



Dietary fiber, hemoglobyn and the correlation to senior high school students age girls

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ABSTRACT

The high fiber content in fruits and vegetables can affect the absorption of nutrients in the body. Both have an important role in preventing and overcoming anemia because they contain high nutrients such as folate and can increase hemoglobyn levels. The purpose of this study was to determine the relationship between fiber intake and hemoglobyn levels in female students of Madrasah Aliyah Negeri Asahan, Kota Kisaran Timur District, Asahan Regency. The research method was conducted quantitatively with a cross-sectional approach. The sample consisted of 45 female students selected by simple random sampling. The fiber intake cut-off was 29 grams, corresponds to the recommended fiber intake for adolescents. The results of the analysis using the fisher exact test showed a p-value of 0.107 which showed no correlation between fiber intake and hemoglobyn levels in MAN Asahan female students. Although statistically there is no positive correlation between fiber intake and hemoglobyn levels, low daily fiber consumption will affect the process of removing food waste from the intestine and if excessive consumption will also excessive fiber can interfere with the absorption of vitamins and minerals, including iron needed in the formation of hemoglobyn. It is recommended for schools to collaborate with health institutions to check students' hemoglobyn regularly and provide a healthy canteen as a means for schools to provide healthy, high-fiber and nutritionally balanced food.

Keyword: Fiber Intake, Hemoglobyn , Anemia

1. Introduction

Adolescence is a critical period in an individual's life, marked by many physical and emotional changes. This period is often considered vulnerable because adolescents are susceptible to various health risks, including nutritional problems. One of the main nutritional problems often experienced by adolescents is anemia, with adolescent girls being ten times more at risk than adolescent boys (Ariani et al, 2023).

The prevalence of anemia in Indonesia, which reaches 48.9% in adolescents aged 15-24 years, has continued to increase significantly in the last 11 years from 37.1% in 2013 to 32% in 2018 (Riskesdas, 2018). Based on data from the Ministry of Health of the Republic of Indonesia, the prevalence reached 27.7% (Kemenkes RI, 2021). Meanwhile, in North Sumatra, the prevalence of anemia in men was 20.35%, which was lower than the prevalence of anemia in women, which was 27.2% (Riskesdas Sumut, 2018).

A decrease in hemoglobyn levels can cause symptoms of anemia. Low hemoglobyn levels can have negative effects on health, such as the body becoming easily tired because the blood cannot carry oxygen throughout the body effectively (Andini & Dwi, 2022). In addition, adolescent girls who have low hemoglobyn and are indicated to have anemia may experience cognitive development disorders. Anemia causes a lack of oxygen to the brain, which affects the elasticity of neurons, causing disturbances in neurotransmitter function. This can reduce sensitivity to nerve receptors, resulting in the loss of these receptors. The impact is on the intelligence, concentration, and comprehension (memory) of students, thereby affecting their academic performance (Indrawatiningsih et al., 2021; Taufiq et al., 2020).

Consuming high fiber can maintain the digestive system and prevent constipation, but consuming less than 40 grams of fiber per day can reduce the absorption of important minerals such as iron, zinc, and calcium (Wandasari, 2022). The main causes of iron deficiency anemia are insufficient iron intake in the daily diet, impaired iron absorption by the body due to the presence of inhibitors such as tannins, phytates, oxalates, and a lack of substances that can increase iron absorption such as vitamin C. In addition, insufficient protein intake can also be a contributing factor (Sugiso et al., 2021; Wandasari, 2022).

Vegetables and fruits are one of the main sources of dietary fiber for the community. Both play an important role in preventing and overcoming anemia because they contain a lot of iron, folate, and vitamin C, which are necessary for the formation of red blood cells. If adolescent girls or people with anemia do not consume enough vegetables and fruits, they are likely to experience worsening anemia, declining health, cognitive impairment, an increased risk of other diseases, and a longer recovery time (Saraswati, 2021). Based on observations of vegetable and fruit consumption among students, the researcher wanted to conduct a study on the relationship between fiber intake and hemoglobin levels in adolescent girls (students at MAN Asahan, East Kisaran District, Asahan Regency).

