THE EFFECT OF TAPETO PATTY (TOFU, TEMPEH, TOMATO) CONSUMPTION ON HEMOGLOBIN LEVEL IMPROVEMENT IN ADOLESCENT GIRLS

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ABSTRACT

Background:Adolescence is a critical phase in growth and development, especially for adolescent girls who begin preparing for reproductive functions. Anemia remains a major health issue among adolescent girls in Deli Serdang Regency, with a prevalence reaching 71% in rural areas. One of the causes is low intake of nutrients, including iron and supporting vitamins. Objective : This study aims to determine the effectiveness of administering TAPETO fritters (Tofu, Tempeh, Tomato) in increasing hemoglobin (Hb) levels in adolescent girls. Methode: This study used a quantitative method with a pre-experimental one-group pretest-posttest design without a control group. Samples were selected using purposive sampling, and the intervention was carried out by providing TAPETO fritters for 21 consecutive days. Hb levels were measured five times: once before, three times during, and once after the intervention. Result : Statistical analysis showed a p-value of 0.000 < 0.05, indicating that the administration of TAPETO fritters significantly increased Hb levels in adolescent girls in Sei Baharu Village (Ha accepted and Ho rejected). Conclusion : The provision of TAPETO shows potential as a healthy and nutritious food alternative to increase Hb levels. This study is expected to produce an innovative food product for anemia management.

Keywords: Adolescent Girls, Hemoglobin, Tofu, Tempeh, Tomato

ABSTRAK

Latar Belakang : Masa remaja merupakan fase penting dalam pertumbuhan dan perkembangan, terutama bagi remaja puteri yang mulai mempersiapkan diri untuk fungsi reproduksi. Anemia masih menjadi masalah kesehatan utama pada remaja puteri di Kabupaten Deli Serdang, dengan prevalensi mencapai 71% di daerah pedesaan. Salah satu penyebabnya adalah ren dahnya asupan zat gizi, termasuk zat besi dan vitamin pendukung. Tujuan : Penelitian ini bertujuan untuk mengetahui efektivitas pemberian perkedel TAPETO (Tahu, Tempe, Tomat) dalam meningkatkan kadar hemoglobin (Hb) pada remaja puteri. Metode : Penelitian ini menggunakan metode kuantitatif dengan desain pre-eksperimental one group pretest-posttest tanpa kelompok kontrol. Sampel dipilih menggunakan teknik purposive sampling, dan intervensi dilakukan dengan pemberian perkedel TAPETO selama 21 hari berturut-turut. Pengukuran kadar Hb dilakukan lima kali: satu kali sebelum, tiga kali selama, dan satu kali setelah intervensi. Hasil : Dari hasil uji statistic didapatkan bahwa nilai p-value 0,000 < 0,05 sehingga ada pengaruh pemberian perkedel Tahu Tempe dan Tomat (TaPeTo) terhadap Peningkatan Kadar Hb pada Remaja Puteri di Desa Sei Baharu (Ha diterima dan Ho ditolak). Kesimpulan : Pemberian TAPETO menunjukkan potensi sebagai alternatif makanan sehat dan bergizi untuk meningkatkan kadar Hb. Penelitian ini diharapkan menghasilkan produk pangan inovatif dalam penanganan anemia.

Kata Kunci : Hemoglobin, Remaja Puteri, Tahu, Tempe, Tomat, ,.

INTRODUCTION

Adolescence is an important transitional phase from childhood to adulthood, characterized by physical growth, emotional development, and the maturation of reproductive organs. During this phase, adolescents, especially girls, begin to prepare their bodies for future reproductive functions. Therefore, adolescence is a crucial period for establishing a foundation of good reproductive health, including efforts to prevent stunting in the next generation.

Stunting is a condition of impaired growth in children caused by chronic malnutrition, particularly during the first 1,000 days of life, from pregnancy until the child reaches two years of age. Stunting not only results in shorter stature than the age standard but also affects brain development,

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learning ability, and increases the risk of degenerative diseases later in life (Djauhari, 2017).

According to the 2022 Indonesian Nutritional Status Survey (SSGI), the prevalence of stunting in Indonesia remains high at 21.6%, although it has decreased compared to the previous year. The government aims to reduce this prevalence to 14% by 2024 (Mukodi and Rahmawati 2023). To achieve this target, prevention efforts cannot focus solely on pregnant women and children but need to begin earlier, during adolescence.

