Journal of Saintech Transfer (JST) Vol. III, No. 2, 2020 | 143-152

JST

Journal of Saintech Transfer

The Application of Providing Analysis Based on Durian Seeds to Improve Protein Intake and Hemoglobin Levels of School Children

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Abstract. School-age children are at high risk of anaemia, because of their low haemoglobin levels due to lack of iron intake. Anaemia causes pain and death, inhibits brain development, motor, mental, intelligence and physical growth, decreased physical abilities, pale faces which will reduce enthusiasm and learning achievement of school children. The purpose of this study was to determine the effect of giving lemuru fish sausage made from durian seeds on protein intake and haemoglobin levels in children with anaemia. This type of research is a quasi-experimental, namely the pre-test design and post-test experiment. Lemuru fish sausage made from durian seeds was given every day for 30 days to 30 school-age children in SD Negeri Jati Sari Lubuk pakam City, Deli Serdang Residence. Measurement of Haemoglobin and food consumption (energy, protein, vitamin C and iron) was carried out before and after the intervention. The results showed that most of the intake of energy, vitamin C and iron in school children was in the <100% category. The mean Haemoglobin before the intervention was 10.9 g / dl; after the intervention, the mean Haemoglobin was 12.1 g / dl. The mean increase in hemoglobin 1.2 g / dl was statistically significant (p-value = 0.000). It has been recommended to increase the time to intervene and use iron status indicators in other studies.

Keywords: Lemuru Fish Sausage, Haemoglobin, Anaemia

Abstrak. *Anak sekolah merupakan salah satu kelompok berisiko tinggi terhadap anemia, karena rendahnya kadar hemoglobin akibat kurangnya asupan zat besi. Anemia menyebabkan rasa sakit dan kematian, terhambatnya perkembangan otak, motorik, mental, kecerdasan dan pertumbuhan fisik, penurunan kemampuan fisik, wajah menjadi pucat yang akan menurunkan semangat dan prestasi belajar anak sekolah. Tujuan penelitian ini adalah untuk mengetahui pengaruh pemberian sosis ikan lemuru berbahan dasar biji durian terhadap Asupan Protein dan Kadar*

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Journal Homepage: https://talenta.usu.ac.id/jst

Hemoglobin Anak Anemia. Jenis penelitian ini adalah eksperimen semu, yaitu desain pre-test dan post-test experiment. Sosis ikan lemuru berbahan dasar biji durian diberikan setiap hari selama 30 hari kepada 30 anak usia sekolah yaitu di SD Negeri Jati Sari Kota Lubuk Pakam, Kabupaten Deli Serdang. Pengukuran hemoglobin, dan konsumsi pangan (Energi, Protein, Vitamin C dan Zat Besi) dilakukan sebelum dan sesudah intervensi. Hasil penelitian menunjukkan sebagian besar asupan energi, vitamin C dan zat besi pada anak sekolah termasuk dalam kategori <100%. Rata-rata hemoglobin sebelum intervensi 10,9 gr / dl, setelah intervensi rata-rata hemoglobin 12,1 gr / dl. Peningkatan rata-rata hemoglobin 1,2 g / dl secara statistik signifikan (nilai-p = 0,000). Direkomendasikan untuk menambah waktu intervensi dan menggunakan indikator status zat besi dalam penelitian lain.

***Kata Kunci**: Sosis Ikan Lemuru, Hemoglobin, Anemia*

Received June 30 2020 | Revised October 28 2020 | Accepted November 28 2020

1. Introduction

Primary school-age children, children aged 7-12 years, are an investment of a nation because they are the nation's next generation. The optimal development of school-age children depends on providing good quality and quantity of nutrition. The nutritional needs of school children are mostly used for tissue formation and maintenance activities. School-age children usually have a lot of energy-consuming play activities. However, there can be an imbalance between incoming and outgoing of their energy. As a result, the children become unhealthy with various unsatisfactory nutritional conditions, such as underweight, anaemia, iron, iodine, vitamin C deficiencies and others [1].

