Giving of Cakalang Fish Nuggets (*Katsuwomus Pelamis)* to Increase of Hemoglobin (Hb) Levels in Adolescents Princess

Nita A. Momongan, Henry S.Imbar, Grace K.L.Langi, Olga L.Paruntu, Jufri Sineke, Ana B. Montol, Muksin Pasambuna, Rudolf B. Purba, Nanda Agustina

Politeknik Kesehatan Kemenkes Manado
kllge@yahoo.com

Abstract. Iron deficiency anemia is the most common problem in women. Even though iron is needed for the formation of red blood cells, iron is lost during menstruation. This study aims to determine the effect of giving skipjack tuna nuggets with the addition of Moringa leaves on increasing hemoglobin intake and levels in adolescent girls. This research is a quasi-experimental design research, 40 samples using the Slovin formula and random sampling method. Data collection used 24 hour recall, organoleptic test questionnaires, while the difference in hemoglobin levels before and after the intervention, used the Paired Sample t-Test. The results of the research showed that there were no differences in taste, aroma and texture in formula 1 and formula 2 but there were differences in the color of formulas 1 and 2. Treatment in the form of giving skipjack tuna nuggets with Moringa leaves could increase hemoglobin levels in young women. With the highest increase in hemoglobin levels of 0.6-1.1 g/dL. It was concluded that Moringa leaf skipjack tuna nuggets are beneficial for young women to help meet the nutritional needs of energy, protein and iron so it is recommended to be given and become a habitual eating pattern.

Keywords: Moringa Leaf, Cakalang Fish Nuggets, Hemoglobin Levels, Nutrient Intake.

1 Introduction

One of the nutritional problems that often occurs during adolescence is nutritional anemia, especially in adolescent girls, which is known as iron nutritional anemia or more commonly referred to as anemia. Iron is needed for the formation of red blood cells, is converted into hemoglobin, circulated in tissues throughout the body, and acts as an oxygen carrier [1]. Hemoglobin is an iron-rich protein which functions as a transporter of oxygen from the lungs to the rest of the body[2]. Meanwhile, iron deficiency anemia is anemia that occurs due to a lack of iron in the blood, namely a reduction in the concentration of hemoglobin in the blood due to disruption of the formation of red blood cells[3]. Lack of protein intake can also cause iron transport to be hampered, resulting in iron deficiency, known as anemia. To meet the need for hemo-

T. Triwiyanto et al. (eds.), *Proceedings of the 6th International Conference of Health Polytechnic Surabaya (ICoHPS 2023)*, Advances in Health Sciences Research 72,
https://doi.org/10.2991/978-94-6463-324-5_26

globin formation, it is obtained through food [4][5].

Young children, pregnant women, and women commonly experience anemia, a debilitating condition characterized by poor cognitive and physical development and associated with an increased risk of child and maternal mortality. WHO predictions, globally more than 42% of children under 5 years of age and 40% of pregnant women experience anemia [6][7]. Similarly, one third of women (33%) of reproductive age 15 years to 49 years suffer from anemia worldwide and anemia affects up to 51.3% of women of reproductive age in India. Although the National Nutritional Anemia Prophylaxis Program (NNAP) which provides folic acid and iron supplements to the target population of pregnant women was launched in 1970 but 50 years later, the prevalence rate of anemia in women of childbearing age (15–49 years) has increased very high in India. Therefore, anemia is an important challenging condition for public health with significant consequences for human health, social development and economic growth[8].

According to research by [9], 8 factors related to the incidence of anemia in adolescent girls are knowledge of adolescent girls, parental income, nutritional status and menstruation with the incidence of anemia. Adolescent girls have a higher risk of developing anemia than adolescent boys due to the loss of iron during menstruation. Some of the direct impacts that occur in young women suffering from anemia are frequent complaints of dizziness and dizziness in their eyes[10]. Apart from that, teenagers also engage in higher levels of physical activity than other ages. due to accelerated physical, sexual growth, psychological maturity and changes in behavior resulting in a transformation from child to adult and energy needs increase[11]. To be able to meet these standards, more nutrients are needed, such as: Energy, Protein, Fat, Carbohydrates and Fe (Iron).