Based on the 2018 Riskesdas data, approximately 32% of Indonesian adolescent girls suffer from anemia, which is one of the main risk factors for stunting in children. Inadequate intake of iron, protein, and other essential micronutrients significantly affects adolescents' bodily readiness for healthy pregnancy in the future (Setyaningrum et al., 2023)

Anemia is a global health problem that must be addressed in developing countries such as Indonesia. It is estimated that about one-third of the world's population suffers from anemia. The prevalence of anemia in Indonesia is very high. Data from the Indonesian Ministry of Health (2018) shows that the prevalence of anemia among adolescents aged 15 to 24 years is 32%, which means that out of every 10 adolescents, 3 to 4 suffer from anemia. The percentage of anemia is higher in females (27.2%) than in males (20.3%). Adolescent girls are one of the most vulnerable population groups to anemia (Ristanti & Fatimah, 2023).

Anemia and stunting also have significant social and economic impacts. Children who experience stunting tend to have lower work productivity in adulthood and an increased risk of chronic diseases, leading to a heavy financial burden on families and the country's healthcare system (Black et al., 2008). Therefore, the prevention of anemia and stunting is an important investment in the development of Indonesia's human resources (Patimah, 2021).

Anemia among adolescent girls in North Sumatra (Sumut) is a significant health problem and contributes to the high stunting rates in the province. Data show that approximately 25% of adolescent girls in Sumut suffer from anemia, totaling around 322,000 individuals out of a population of 1,329,920 adolescent girls aged 10–19 years (Us & Safitri, 2023).

Adolescents often pay little attention to a balanced diet. The habit of consuming arbitrary foods such as fast food, high-sugar items, and foods low in essential nutrients can lead to deficiencies in iron, vitamin B12, or folic acid, all of which are crucial for the formation of red blood cells (Imani, 2020).

The issue of anemia among adolescents needs to be addressed promptly. Several measures can increase hemoglobin levels in the blood, including pharmacological and non-pharmacological approaches. Pharmacological therapy, according to the decisions and regulations of the Ministry of Health, recommends that adolescents and women of reproductive age consume iron supplement tablets containing 60 mg of FeSO4 and 0.400 mg of folic acid once a week, and daily during menstruation (Mayasari et al., 2021).

Meanwhile, non-pharmacological therapy that adolescents can undertake includes consuming animal-based foods, fruits, vegetables, tofu, and tempeh. All of these ingredients can be made into juices, puddings, or other appealing food preparations that adolescents enjoy, such as fritters.

TaPeTo Fritters (Tofu, Tempeh, Tomato) are a healthy innovation of traditional dishes that are not only delicious but also highly nutritious. The combination of tofu, which is rich in plant-based protein, and tomato, which contains vitamin C and iron, makes these fritters a popular food choice, especially for adolescent girls who need a balanced intake of nutrients during their growth period.

Adolescents' eating patterns are greatly influenced by family environment and local culture. The availability of nutritious food, eating habits, and parental support in regulating consumption patterns play a crucial role in determining adolescents' nutritional status (Indriyani n.d.). In the context of Indonesia, the culture of consuming high-calorie, low-nutrient fast food poses a particular challenge in achieving healthy eating patterns among adolescents(Pamelia 2018).

Currently, many adolescents are still unaware of the importance of maintaining hemoglobin (Hb) levels in the body. Hemoglobin is an essential protein in red blood cells responsible for transporting oxygen throughout the body (Sari et al., 2022). Low hemoglobin levels, commonly known as anemia, can cause symptoms such as fatigue, weakness, difficulty concentrating, and decreased immunity. This condition frequently occurs in adolescents, especially adolescent girls, due to unbalanced diets, unhealthy eating habits, and lack of knowledge about nutrition (Marselina et al., 2022).

According to interviews conducted in Seibaharu Village, many adolescents are still unaware that there are various food preparations that can naturally help increase hemoglobin levels. Ingredients such as chicken liver, spinach, red meat,

nuts, and fruits like beets and dates are rich in iron and vitamin C, which helps improve iron absorption

The Indonesian government has issued various policies and programs to address anemia and stunting, such as iron supplement tablets for adolescent girls, nutrition education campaigns, and school-based supplementary feeding programs (Ministry of Health of the Republic of Indonesia, 2022). However, the success of these programs largely depends on the awareness and active participation of the community, especially adolescents and their families (Mardhiah 2024)

RESEARCH METHODS

This study is quantitative research using a pre-experimental one-group pretest-posttest design without a control group (Kuantitatif, 2016). The research location is in Sei Baharu Village. The sample in this study consisted of adolescent girls, selected using purposive sampling technique. The intervention involved providing processed foods made from mashed tofu, tempeh, and tomatoes for 21 consecutive days to the intervention group, while no treatment was given to the control group. Hemoglobin levels of the adolescents were measured in five stages: before and after the intervention, three times during the intervention process, and once the day after the intervention was completed. Data analysis was conducted using analysis of variance (ANOVA) with a significance level of 95% (0.05).