2. Method

The research location was determined based on data and priority issues at the Gambir Baru Community Health Center in East Kisaran District, where MAN Asahan ranked first in the category of anemia risk among adolescent girls, with 96 female students at risk of anemia. This study used a descriptive analytical observational approach with a cross-sectional approach, where independent and dependent variables were measured at the same time. The research location was at MAN Asahan with a sample size of 45 people, consisting of 10th and 11th grade female students.

The sampling method used probability sampling by simple random sampling, as well as inclusion and exclusion criteria to control the validity of the data obtained. The inclusion criteria used included being 15-16 years old, being in grades X and XI, and being willing to have their blood sampled to test the hemoglobin level in the blood, where blood sampling was carried out by authorized health personnel from the local health center. Meanwhile, the exclusion criteria used were respondents who were menstruating, had blood disorders or abnormalities, and suffered from infectious diseases that could be transmitted through blood during the examination. Ethical clearance was also obtained before the data collection process was carried out to ensure that the research process did not violate the rights of the respondents involved.

Research permission was also obtained directly from the head of the madrasah by bringing supporting research files and instruments to be used in the data collection process, such as informed consent forms, SQ-FFQ questionnaires, and hemoglobin level measuring devices to be used in blood sampling. At this stage, it was also conveyed that during the blood sampling process, the researchers were assisted by midwives from the community health center in the school area.

Hemoglobin levels were categorized as normal if hemoglobin was >12 g/dl, and abnormal if hemoglobin was <12 g/dl. Meanwhile, fiber intake was considered adequate if the measured fiber consumption was in accordance with the requirement of at least 29 g/day, and considered insufficient if the measured fiber consumption was not in accordance with the requirement of <29 g/day.

The level of fiber intake among respondents was obtained from interviews using a semi-quantitative FFQ to determine habits by asking about the frequency of consumption of certain foods or food groups. The data was then processed using Nutrisurvey and categorized according to the 2019 Indonesian Ministry of Health regulation on Nutrient Adequacy Rates (AKG). According to these guidelines, fiber intake is considered insufficient if it is <29 g/day (Fayasari, 2020). Thus, this was done to determine the adequacy of fiber in the respondents' diets. After data collection was completed, the data obtained will be presented systematically to facilitate understanding and analysis.

3. Results

From the data collection process, information was obtained that the fiber consumption level based on the Semi Food Frequency Questionnaire (SQ-FFQ) of 45 respondents showed that the majority of respondents did not consume enough fiber, with 39 students (86.7%) recorded as having a history of fiber consumption lower than the recommended daily requirement and only 6 students consuming fiber in accordance with their daily nutritional adequacy. In addition, only 35.6% of respondents had normal hemoglobin levels (>12 g/dl), namely 16 female students.

The respondents' eating patterns showed that their daily consumption consisted of staple foods, vegetable side dishes, vegetables, fruits, and snacks. The most frequently consumed staple foods were rice and noodles, with varying portions and a frequency of 2-3 meals per day. The most popular vegetable side dishes were

tempeh and tofu, which were usually prepared in various ways, such as fried or in a chili sauce. The relatively high frequency of eating and variety of food portions indicate that the respondents had a relatively stable and varied diet. However, it should be noted that a varied diet does not always mean that fiber intake is sufficient, so further analysis is needed to determine the daily fiber adequacy status.

The variety of vegetables and fruits consumed by respondents shows that the most commonly consumed vegetables are spinach, kale, cabbage, cucumber, and cassava leaves. Meanwhile, the fruits that are often consumed are avocados, pineapples, pears, apples, papayas, Ambon bananas, oranges, mangoes, and rambutans. Respondents tend to process fruit into juice and add sugar. In addition, the most frequently consumed snacks are fried foods, meatballs, snack puffs, wafers, and candy. However, the portions of fruit and vegetables consumed by respondents are smaller than recommended.