In young women, total iron requirements are high due to menstruation and growth. Age, equivalent to more than half a billion women aged 15-49 years (WHO, 2019 & Mengistu, G., Azage, M., & Gutema, H, 2019)[4]. The incidence rate in Indonesia is based on Riskesdas data in 2018, the prevalence of anemia in teenagers was 32%, meaning that 3-4 out of 10 teenagers suffer from anemia, this is influenced by suboptimal nutritional intake habits and lack of physical activity.

The Ministry of Health has carried out special interventions by providing Blood Supplement Tablets (TTD) to young women and pregnant women[7]. Based on the 2018 National Riskesdas Report, for the province of North Sulawesi the provision of iron supplement tablets to adolescent girls aged 10-19 years obtained in the last 12 months from health facilities was around 23.5%. Meanwhile, in Manado City, among young women aged 10-19 years, around 2.38% of young women have received blood supplement tablets from health facilities.

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[12]. The incidence rate in Indonesia is still quite high. Based on 2018 riskesdas data, the prevalence of anemia in teenagers is 32%, meaning that 3-4 out of 10 teenagers suffer from anemia. This is influenced by suboptimal nutritional intake habits and lack of physical activity. The Ministry of Health has carried out specific interventions by administering Blood Supplement Tablets (TTD) to adolescent girls and pregnant women.

According to the 2018 National Riskesdas Report, for the province of North Sulawesi the provision of blood supplement tablets to adolescent girls aged 10-19 years obtained in the last 12 months from health facilities was around 23.5%. Meanwhile, for Manado City, for young women aged 10-19 years, around 2.38% of young women have received blood supplement tablets from health facilities.

In general, adolescents' nutritional needs are relatively large because they are still growing. Adolescent girls have a higher risk of experiencing anemia than adolescent boys. The increased need for iron is mainly due to iron loss during menstruation. Apart from that, teenagers also engage in higher levels of physical activity than other ages. To be able to meet these standards, more nutrients are needed, such as: Energy, Protein, Fat, carbohydrates and Fe (Iron). Factors that need to be considered for the intake needs of teenagers are physical activity and growth, so that energy needs increase[13]. According to[14], factors related to the incidence of anemia in adolescent girls are knowledge of adolescent girls, parental income, nutritional status and menstruation with the incidence of anemia.

In preventing anemia in teenagers, giving skipjack fish nugget products with the addition of Moringa leaves can be an alternative for increasing hemoglobin and preventing anemia. The function of adding Moringa leaves is to increase the nutritional content of the nuggets[15]. The Moringa plant in North Sulawesi Province is a treasure apart from gedi leaves and is often found in Manado City. Moringa leaves are a source of food which has excellent nutritional content and has a high antioxidant content and is useful for increasing the body's immunity. Moringa leaves are high in iron, protein and vitamin C.

Moringa plants have an important role in preventing metabolic diseases and several infectious diseases because they have the potential to be the main source of several nutrients and therapeutic elements, including anti-inflammatory, antibiotic and stimulating the immune system[16]. That the iron and protein content is high enough so that it has the potential for supplementation therapy in children. Malnourished children with the special features of Moringa leaves, in the City of Manado a one-tree Moringa tree house program is being held.

Meanwhile, skipjack tuna is an active fish in the scomridae family. Skipjack tuna is also a mainstay product of North Sulawesi Province which has high economic value. This is because skipjack tuna is widely used as raw material for making skipjack fufu, wooden fish, fish floss, and canned fish[17]. Based on the Indonesian Food Composition Table, 100 grams of skipjack tuna contains 107 kcal of energy, 19.6 g of protein, 0.7 g of fat and 2.9 mg of Fe[18].