According to the World Health Organization (WHO), about 40% or more than 2 billion people in the world population suffers from anaemia, including school-age children. More than half of them suffer from iron deficiency anaemia [2]. Anaemia can impair immune mechanisms, and increase morbidity, leading to fatigue, decreased productivity, and a general sense of body discomfort [3]. Anaemia can interfere with physical growth, cognitive development, and school performance [4].

The prevalence of iron deficiency anaemia for school children in Indonesia is still relatively high. Apart from the behaviour and diet of familiar sources of iron, the problem of poverty which is generally also in rural and mountainous areas is a significant factor contributing to the high rate of iron nutrition anaemia [5]. The results of Riskesdas [6] show that iron nutrition anaemia in children 5-12 years is 29%, with a prevalence in rural areas of 31%.

SD Negeri Jati Luhur is one of the primary schools in Lubuk Pakam City, Deli Serdang Regency. Based on the situation analysis results, in this school found many children with iron deficiency anaemia. Therefore, in this community service activity, other food is provided to school children, namely supplementary food rich in iron. Additional foods that are given must be foods that the child likes, for example, sausages.

Sausages are processed product and very popular among a wide variety of consumers of all ages. According to Moehji [7], sausage is often consumed as snacks or box lunch by school-age children, and parents/aged. Sausage is made of several minced portions of meat and mixed with several seasonings or spices, then put into sausage casings. Good quality of flour as a binder is required to produce good quality of sausage. Binder in sausage serves to draw water, give a distinctive colour, shape solid texture, improve emulsion stability, reduce cook time, improve taste and slice trait [8]. In general, sausage is made from beef and chicken. But nowadays, fish sausages are developed. The kind of fish which often used are red snapper, mackerel, yellowtail fish, and catfish. The production of sausages in this activity is carried out using raw materials of lemuru fish meat, tapioca starch and durian seed flour as a binder, and extract of beetroots as a natural colourant. Sausage made from lemuru fish, tapioca starch, durian seed flour, and beetroot were useful for increasing children's blood haemoglobin levels, thereby reducing anaemia's risk.

Tapioca starch is a starch that originated from cassava that could be utilized as stabilizer and texture formation. The tapioca contains 20-27% amylose, similar to durian seeds starch (26.6%). Therefore, durian seeds starch could be combined with tapioca to be used as filler on sausage making. Durian seeds could be obtained from several areas that have the potential for durian fruit. The durian seeds become one of dormant waste or could not be utilized. It contains a lot of additional value. Therefore, this waste can be used accordingly and used relatively long through further processing into varying results [9].

Lemuru fish is a kind of Sardinella fish and exists in warm West Pacific Indo sea, including the Archipelago Sea. Lemuru fish is quite affordable compared to other sea fishes. Lemuru fish is also utilized as high nutrient foodstuffs, especially in overcoming multiple nutritional problems. But many people don't know and dislike Lemuru fish because it has many scales and side bones. Compared to other sea fish on the market, lemuru fish contain high protein (17,8%-20%) and essential fatty acids, especially Omega 3 [10].

Beet is one of the antioxidants that could be utilized as a natural dye because it contains betalain pigments. Beet also has a high vitamin and mineral content such as vitamin B, calcium, phosphor, and iron [11]. Beet can be used as a colouring in a food product such as sausage.

This community service activity aims to provide knowledge to parents of school-age children about food sources that can reduce anaemia in children. In this activity, durian seeds are also used, which are durian fruit waste that is often found in partner areas, so that it can increase the added value of durian fruit.

2. Methods

This community service activity was carried out at SD Negeri Jatiluhur, Lubuk Pakam City, Deli Serdang Regency. The target targets in this activity are 30 students and parents of 30 students who are the targets. The selection of the target children was made by purposive sampling. The selected school children are school children with Hb blood levels <12 g/dl. Before giving lemuru fish sausage, a food recall and measurement of the blood haemoglobin levels of the 30 students were carried out. All sample was administered anthelmintic in the form of pyrantel pamoat two days before giving lemuru fish sausage.