RESULTS AND DISCUSSION

Normality Test

Table 1
Normality Test Using Shapiro-Wilk for Pretest and Posttest Hemoglobin Levels in Adolescent Girls in Sei Baharu Village

Group	statistic	Df	Sig
Hemoglobin Pre-Test	0.904	21	0.042
Hemoglobin Post-Test	0.945	21	0.275

Based on Table 1, it is known that the degrees of freedom (df) before and after being given the Tahu Tempe and Tomato (TaPeTo) fritters are 21 respondents, meaning there are fewer than 50 respondents. Therefore, the normality test technique used is the Shapiro-Wilk test. Based on the normality test using Shapiro-Wilk, the significance value for the pre-test is 0.042 < 0.05, and for the post-test is 0.275 > 0.05, which means the data is not normally distributed.

After conducting the normality test using the Shapiro-Wilk method, it was found that the pre-test data were not normally distributed (sig = 0.042 < 0.05), whereas the post-test data were normally distributed (sig = 0.275 > 0.05). Therefore, the subsequent analysis used a non-parametric statistical test. This is because the non-normal distribution of the pre-test data requires a testing approach that does not rely on the assumption of normality, so the Wilcoxon Signed Rank test was chosen to compare the changes in hemoglobin levels before and after the intervention with TaPeTo fritters.

The use of the Wilcoxon test allows for an accurate evaluation of whether there is a significant difference in the hemoglobin levels of respondents after consuming TaPeTo fritters. Thus, the statistical test results will provide a valid representation of the effectiveness of the intervention in improving hemoglobin status among adolescent girls

Table 2
Wilcoxon Test Results Based on the Effect of Giving Tahu Tempe and Tomato Fritters (TaPeTo) on Increasing Hemoglobin Levels in Adolescent Girls in Sei Baharu Village.

Variable		N	P-value
Hemoglobin Pre-Test – Hemoglobin Post-Test	Negative Ranks	0	0,000
	Positive Ranks	21	
	Ties	0	

Based on Table 2, it shows that there were 21 adolescent girl respondents. After the intervention of giving Tahu Tempe and Tomato fritters (TaPeTo) for 21 days, the Wilcoxon test results obtained a p-value of 0.000 < 0.05. This indicates that there is an effect of giving TaPeTo fritters on increasing hemoglobin levels in adolescent girls in Sei Baharu Village (Ha is accepted and Ho is rejected).

The Wilcoxon test results showed that among the 21 adolescent girl respondents who participated in the intervention of giving Tahu Tempe and Tomato fritters (TaPeTo) for 21 days, there was a significant change in hemoglobin (Hb) levels. The obtained p-value of 0.000 < 0.05 indicates that the difference in Hb levels before and after the intervention is statistically significant. This means that the administration of TaPeTo fritters has a positive effect on increasing Hb levels in adolescent girls in Sei Baharu Village.

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DISCUSSION

Based on Table 2, it shows that there is a significant effect on the increase in hemoglobin levels in adolescent girls before and after being given Tahu Tempe and Tomato fritters (TaPeTo) for 21 days, with a p-value of 0.000 < α 0.05. The study results indicate that the administration of TaPeTo fritters during the intervention period had a significant impact on increasing hemoglobin (Hb) levels in adolescent girls. This suggests that foods based on local ingredients such as tofu, tempeh, and tomato can be an effective alternative in addressing iron deficiency anemia, especially among adolescents.

Theoretically, iron deficiency anemia occurs when iron intake is insufficient to meet the body's needs for the production of hemoglobin and red blood cells. Iron is the main component of hemoglobin, which functions to transport oxygen throughout the body's tissues. (Azhara, 2023). Iron deficiency can lead to a decrease in hemoglobin production, resulting in anemia. (DeMaeyer et al., 1989). Adolescent girls are a vulnerable group due to rapid growth and blood loss during menstruation, which increases their iron requirements (Aabdien et al., 2022)

Vitamin C is known to play an important role in enhancing the absorption of non-heme iron, which is commonly found in plant-based sources such as tofu and tempeh. Vitamin C converts non-heme iron into a form that is more easily absorbed by the small intestine, Therefore, the combination of plant-based iron sources and vitamin C can theoretically increase the bioavailability of iron and support the process of hematopoiesis, which is the formation of new red blood cells in the bone marrow(Cook & Monsen, 1977).