SMP Negeri 2 Manado is one of the junior high schools located in Manado City, Paal 2 District. This school has more female students than male students. In this school there are also many sellers of junk food, snacks (cilok and happy food) which many students like and cause them to rarely have breakfast before going to school. Unhealthy eating habits, such as skipping breakfast, snacking on low-nutrient foods and ready-to-eat foods, in the long term will cause anemia and decreased performance.

2 Materials and Method

The type of research used was a quasi-experimental and used a pretest-posttest research design. This research was conducted at Manado 2 Public Middle School, Paal 2 sub-district, Manado City and was carried out on February 2 – February 17 2023. The population in this study were all grade 8 junior high school students Negeri 2 Manado, totaling 61 female students. In determining the size of the sample in this study using the Slovin formula, so that the sample in this study was 38 female students. The sampling technique used inclusion and exclusion criteria, did not consume vitamins or blood-boosting supplements, was not menstruating, and had no history of chronic disease/infection. Data collection was carried out using questionnaires and observations. Data on nutrient intake (Energy, Protein and Iron (Fe)) were obtained by means of a 2x24 hour food recall and examination of hemoglobin levels was obtained by using the Easy Touch GCHB tool using the POCT (Point of care testing) method. Data analysis used univariate and bivariate analysis using the Paired Sample t-Test. The data in this study are presented in tabular form and in the form of text or narrative. This research has obtained ethical approval from the Health Research Ethics Commission, Poltekkes Kemenkes Manado with number: KEPK 01/06/070/2023.

3 Results

The results of the research on hemoglobin levels before and after the intervention of giving cakalang fish nuggets added with Moringa leaves can be seen in Table 1.

Table 1. Hemoglobin Before and Hemoglobin Intake After

Treatment	
N	40
Mean Pre-test Hb	16,615
Mean Post-test Hb	17,085
Sig. (2-tailed)	0,000

The results of the Paired Sample t-Test correlation test in Table 1 showed that there were significant differences in hemoglobin levels in respondents with a Sig. (2-tailed) of 0.000 <0.05. The results of the Hb measurements show that there has been an increase in terms of the average Hb, which is 16.615 g/dL at the initial measurement and 17.085 g/dL at the final measurement.

The results of the research on increasing energy intake before and after the intervention of giving cakalang tuna nuggets added with Moringa leaves can be seen in Table 2.

Table 2. Energy Before and Energy Intake After

Treatment	
N	40
Mean Pre-test intake energy	1.368
Mean Post-test intake energy	1.556
Sig. (2-tailed)	0,000

Table 2 showed that the results of the Paired Sample t-Test correlation test show that there are significant differences in energy intake in respondents with a Sig. (2-tailed) of 0.000 <0.05. The results of the 24-hour recall of iron intake before and after the intervention showed that there was an increase seen from the average iron intake, namely 1,368 kcal at the initial recall and 1,556 kcal at the end of the recall.

Table 3 illustrates the results of the study on increasing protein intake before and after the intervention of giving cakalang fish nuggets added with Moringa leaves.

Table 3. Protein Before and Protein Intake After

Treatment	
N	40
Mean Pre-test intake Protein	49,450
Mean Post-test intake Protein	67,470
Sig. (2-tailed)	0,000

The results of the Paired Sample t-Test correlation test in table 3 showed that there were significant differences in protein intake in respondents with a Sig. (2-tailed) of 0.000 <0.05. The results of the 24-hour recall of iron intake before and after the intervention showed that there was an increase seen from the average iron intake, namely 49.450 gr at the initial recall and 67.470 g at the end of the recall.

Table 4 illustrates the results of the study on increasing intake of iron (Fe) before and after the intervention of giving cakalang fish nuggets added with Moringa leaves.

Table 4. Iron Before and Iron Intake After

Treatment	
N	40
Mean Pre-test intake Besi (Fe)	5,252

Mean Post-test intake Besi (Fe)	13,795
Sig. (2-tailed)	0,000

The results of the correlation test of the Paired Sample t-Test in Table 4 showed that there were significant differences in iron (Fe) intake in respondents with a Sig. (2-tailed) of 0.000 <0.05. The results of the 24-hour recall of iron intake before and after the intervention showed that there was an increase seen from the average iron intake of 5.252 mg at the initial recall and 13.795 mg at the end of the recall.