The activities carried out at this community service consist of 3 stages. Stage 1 is making the lemuru sausage; Stage 2 gives lemuru fish sausage to target students, and Stage 3 is measuring the child's haemoglobin level.

Stage 1: Making sausages from lemuru fish

The main composition of lemuru fish sausage based on durian seed flour is lemuru fish, durian seed flour, tapioca flour. Other essential ingredients added in the manufacture of lemuru fish sausage in this study are: durian seed flour, tapioca flour skim milk powder to add a savoury taste, vegetable oil to make the sausages soft and more delicious, beet extract as a colouring agent for lemuru fish sausage, pepper, nutmeg, garlic as a remover of fishy taste in fish and increase the taste of sausage.

Stage 2: Giving lemuru fish sausages to 30 students

Lemuru fish sausage was given to 30 target students every day for 30 days as much as one sausage weighing 100g. The team gave sausages, and each child had to consume sausages until they were finished and supervised by the team.

Phase 3 Measurement of blood haemoglobin levels

Measurement of children's blood haemoglobin levels was carried out after giving lemuru fish sausage. At this stage, a food recall and questionnaire were administered again. The food intake of protein, vitamin C, and iron is calculated since they are the main factor in increasing haemoglobin formation. Then, these substances will be analyzed with Hb level examination nutrisurvey program with cyanmethaemoglobin method.

3. Results and Discussion

3.1. The Characteristics of Target Students

Table 1 shows the target student characteristics, including gender and age. Based on Table 1, the target students were dominated by women (53%) with aged eight years old (63%).

Table 1. The target student characteristics

Variable	N	Percentage (%)
1. Gender		
a. Men	14	47
b. Women	16	53
2. Age		
a. 7 years old	6	20
b. 8 years old	19	63
c. 9 years old	5	17

3.2. Lemuru Fish Sausage

The sausages given to the target students were sausages made from lemuru fish meat, tapioca starch and durian seed flour as a binder, and beetroot extract as colouring, plus spices. The resulting lemuru fish sausage can be seen in Figure 1. The nutritional composition of sausage and its suitability with recommended daily allowance (RDA) can be seen in Table 2.

Table 2 shows that 100 g of lemuru fish sausage given still meets 18.4% and 10% of the RDA of energy and Fe. The test results of lemuru fish sausage's organoleptic value show that lemuru fish sausage has acceptable colour, taste, and texture with the very like category. The processing of lemuru fish sausage is a simple process. Student parents can do it in the household and raw materials that are readily available in the community.

Figure 1. Lemuru fish sausage with tapioca starch and durian seed flour

Table 2. Nutritional composition of lemuru fish sausage and recommended daily allowance (RDA) for 7-9 years old children

Nutritional Composition	Value	RDA[12]	%RDA
Energy (Kcal)	303.4	1650	18.4
Protein (g)	19.4	40	48.5
Vitamin C (mg)	0.5	45	1.1
Fe (mg)	1.0	10	10.0
Zinc (mg)	1.4	5	2.8

3.3. Giving Durian seeds starch-based Lemuru Fish Sausage

A 100 g of lemuru fish sausage contained energy of 303.4 kcal, a protein of 19.4 g, vitamin C of 0.5 mg, Fe of 1.0 mg, and zinc of 1.4 mg. The sausage was distributed every day to school children suffering from anaemia which is individually packaged in plastic, consumed in a day. The amount of sausage consumed is noted at compliance form control provided. Observation result shows that every child could consume sausage. Each of them eagerly waited for the sausage. The results from an interview with several children said that the sausage was delicious and savoury.