The relationship between fiber intake and hemoglobin levels in female students at MAN Asahan can be seen in the table below:

Table 1. Relationship between Fiber Intake and Hemoglobin Levels

		Hemoglobyn				Total		P Value
		Under		Normal				
		n	%	n	%	n	%	
Fiber Intake	Not Adequate (<29 gram)	27	69,2	12	30,8	39	100	0,107
	Adequate (≥ 29 gram)	2	33,3	4	66,7	6	100	
Total		29	64,4	16	35,6	45	100	

A bivariate analysis was conducted to determine the relationship between fiber intake and hemoglobin levels using Fisher's Exact test. From the statistical analysis, a p-value of 0.107 was obtained. When compared to an α value of 0.05, it can be concluded that there is no significant relationship between fiber intake and hemoglobin levels. The results of this study are in line with previous studies which stated that fiber intake is not correlated with hemoglobin levels (Mahmud., 2013). The insignificant results of the analysis may be due to the inhibitory effect of fiber which inhibits the absorption of iron from food consumed (Abbaspour et al., 2014).

4. Discussion

Fiber is a type of carbohydrate that cannot be digested by the body, and is found in plant cell walls after undergoing enzymatic hydrolysis. Fiber cannot be digested by the human digestive tract, but it has a positive effect in preventing disease and keeping the body healthy. Fiber is generally divided into water-soluble fiber and water-insoluble fiber, both of which have benefits for the digestive system. Water-soluble fiber can help increase iron absorption in the body.

Iron plays a role in the synthesis of hemoglobin in red blood cells, which function to transport oxygen from the lungs to body tissues to be secreted into the respiratory system. If iron intake is insufficient, hemoglobin synthesis will decrease, resulting in low hemoglobin levels. Hemoglobin levels can be affected by dietary intake, including protein, iron, and fiber intake. Hemoglobin levels are a parameter used to determine anemia status. The function of hemoglobin is to bind oxygen (O_2) in red blood cells. If the amount of hemoglobin is lower than normal, it may indicate that the oxygen level in the blood is also low, which can ultimately lead to anemia.

Fiber is an important nutrient for digestion and metabolism. However, people with anemia/low hemoglobin levels need to be more careful in consuming fiber so that their anemia symptoms do not worsen. Marsono, said that people with anemia have iron deficiency in their bodies. On the other hand, fiber has the property of inhibiting Fe absorption in the body. Although excess fiber can have a negative impact on people with anemia, this does not mean that people with anemia should avoid fiber. People with anemia can still consume fiber as long as the fiber intake does not exceed the body's daily requirements. Fiber is a non-nutritive component that must always be considered in daily meals. Fiber deficiency can cause disturbances in the process of removing food waste from the intestines. However, excessive fiber consumption can reduce the absorption of vitamins and minerals, which will lead to impaired iron absorption.

A high-fiber diet has positive effects on health, such as lowering cholesterol levels in the duodenum and blood vessels. The binding of bile acids by dietary fiber, which is the end result of cholesterol metabolism, will reduce the amounts of fatty acids in the duodenum and blood vessels. However, on the other hand, a high-

fiber diet also has negative effects on health, namely reducing the availability of minerals. The binding of Fe minerals by dietary fiber is the main cause of decreased Fe mineral absorption, which can affect hemoglobin formation in the blood. Decreased iron absorption can affect hemoglobin formation in the blood. Consuming low-fiber foods can increase organic substances such as bile acids and cholesterol in the blood, which can cause coronary heart disease and increase appetite, leading to obesity or weight gain. Stools become hard, causing constipation. Consuming more than 40 grams of fiber per day can also reduce iron absorption, which can affect hemoglobin formation.

Red blood cells are used for 120 days in the body before they are eventually destroyed in the liver and new blood cells are produced in the spinal cord. Therefore, consuming a high-fiber diet will be effective if done for four months, ensuring that fiber intake is met every day. Insufficient consumption of fruits and vegetables can lead to low fiber intake. One of the causes of low fiber consumption is the habit of eating snacks. Consuming vegetables and fruits is essential to achieve optimal health. Vegetables and fruits are sources of phytochemicals, vitamins, minerals, antioxidants, and natural fiber. The largest component of fruits is water. Therefore, the fiber content in fruits is lower. The largest components of fiber in fruits are pectin and lignin compounds. The fiber content in vegetables is higher than in fruits. The fiber content in vegetables ranges from 2-3g/100g. Most vegetable fiber is water-soluble, so consuming fiber in the form of fresh vegetables is more efficient than consuming dietary fiber in processed vegetables.