4 Discussion

Adolescent girls have a higher risk of developing anemia than male adoles-cents. Research from The increase in iron requirements is mainly due to iron loss during menstruation[19]. In addition, young women pay more attention to changes in body size and physical appearance so that their behavior or eating habits are often wrong, such as limiting food intake, especially animal foods which are sometimes seen as foods that contain high fat and can lead to obesity among poor woman or rich woman or urban[20][21]. Anemia occurs due to several factors, namely low food intake, infection, blood loss (menstruation and bleeding), metabolic disorders, social econo-my[1]. The results of a study that before consump-tion of Moringa Oliefera, most pregnant women experienced mild anemia. Mean-while, after consuming Moringa Oliefera, almost some did not experience anemia[2][22]. By consuming Moringa Oliefera regularly every day, it can increase the Hb level of pregnant women by 0.34 g/dL in the first week and increase the Hb level of pregnant women up to 0.96 g/dL in 14 days or 2 weeks after consuming Moringa Oliefera.

Energy consumption from food is necessary to cover the energy expenditure of a person if one has a body size and composition with levels of activity that are compati-ble with long-term health and that allow the maintenance of socially and economical-ly required physical activity[9][23]. If energy intake is lacking, energy formation will be taken from protein. There is a significant difference in energy intake in respond-ents with Sig. (2-tailed) of 0.000 <0.05. The results of the 24-hour recall of iron intake before and after the intervention showed that there was an increase seen from the average iron intake, namely 1,368 kcal at the initial recall and 1,556 kcal at the end of the recall.

These results are also in line with research conducted by Affonfere, M., et al[13] and Boateng, L., Nyarko, R., Asante, M., & Steiner-Asiedu, M[24] that the potential of local food ingredients in the formulation of an iron-rich and acceptable comple-mentary food supplement. The result is that the energy intake in the treatment group before being given Moringa juice pudding was 876.2 kcal. Whereas after giving Moringa leaf pudding, the average energy intake of children increased to 1314.1 kcal.

Protein is one of the macronutrients that has an important role in the process of forming body tissues[3]. Protein helps form enzymes so that they can optimize the

function of every organ in the body. There is a significant difference in protein intake in respondents with Sig. (2-tailed) of 0.000 <0.05. The results of the 24-hour recall of iron intake before and after the intervention showed that there was an increase seen from the average iron intake, namely 49.450 gr at the initial recall and 67.470 g at the end of the recall.

These results are also in line with research conducted by Paruntu et al [25] [22] entitled fish nugget (yellow fin tuna) supplementation as an alternative to school lunch feeding, protein adequacy, improving nutritional status and cognitive function in malnourished students at elementary schools. Malalayang with the results of the statistical T-test comparison of protein nutrient intake showed that there was a very significant difference in the average protein intake before the intervention, namely 30.9800 ± 10.13307, protein intake after the intervention was 38.6000 ± 11.51752 where the value was $p < 0.05$ or $p = 0.000$.

5 Conclusion

From the treatment in the form of giving the cakalang fish nugget product, Moringa leaves, it can increase energy intake, iron and protein intake in young women. So it can be seen that giving nugget products once a day gets an energy distribution of 191.2 kcal or 9.3% of daily needs. Meanwhile, 5 mg of iron is given or 33% of the daily requirement and protein distribution is 12 grams or 18% of the daily requirement. In the first examination of 40 young female respondents, there were 38 people with normal Hb status and 2 people had mild anemia, so the researchers gave them Moringa leaf fish nuggets for consumption. After the intervention, 39 people had normal Hb status and 1 person still had mild anemia. Treatment in the form of giving moringa leaf nuggets from skipjack tuna can increase hemoglobin levels in young women. Hemoglobin levels in respondents who consumed Moringa leaf skipjack tuna nuggets experienced a significant increase. It is recommended that schools and older people be able to work together with health service centers (nearest health centers) especially in the field of nutrition to provide education about anemia, provide information about foods that contain nutrients, especially sources of iron and protein, good eating patterns to prevent anemia, and lifestyle habits. healthy and optimize the administration of blood supplement tablets.