3.4. Energy, protein, vitamin C dan iron food intake

Before giving lemuru fish sausage as an intervention in overcoming the problem of anaemia in students, the food recall was conducted by 1x24 hours for two days. Then, after the intervention, food recall was conducted by 1x24 hours for one month. The food recall results for food intake (energy, protein, vitamin C, and iron) are shown in Table 2. Most of the distribution of the subject's intake consumption level was at a low level for every nutrient substance. Most of the category of school children intake was less than 100%. Energy, protein, vitamin C, and iron have an essential role in the formation of

Haemoglobin. Almatsier [13] said that iron and protein are the main elements for forming Haemoglobin. Other nutrients such as vitamin A, vitamin C, and vitamin B6 act as catalysator or enzyme at various formation haemoglobin levels and metabolism.

Table 2. Food recall for food intake

	N	Percentage (%)
1. Food Intake		
Before		
a. Good	1	3.3
b. Poor	29	96.7
After		
a. Good	8	27
b. Poor	22	73
2. Protein intake		
Before		
a. Good	7	50
b. Poor	23	50
After		
a. Good	15	23.3
b. Poor	15	76.7
3. Vitamin C intake		
Before		
a. Good	6	30
b. Poor	24	70
After		
a. Good	9	20
b. Poor	21	80
1. Fe intake		
Before		
a. Good	1	3.3
b. Poor	29	96.7
After		
a. Good	1	3.3
b. Poor	29	96.7

3.5. Haemoglobin Level

Haemoglobin level measurement was conducted in advance before intervention by giving lemuru fish sausage (Table 3). It was found that the lowest haemoglobin level was 7.3g/dL, and the highest level was 11.9g/dL, with an average of 10.9g/dL. After the intervention was given for 30 days, the Hb level increase with the lowest hemoglobin level was 9.0g/dL. The highest level was 14.4g/dL with the average growth of 1.2g/dL and a total average of 12.1g/dL. When viewed from measurement, after giving durian seeds starch-based lemuru fish sausage for 30 days, there was still 13 person (43.3%)

who have a haemoglobin level of <12g/dL (suffering from anaemia). Of these 13 persons, 12 were in mild anaemia, and 1 of them was in moderate anaemia.

Table 3. Haemoglobin level measurement results before and after an intervention

Measurement	Mean ± *1SD*	Minimum	Maximum	*p-value*
Hemoglobin level before (g/dL)	10.9 ± 0.9	7.3	10.9	0.000
Hemoglobin level after(g/dL)	12.1 ± 1.0	9.0	14.4	
Increase(g/dL)	1.2 ± 1.9			

3.6. Hemoglobin Level

This research reported that the average of Haemoglobin increased by 1.2g/dL after giving intervention for 30 days. The increase in haemoglobin level was statistically significant (p<0.000). From 30 school children suffering from anaemia, after the intervention, 100% of them had an increase in Hb levels. The significant increase in Hb level can reduce the prevalence of anaemia. Nutritional value from lemuru fish sausage was 19.4g which was meet 48.5% RDA of protein [12]. Protein is a nutrient substance needed by the human body, especially for building cells and tissues, enzymes, hormone, and maintaining body endurance.

According to Maesaroh [14], the protein consumption level has a strong connection with the haemoglobin level. Besides that, high animal protein foods have a lot of iron. Inside the body, iron is an ion which binds to protein molecule forming ferritin. This protein is referred to as Haemoglobin which transport oxygen inside erythrocytes. While inside tissues, oxygen-transporting protein is called myoglobin. Iron ion is transported inside blood plasma by transferrin and stored inside the liver as complex by ferritin.

The analysis shows that the zinc level inside sausage is relatively high, which is 1.4mg. Zinc could help prevent diseases and serve a role as enzyme cofactors superoxide dismutase. Zinc also plays a role inside protein synthesis, and arrangement of stem cells inside the immune system. Zinc is useful in child growth and development of infancy and childhood. Sausage has a relatively high zinc content because 100 g of sausage could fulfil almost 5% of zinc (Zn) intake for 7-9 age [14].

Haemoglobin level is an indicator of someone suffering from anaemia. Anaemia could happen due to bleeding, damage to red blood cells, and low production of red blood cells. The main factor of nutritional anaemia is insufficient iron consumption,

inadequate absorption of iron, and the dietary habit of high rice intake and low variation of the menu. Besides that, hookworm infestation could aggravate anaemia in certain areas, especially rural areas [14].