To maintain healthy hemoglobin levels, it is recommended to consume foods rich in fiber and iron, such as red meat, liver, green vegetables (spinach, broccoli), nuts, and fruits. Some foods and beverages, such as milk, coffee, tea, and carbonated drinks, can inhibit iron absorption. It is best to avoid excessive consumption of these foods when eating iron-rich foods.

From a cultural perspective, the habit of drinking tea and coffee with meals is one phenomenon that may help explain this condition. The tannins in tea can bind to iron in food. Tannins are polyphenolic compounds that can react with various substances, including iron. When tannins meet iron, they form a complex that is insoluble in water and cannot be absorbed properly by the body, thereby reducing the availability of iron for hemoglobin formation. So when tea is drunk at mealtimes, iron malabsorption by the body occurs. The iron needed by the body to form new red blood cells cannot be obtained, resulting in the failure of red blood cell formation. If this habit continues and becomes a daily eating behavior, it will increase the risk of anemia.

Based on direct interviews with respondents, most respondents are still accustomed to drinking tea after meals. This habit can trigger nutritional absorption disorders in the body, resulting in suboptimal absorption of fiber and iron in the body, which then leads to low hemoglobin levels. Previous studies have proven that there is a relationship between tea consumption with meals and the incidence of anemia in adolescents, with results showing that adolescents who consume tea are 3.259 times more likely to experience anemia than adolescents who do not consume tea after meals. Iron absorption is greatly influenced by the combination of foods absorbed at certain mealtimes. There needs to be a break between eating and drinking tea (Ikhtiyaruddin et al., 2020).

Fiber helps the absorption of nutrients much better, because adequate fiber consumption will help maintain digestive health, increase energy, and maintain focus, and if done regularly, will contribute to improved performance. Fiber helps keep the intestines healthy and functioning optimally, so that the absorption of important nutrients needed by the brain in the learning process will be optimal. A healthy and well-functioning brain is very important for learning, problem solving, and creativity. Therefore, by meeting daily fiber requirements, physical health can be improved and ultimately contribute to improved performance and learning processes.

5. Conclusion

Based on the research conducted, there is no significant relationship between fiber intake and hemoglobin levels in female students at MAN Asahan. The majority of respondents consume less than 29 grams of fiber per day and have low hemoglobin levels (<12 grams/dl). Statistically, low fiber consumption does not appear to affect hemoglobin levels, but consuming fiber in accordance with daily recommendations will have an impact on the absorption of vitamins and minerals, including iron. It is recommended that schools collaborate with health institutions to conduct regular hemoglobin checks on students and provide healthy canteens as a means for schools to provide healthy, high-fiber, and nutritionally balanced meals. It is highly recommended to revive school-based nutrition and health education programs led by the School Health Unit (UKS), so that efforts and information aimed at increasing fiber consumption to meet nutritional needs can be realized and monitored directly to positively impact student performance and health status.