Reference

1. Rramani, Q., Barakat, Y., Jacob, G., Ohla, K., Lim, S.X.L., Schicker, D., Freiherr, J., Saruco, E., Pleger, B., Weber, B., Schultz, J.: Nutrition claims influence expectations about food attributes, attenuate activity in reward-associated brain regions during tasting, but do not impact pleasantness. Brain Behav. 13, 1–20 (2023). https://doi.org/10.1002/brb3.2828.
2. Ndong, M., Uehara, M., Katsumata, S.I., Suzuki, K.: Effects of oral administration of Moringa oleifera Lam on glucose tolerance in Goto-Kakizaki and wistar rats. J. Clin. Biochem. Nutr. 40, 229–233 (2007). https://doi.org/10.3164/jcbn.40.229.

3. Mengistu, G., Azage, M., Gutema, H.: Iron Deficiency Anemia among In-School Adolescent Girls in Rural Area of Bahir Dar City Administration, North West Ethiopia. Anemia. 2019, 1–9 (2019). https://doi.org/10.1155/2019/1097547.
4. Gemechu, K., Asmerom, H., Gedefaw, L., Arkew, M., Bete, T., Adissu, W.: Anemia prevalence and associated factors among school-children of Kersa Woreda in eastern Ethiopia: A cross-sectional study. PLoS One. 18, 1–15 (2023). https://doi.org/10.1371/journal.pone.0283421.
5. Stevens, G.A., Finucane, M.M., De-Regil, L.M., Paciorek, C.J., Flaxman, S.R., Branca, F., Peña-Rosas, J.P., Bhutta, Z.A., Ezzati, M.: Global, regional, and national trends in haemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: A systematic analysis of population-representative data. Lancet Glob. Heal. 1, 16–25 (2013). https://doi.org/10.1016/S2214-109X(13)70001-9.
6. WHO: Adolescent Health at a Glance in South-East Asia Region,2007. 133 (2007).
7. F, D., T, A.: Factors Affecting Iron Absorption and Mitigation Mechanisms: A review. Int. J. Agric. Sci. Food Technol. 4, 024–030 (2018). https://doi.org/10.17352/2455-815x.000033.
8. Horton, S., Ross, J.: The economics of iron deficiency. Food Policy. 28, 51–75 (2003). https://doi.org/10.1016/S0306-9192(02)00070-2.
9. USAID: Multisectoral Anemia Partners Meeting Conceptual Frameworks for Anemia. Washingt. DC. 1–4 (2013).
10. Skachkov, D.A., Ukrainets, Y. V., Pilipenko, D.N., Obrushnikova, L.F., Sivko, A.N., Slozhenkina, M.I.: Expansion of the assortment of food: Development of new types of canned food. IOP Conf. Ser. Earth Environ. Sci. 981, (2022). https://doi.org/10.1088/1755-1315/981/2/022091.
11. McLean, E., Cogswell, M., Egli, I., Wojdyla, D., De Benoist, B.: Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993-2005. Public Health Nutr. 12, 444–454 (2009). https://doi.org/10.1017/S1368980008002401.
12. Young, M.F.: Maternal anaemia and risk of mortality: a call for action. Lancet Glob. Heal. 6, e479–e480 (2018). https://doi.org/10.1016/S2214-109X(18)30185-2.
13. Diana, P., Hikmah, N.: Factors Causing Anemia in Women of Reproductive Age. Int. Conf. Heal. Sci. Technol. 34–35 (2021).
14. Aziz Ali, S., Abbasi, Z., Feroz, A., Hambidge, K.M., Krebs, N.F., Westcott, J.E., Saleem, S.: Factors associated with anemia among women of the reproductive age group in Thatta district: Study protocol. Reprod. Health. 16, 1–9 (2019). https://doi.org/10.1186/s12978-019-0688-7.
15. Ginta, S.: Effectiveness of the Provision of Snakehead Fish Nuggets and Colored Fruit Extracts to Blood Protein (Total Protein, Albumin, HB) in PLHIV. J. Phys. Conf. Ser. 1665, (2020). https://doi.org/10.1088/1742-6596/1665/1/012026.
16. Villarruel-López, A., López-de la Mora, D.A., Vázquez-Paulino, O.D., Puebla-Mora, A.G., Torres-Vitela, M.R., Guerrero-Quiroz, L.A., Nuño, K.: Effect of Moringa oleifera consumption on diabetic rats. BMC Complement. Altern. Med. 18, 1–11 (2018). https://doi.org/10.1186/s12906-018-2180-2.
17. Islamy, R.A., Senas, P.: Effect of Adding Carrot Flour (Daucus carota L) to The Nutritional Value and Organoleptic Snakehead Fish Nuggets (Channa striata). J. Penelit. Pendidik. IPA. 9, 1705–1712 (2023). https://doi.org/10.29303/jppipa.v9i4.3270.
18. Kunnath, A.K., Mathew, S., Mothadaka, M.P., Rao, R.C.N.: Iron-Enriched Fish Powder Improved Haemoglobin Levels in Adolescent Girls of West Jaintia Hills District of Meghalaya, India. Biol. Trace Elem. Res. 200, 2017–2024 (2022). https://doi.org/10.1007/s12011-021-02820-0.