In addition, the plant-based protein in tofu and tempeh also provides essential amino acids needed for the synthesis of hemoglobin and tissue repair. (Gibson, 2005). Thus, the simultaneous consumption of foods containing iron, vitamin C, and protein can have a synergistic effect that accelerates the recovery of hemoglobin status in individuals with mild anemia. TaPeTo fritters contain non-heme iron from tofu and tempeh, as well as vitamin C from tomatoes. Vitamin C is known to significantly enhance the absorption of non-heme iron in the digestive tract (Cook & Monsen, 1977). This combination generates a nutritional synergy that facilitates the process of hematopoiesis (the formation of red blood cells), thereby explaining the observed increase in hemoglobin (Hb) levels within the intervention group. Furthermore, the high content of plant-based protein found in tempeh and tofu contributes to tissue repair and the regeneration of blood cells (Boye et al., 2010).

In the context of public health, nutrition interventions based on local foods like this align with the principles of Food-Based Approaches (FBA), which promote the utilization of local resources and diverse food consumption as strategies for preventing malnutrition (WHO, 2016) (Silalahi et al., 2020). This approach is considered more sustainable and socially acceptable compared to pharmacological supplementation, especially in areas with limited access to healthcare services.

An improvement in hemoglobin levels was observed after the administration of TaPeTo. This indicates that simple food-based interventions like this can effectively address mild micronutrient deficiencies without the need for pharmacological supplements, which often cause gastrointestinal side effects such as nausea or constipation.

An improvement in hemoglobin levels was observed after the administration of TaPeTo. This indicates that simple food-based interventions like this can effectively address mild micronutrient deficiencies without the need for pharmacological supplements, which often cause gastrointestinal side effects such as nausea or constipation (Cahyaningtyas & Estri, 2017). This reinforces the finding that local foods can be creatively processed into functional foods like TaPeTo. Another factor supporting the success of the intervention is the high level of food acceptance by the respondents. TaPeTo has a pleasant taste and a form familiar to adolescents' eating habits, such as fried snacks or daily side dishes. Compliance with consumption was also high because the adolescents enjoyed it and did not feel like they were taking medicine. This becomes a strength in the approach to adolescents compared to the administration of iron tablets, which are often not taken regularly.

Besides the food provision, the success of this intervention was also influenced by support from the surrounding environment, such as schools and parents. Nutrition education provided before and during the intervention increased adolescents' awareness of the importance of iron and how to obtain it from food (Nugraheni, 2024). These changes in attitudes and knowledge also supported the regular and consistent consumption of TaPeTo.

This study confirms that nutrition interventions based on local foods can be an effective and affordable non-pharmacological alternative to prevent and address anemia. Compared to iron supplements, which require medical supervision and special distribution, foods

like TaPeTo are easier to integrate into daily diets without significant risk of side effects.

Although the results are positive, it should be noted that hemoglobin levels can also be influenced by other factors such as overall nutritional status, menstrual history, physical activity, and infections. This study has not thoroughly controlled for all of these variables (Organization, 2024). Therefore, although TaPeTo contributes to the increase in Hb levels, a comprehensive approach is still needed in efforts to tackle anemia in adolescents.

The approach of providing food based on local ingredients, such as TaPeTo fritters, also aligns with the theory of meeting nutritional needs through a balanced diet. The Balanced Nutrition Pyramid model emphasizes the consumption of a variety of foods to fulfill macro- and micronutrient requirements, including iron and vitamin C. (Kodyat, 2014). By combining tofu and tempeh as sources of protein and non-heme iron, along with tomatoes rich in vitamin C, this intervention supports that principle and maximizes iron absorption through nutritional synergy.

Based on the discussion results, the provision of TaPeTo fritters can be incorporated into nutrition programs at schools or community health centers. This effort can also be extended with training on how to make TaPeTo for parents or health workers. Local governments can promote this dish as part of a campaign to prevent anemia in adolescents, emphasizing local wisdom, affordability, and effectiveness.

In addition to having a positive impact on increasing hemoglobin levels, the intervention of providing TaPeTo fritters also has the potential to offer long-term benefits for the reproductive health of adolescent girls. With improved nutritional status and optimal Hb levels, adolescents become better physically prepared for future pregnancies (Organization, 2012). This is crucial for reducing the risk of pregnancy complications and preventing stunting in infants, in line with the concept of the 1,000-day nutrition intervention that emphasizes maternal health starting from adolescence.

To strengthen the obtained results, further research with a larger sample size and a longer intervention duration is highly recommended. Additionally, such studies should consider other factors that may affect Hb levels, such as menstrual patterns, infection status, and physical activity of the respondents. This more comprehensive approach will provide a more valid picture of the effectiveness of TaPeTo fritter consumption under various conditions.

CONCLUSION

Based on the research results, it was found that there is a significant effect on the increase in hemoglobin levels of adolescent girls before and after being given TaPeTo fritters, with a p-value of $0.000 < \alpha\ 0.05$.

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