Bibliography

- Abbaspour, N., Hurrell, R., & Kelishadi, R. (2014). Review On Iron And Its Importance For Human Health. *Journal of Research in Medical Sciences*, 19(2), 164–174. <https://pmc.ncbi.nlm.nih.gov/articles/PMC3999603/>
- Verediano, T.A., Agarwal, N., Gomes, M.J.C., Martino, H. S. D., & Tako, E. (2022). Effects Of Dietary Fiber On Intestinal Iron Absorption, And Physiological Status: A Systematic Review of In Vivo And Clinical Studies. *Critical Reviews in Food Science and Nutrition*, 63(27), 9017–9032. <https://doi.org/10.1080/10408398.2022.2060933>
- Almatsier, S. (2005). Prinsip Dasar Ilmu Gizi. PT Gramedia Pustaka Utama.
- Almatsier, S. (2007). Penuntun Diet. PT Gramedia Pustaka Utama.
- Andini, N. O., & Dwi, E. D. (2022). Gambaran Faktor Risiko Kadar Hemoglobin Rendah Pada Calon Pendoron Di UDD PMI Kabupaten Gunungkidul Tahun 2022. *Skripsi*, Universitas Jenderal Achmad Yani Yogyakarta.
- Ariani, A., Wijayanti, D., Yuliantini, A., Nurfitri, R., Mulyana, A., & Ermilda, E. (2023). Edukasi Gaya Hidup, Pola Jajan Sehat Dan Pemberian Jus ABC (*Apple Bit Carrot*) Untuk Pencegahan Anemia Pada Remaja Putri. *Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM)*, 6(4), 1462–1474. <https://doi.org/10.33024/jkpm.v6i4.8970>
- Fayasari, A. (2020). Penilaian konsumsi pangan. Kun Fayakun.
- Hardinsyah, & Supariasa, I. D. N. (2016). *Ilmu gizi: Teori dan aplikasi*. EGC.
- He, Y., Wang, B., Wen, L., Wang, F., Yu, H., Chen, D., Su, X., & Zhang, C. (2022). Effects Of Dietary Fiber On Human Health. *Food Science and Human Wellness*, 11(1), 1–10. <https://doi.org/10.1016/j.fshw.2021.07.001>
- Ikhtiyaruddin, Alamsyah, A., Mitra, & Setyaningsih, A. (2020). Determinants Of Anemia Occurrence In Female Students At SMAN 1 Teluk Belengkong, Indragiri Hilir Regency In 2019. *Jurnal Kesehatan Komunitas*, 6(1), 56–62. <https://doi.org/10.25311/keskom.Vol6.Iss1.527>
- Indrawatiningsih, Y., Hamid, S. A., Sari, E. P., & Listiono, H. (2021). Faktor-Faktor Yang Mempengaruhi Terjadinya Anemia Pada Remaja Putri. *Jurnal Ilmiah Universitas Batanghari Jambi*, 21(1), 331. <https://doi.org/10.33087/jiubj.v21i1.1116>
- Kementerian Kesehatan Republik Indonesia. (2021). *Profil Kesehatan Indonesia 2020*. Kemenkes RI
- Li, Y., et al. (2022). The Prebiotic Effects Of Soluble Dietary Fiber Mixture On Renal Anemia And The Gut Microbiota In End-Stage Renal Disease Patients On Maintenance Hemodialysis: A Prospective, Randomized, Placebo-Controlled Study. *Journal of Translational Medicine*, 20, Article 599. <https://doi.org/10.1186/s12967-022-03812-x>
- Mahan, L K., Escott-Stump, S. (2011). *Krause's food & the nutrition care process (13th ed.)*. Saunders.
- Norris, S. A., et al. (2022). Nutrition In Adolescent Growth And Development. *The Lancet*, 399(10320), 172–184.
- Riskesdas Sumatera Utara. (2018). *Riset Kesehatan Dasar Sumatera Utara 2018*. Kemenker RI
- Saraswati, P. M. I. (2021). Hubungan Kadar Hemoglobin (Hb) Dengan Prestasi Pada Siswa Menengah Atas (SMA) Atau Sederajat. *Jurnal Medika Hutama*, 2(4), 1187–1191. <https://www.jurnalmedikahutama.com/index.php/JMH/article/view/246>
- Sugiso, AP., Darmalaksana, W., Solihin, M., & Setiadji, S. (2021). Takhrij And Syarah Hadith Of Chemical: Prohibition Of Blowing Food And Drinks. *Gunung Djati Conference Series*, 5, 42–48.
- Taufiq, Z., Ekawidnyani, K. R., & Sari, T. P. (2020). *Aku Sehat Tanpa Anemia: Buku Saku Anemia Untuk Remaja Putri*. CV. Wonderland Family Publisher.
- Wandasari, D. Y. (2022). Faktor-Faktor Yang Mempengaruhi Kejadian Anemia Pada Remaja Putri Di Wilayah Kerja Puskesmas Wonosalam 1. *Skripsi*, Universitas Islam Sultan Agung Semarang.
- Yang, H., et al. (2022). Effects Of Dietary Fiber On Human Health. *Food Science and Human Wellness*, Volume 11, Issue 1, 2022, Pages 1-10, ISSN 2213-4530, <https://doi.org/10.1016/j.fshw.2021.07.001>