19. Desalegn, A., Mossie, A., Gedefaw, L.: Nutritional iron deficiency anemia: Magnitude and its predictors among school age children, southwest ethiopia: A community based cross-sectional study. PLoS One. 9, 1–13 (2014). https://doi.org/10.1371/journal.pone.0114059.
20. Henninger, M., Iacocca, M.O.: Technical Brief Screening and Interventions for Social Risk Factors : A Technical Brief to Support the U . S . Preventive Services Task. (2015).
21. Putri, A.R., Anwar, A., Chasanah, E., Fawzya, Y.N., Martosuyono, P., Nuryanto, Afifah, D.N.: Analysis of iron, calcium and zinc contents in formulated fish protein hydrolyzate (FPH) complementary feeding instant powder. Food Res. 4, 63–66 (2020). https://doi.org/10.26656/fr.2017.4(S3).S09.
22. Teshale, A.B., Tesema, G.A., Worku, M.G., Yeshaw, Y., Tessema, Z.T.: Anemia and its associated factors among women of reproductive age in eastern Africa: A multilevel mixed-effects generalized linear model. PLoS One. 15, 1–16 (2020). https://doi.org/10.1371/journal.pone.0238957.
23. Winpenny, E.M., van Sluijs, E.M.F., White, M., Klepp, K.I., Wold, B., Lien, N.: Changes in diet through adolescence and early adulthood: longitudinal trajectories and association with key life transitions. Int. J. Behav. Nutr. Phys. Act. 15, 86 (2018). https://doi.org/10.1186/s12966-018-0719-8.
24. Keats, E.C., Rappaport, A., Jain, R., Oh, C., Shah, S., Zulfiqar, A.: Diet and Eating Practices among Adolescent Girls Countries: a Systematic Review. Strength. Partnerships, Results, Innov. Nutr. Glob. Proj. 1–166 (2018).
25. Paruntu, O.L., Djendra, I.M.: Suplementasi Fish Nuget (Yellowfin Tuna) Sebagai Alternatif School Lunch Feeding, Kecukupan Protein, Peningkatan Status Gizi Dan Fungsi Kognitif Pada Siswa Gizi Kurang Di Sdn Malalayang. GIZIDO-Jurnal Ilm. Gizi. 4, 313–320 (2013).