. A., & Atkinson, S. H. (2023). Severe anaemia, iron deficiency, and susceptibility to invasive bacterial infections. *Wellcome Open Research*, 8. <https://doi.org/10.12688/WELLCOMEOPENRES.18829.1>
- [2] Akalu, A. G. B., Wolde, H. F., Desyibelew, H. D., Derseh, B. T., & Takele, W. W. (2020). Anemia and determinants among severely malnourished children admitted to Amhara Regional Referral Hospitals, Northwest Ethiopia. *Open Journal of Nutritional and Food Sciences*, 2(1), 36–41.
- [3] Alshwaiyat, N., Ahmad, A., Wan Hassan, W. M. R., & Al-jamal, H. (2021). Association between obesity and iron deficiency (Review). *Experimental and Therapeutic Medicine*, 22(5), 1–7. <https://doi.org/10.3892/etm.2021.10703>
- [4] Annan, R. A., et al. (2021). Factors associated with iron deficiency anaemia among pregnant teenagers in Ashanti Region, Ghana: A hospital-based prospective cohort study. *PLoS One*, 16(4). <https://doi.org/10.1371/JOURNAL.PONE.0250246>
- [5] Best, O., & Ban, S. (2021). Adolescence: Physical changes and neurological development. *British Journal of Nursing*, 30(5), 272–275. <https://doi.org/10.12968/BJON.2021.30.5.272>
- [6] Binoy, R., & Acharya, N. (2017). Impact of anemia on menstruation and academic performance of adolescent girls attending secondary schools of Rural Wardha District. *World Journal of Anemia*, 1(1), 1–4. <https://doi.org/10.5005/jp-journals-10065-0001>
- [7] Budiarti, A., Anik, S., & Wirani, N. P. G. (2021). Studi fenomenologi penyebab anemia pada remaja di Surabaya. *Jurnal Kesehatan Mesencephalon*, 6(2). <https://doi.org/10.36053/mesencephalon.v6i2.246>
- [8] Dinas Kesehatan Provinsi Jawa Timur. (2018). Profil Kesehatan Jawa Timur 2018. Retrieved from https://www.google.com/search?client=firefox-b-d&ei=zxpWXtieKq6c4-EPzvSfyAs&q=profil+kesehatan+jawa+timur+2018&oq=profil+kesehatan+jawa+timur+2018&gs_l=psy-ab.3..0i7i30i10.98332.105008..105951...0.4..0.1459.7810.2-1j0j2j2j3.....0....1..gws-wiz.....0i
- [9] Elder, L., & Ransom, E. (2024). Nutrition of women and adolescent girls: Why it matters. Retrieved July 3, 2024, from <https://www.prb.org/resources/nutrition-of-women-and-adolescent-girls-why-it-matters/>
- [10] Garfein, R. S., et al. (2018). Tuberculosis treatment monitoring by video directly observed therapy in 5 health districts, California, USA. *Emerging Infectious Diseases*, 24(10), 1806–1815. <https://doi.org/10.3201/EID2410.180459>
- [11] Hamed, M., et al. (2024). Prevalence of overweight/obesity associated with anemia among female medical students at Umm Al-Qura University in Makkah, Saudi Arabia: A cross-sectional study. *Cureus*, 16(3). <https://doi.org/10.7759/CUREUS.57081>
- [12] Hamrani, S. S. T., Permatasari, D., & Murti, S. A. (2020). Faktor yang mempengaruhi kepatuhan minum tablet Fe pada remaja. *Jurnal Penelitian Perawat Profesional*, 2(4), 579–590.

- [13] Hoque, K. E., Hoque, K. F., & Thanabalan, R. A. P. (2018). Relationships between parents' academic backgrounds and incomes and building students' healthy eating habits. *PeerJ*, 2018(5), 1–19. <https://doi.org/10.7717/peerj.4563>
- [14] Kementerian Kesehatan RI. (2018). *Pedoman Pencegahan dan Penanggulangan Anemia Pada Remaja Putri dan Wanita Usia Subur (WUS)*.
- [15] Kothari, M. T., Coile, A., Huestis, A., Pullum, T., Garrett, D., & Engmann, C. (2019). Exploring associations between water, sanitation, and anemia through 47 nationally representative demographic and health surveys. *Annals of the New York Academy of Sciences*, 1450(1), 249. <https://doi.org/10.1111/NYAS.14109>
- [16] Kounnavong, S., Vonglokham, M., Kounnavong, T., Kwadwo, D. D., & Essink, D. R. (2020). Anaemia among adolescents: Assessing a public health concern in Lao PDR. *Global Health Action*, 13(Suppl 2). <https://doi.org/10.1080/16549716.2020.1786997>
- [17] Meilani, N., & Setiyawati, N. (2023). Directly observed treatment for iron tablet supplements consumption among female senior high school students. *Kemas*, 18(3), 375–382. <https://doi.org/10.15294/kemas.v18i3.38594>
- [18] Peng, Y. Y., & Uprichard, J. (2016). Ferritin and iron studies in anaemia and chronic disease. *Annals of Clinical Biochemistry*, 54(1), 43–48. <https://doi.org/10.1177/0004563216675185>
- [19] Riskesdas. (2018). *Laporan Nasional 2018, Badan Penelitian dan Pengembangan Kesehatan Departemen Kesehatan*.
- [20] Runiari, N., & Hartati, N. N. (2020). Pengetahuan dengan kepatuhan minum tablet tambah darah pada remaja putri. *Jurnal Gema Keperawatan*, 13(2), 103–110. <https://doi.org/10.33992/jgk.v13i2.1321>
- [21] Soliman, A., De Sanctis, V., & Kalra, S. (2014). Anemia and growth. *Indian Journal of Endocrinology and Metabolism*, 18(Suppl 1), S1. <https://doi.org/10.4103/2230-8210.145038>
- [22] Sumarmi, S., Puspitasari, N., Handajani, R., & Wirjatmadi, B. (2016). Underweight as a risk factor for iron depletion and iron-deficient erythropoiesis among young women in rural areas of East Java, Indonesia. *Malaysian Journal of Nutrition*, 22(2), 219–232.
- [23] Teni, M., Shiferaw, S., & Asefa, F. (2017). Anemia and its relationship with academic performance among adolescent school girls in Kebena District, Southwest Ethiopia. *Biotechnology and Health Sciences*, 4(1). <https://doi.org/10.5812/BHS.13431>
- [24] Uzunov, A. V., et al. (2022). Mode of delivery and neonatal outcome in adolescent pregnancy (13–16 years old) associated with anemia. *Medicina*, 58(12), 1796. <https://doi.org/10.3390/MEDICINA58121796>
- [25] World Health Organization. (2017). *Nutritional Anaemias: Tools for Effective Prevention*.
- [26] World Health Organization. (2018). *WHO Recommendations On Adolescent Sexual and Reproductive Health and Rights*.
- [27] World Health Organization. (2024). Adolescent health. Retrieved July 1, 2024, from https://www.who.int/health-topics/adolescent-health#tab=tab_1
- [28] World Health Organization. (2024). Anaemia in women and children. Retrieved July 2, 2024, from https://www.who.int/data/gho/data/themes/topics/anaemia_in_women_and_children
- [29] World Health Organization. (2024). Anaemia. Retrieved July 2, 2024, from <https://www.who.int/news-room/fact-sheets/detail/anaemia>
- [30] World Health Organization. (2024). Anemia - What is anemia? | NHLBI, NIH. Retrieved July 1, 2024, from <https://www.nhlbi.nih.gov/health/anemia>