4. Conclusions

Giving lemuru fish sausage based on durian seed flour can increase school children's blood haemoglobin levels before the intervention 10.9 g/dL. After the intervention 12.1, g/dL or there is a significant increase ($p < 0.001$) of 1.2 g/dL. To maximize the effectiveness of giving sausages in increasing haemoglobin levels of school children, it is recommended that children consume food according to the recommended daily allowance.

References

[1] A.D. Sediaoetama, Ilmu Gizi untuk Mahasiswa dan Profesi [Nutrition Science for Students and Professions], Dian Rakyat, Jakarta, 1996.

[2] World Health Organization. The world prevalence of anaemia 1993-2005. WHO Global Database on Anemia. Geneva: World Health Organization. 2008.

[3] D. Bundy, "School health and nutrition: Policy and programs." *Food and Nutrition Bulletin*, vol. 26, pp. S186-S192. PMID: 16075568, 2004.

[4] G. Bobonis, E. Miguel, C. Puri-Sharma, "Anemia and school participation." *J Hum Resources*, vol. 41, no. 4, 2006, doi: 10.2307/40057287.

[5] G. Bekele, A. Wondimagegn, A. Yaregal, G. Lealem, "Anaemia and associated factors among school-age children in Filtu Town, Somali Region, Southeast Ethiopia." *BMC Hematol*, vol. 14, no. 7, pp. 9511-9528, 2014.

[6] Health Research and Development Agency Ministry of Health Republic, Indonesia 2018. Basic Health Research, 2018.

[7] S. Moehji, Ilmu Gizi 2 (Nutrition Science 2) Papas Sinar Sinarti, Jakarta, pp. 63-66, 2009.

[8] A.I. Prastini, S.B. Widjanarko, "Pembuatan sosis menggunakan gel porang (*Amorphophallus mueleri* Blume) sebagai bahan pengikat terhadap karakteristik sosis" [Production chicken sausage using porang gel as a binder to the characteristics of sausages], *Jurnal Pangan dan Agroindustri* vol. 3, no. 4, pp. 1503-1511, 2015.

[9] Wahyono, "Karakteristik edible film berbahan dasar kulit dan pati biji durian (*Durio sp*) untuk pengemasan buah strawberry" [Characteristics of edible film from durio (*Durio sp*) peel and seed starch for strawberry fruit packaging] Undergraduate Thesis Universitas Muhammadyah Surakarta, 2009.

[10] F. Arifan, D.K. Wikanta, "Optimasi produksi ikan lemuru (*Sardinella longiceps*) tinggi asam lemak omega-3 dengan proses fermentasi oleh bakteri asam laktat" [Production optimization of lemuru (*Sardinella longiceps*) fish with high content of omega-3 fatty acid through fermentation process by lactic acid bacteria] *Proceeding of National Seminar of Science and Technology*, Faculty of Engineering, University of Wahid Hasyim Semarang, vol. 15, pp. B15-B20, 2011.

[11] M.A.W. Setiawan, E.K. Nugroho, L.N. Lestario, "Ekstraksi betasianin dari kulit umbi bit (*Beta vulgaris*) sebagai pewarna alami" [Extraction of betacyanin from beet (*Beta vulgaris*) peel for natural dyes], *AGRIC*, vol. 27, no. 1, pp. 38-43, 2015.

[12] S. Almatsier,. Prinsip Dasar Ilmu Gizi. [Basic Principle of Nutrition Science] PT.Gramedia Pustaka Umum, 2004.

[13] Regulation of Ministry of Health Republic Indonesia No. 28 of 2019 about Recommended Daily Allowance for Indonesian Society.

[14] M. Maesaroh, "Tingkat konsumsi energi, protein dan zat besi, hubungannya dengan kadar Hb" [Consumption level of energy, protein and iron, Its relationship with Hb level]. Undegraduate Thesis of Department of Nutrition Science Faculty of Medicine Universitas Diponegoro, 2007.