The Development of Iron-Rich Snack Bar Form Catfish-Corn-Banana Called "LANGSA" as an Alternative to Combat Anemia

Dhamas Pratista[1], Siti Mutia Rahmawati [2],
[1,2] Nutirion Department, Politeknik Kesehatan Kemenkes Jakarta II, South Jakarta, Indonesia, 12120
Email: dhamas.pratista@gmail.com; sitimutia000@gmail.com[2],

ABSTRACT

Background: Anemia in adolescent girls is still one of the health problems in Indonesia. One of the causes of anemia in adolescent girls is iron deficiency. The use of catfish as a source of iron, corn, and Raja banana as a source of provitamin A are expected to be a snack in the form of a snack bar, as an alternative solution to treat anemia in adolescent girls.
Objectives: To determine the acceptability and nutritional value of "langsa" snack bar products made of catfish, corn and Raja banana as a snack for adolescent girls.
Methods: This study used an experimental design with a Completely Randomized Design (CRD) and 3 replications. The formula in this study was the ratio of catfish, corn, and Raja banana with 3 formulas, F1 (30%: 25%: 45%), F2 (40%: 30%: 30%), F3 (50%: 35%: 15%). Data collection tools use organoleptic test forms which are then processed descriptive and Friedman test analysis. Meanwhile, an analysis of nutritional content was carried out at the PT. Saraswanti Indo Genetech.
Results: Friedman test showed on significant difference in the level of color, taste, and acceptance level ($p < 0.05$). The snack bar product most preferable for adolescent girls as panelists were F1 (30%: 25%: 45%). The product has the criteria of yellowish-brown color, non-fishy aroma, not hard texture, and sweet taste. The results of the nutritional analysis of the selected product per serving (56g) were 191 kcal of energy, 6.5g protein, 3g fat, 36g carbohydrates, 3 mg iron, and 132 µg vitamin A.
Conclusions: The most preferred formula is the formula of catfish, corn, and Raja banana with a ratio of 30%: 25%: 45%. It is recommended to consume 2 servings of "langsa" snack bar products per day to meet the RDA for adolescent girls by 16% energy, 20% protein, 10% fat, 20% carbohydrates, 32% iron (Fe), and 44% vitamin A.
Keywords: anemia, snack bar, langsa, catfish, corn, raja banana.

INTRODUCTION

The Sustainable Development Goals (SDGs) are a reference for development efforts in global development until 2030 and consist of 17 very measurable goals. The second and third goals of the SDGs are to improve the nutrition of adolescent girls and reduce maternal and infant mortality. Nutritional problems that often occur in adolescent girls are micronutrient deficiencies, including iron deficiency causing anemia. If not treated, anemia in adolescent girls will continue into adulthood and contribute to maternal mortality, infant mortality, premature birth, and low birth weight.

Based on research by Ernawati, Sandjaja, and Soekatri (2013), stated that mothers who are anemic will give birth to children who have anemia, is also evidenced by the high prevalence of anemia in the young age group (0.5-0.9 years) of 54.7% in urban areas and 61.9% in rural areas. Until now, anemia still needs serious attention. Based on the results of Riskesdas (2013) shows the number of anemia in adolescent girls is 22.4% and in women of childbearing age by 17% and has an impact on the high number of anemia in pregnant women by 37.1% and increased in 2018 to 48.9% (Riskesdas, 2018)

One of the causes of anemia is a low iron intake, especially iron sources in animal foods that contain heme iron (Pasricha et al. 2021; Skolmowska and Głąbska 2019). One source of heme iron is catfish (*Clarias batrachus*) which yields abundance and is relatively more economical compared to other animal foods. Iron in catfish contains amino acids that have an important role in the reduction of Fe^{3+} and can be absorbed in the form of Fe^{2+} facilitating absorption in the intestine due to the presence of sulfhydryl groups and the content of cysteine and histidine (Wijiindyah, Anwar, and Susetyorini 2012). In addition to iron, vitamin A deficiency is known to aggravate anemia.

According to Thamin and Sharief (2020) stated that the increase in Hb levels in the Fe and vitamin A tablet groups was higher than the Fe and vitamin C tablet groups. Other studies have shown that taking iron and vitamin A in a row is more effective in preventing anemia than taking only iron (Cañete et al. 2017). There is clear evidence of an association between serum retinol, iron indicators, and vitamin A deficiency which is considered to be one of the causes of anemia (Jus'at et al. 2014). Vitamin A plays a role in regulating erythropoiesis, especially the synthesis of erythropoiesis in the kidneys, mobilizing iron from reserves to the transferrin circulation, increasing the body's resistance to infection, and increasing iron absorption in the intestine (Hurrell and Egli 2010).

Corn (*Zea mays*) and plantain (*Musa paradisiaca* L. *var sapientum*) are high sources of β-carotene which is a provitamin A in the body and is a source of energy. The Utilization of catfish as a source of iron and protein as well as corn and Raja banana as a source of provitamin A has the potential as functional food ingredients to become healthy food that is affordable for all social status groups.

Apart from staple foods, the availability of nutrients also comes from snacks. Currently, many people are choosing snacks produced by the food industry. The snack bar is one of the snacks or hunger delays that are liked by today's society because it is nutrient-dense and easy to consume when undergoing busy activities and durable to store (Syahwal and Dewi 2018). Therefore, the researcher wants to develop a snack bar product with the basic ingredients of catfish, corn, and Raja banana to make a snack bar that is high in iron and vitamin A for young women who have anemia.

RESEARCH METHODS

This research is an experimental study with a completely randomized design (CRD). The type of food used consisted of catfish flour, cornflour, and Raja banana flour with a ratio of each formula, namely F1 (30%: 25%: 45%), F2 (40%:

30%: 30%), F3 (50%: 30%): 35%: 15%) with each treatment performed 3 repetitions.

This research has been carried out at the Food Technology Laboratory, Department of Nutrition, Poltekkes Kemenkes Jakarta II in making snack bar products. Organoleptic tests to obtain products with the best formulas were carried out at the Taste Testing Laboratory, Department of Nutrition, Poltekkes Kemenkes Jakarta II.

The organoleptic test was carried out by semi-trained panelists, namely 30 adolescent girls. Organoleptic tests were carried out to determine the panelists' assessment of color, aroma, texture, taste, and acceptance level. The data from the organoleptic test were processed descriptively and statistically analyzed through the Friedman test to get the best formula.

The materials used are materials that are obtained by homemade or buying them. Homemade ingredients include catfish flour, cornflour, and Raja banana flour. While other ingredients are obtained by buying, namely Rice flour, margarine, honey, refined palm sugar. The tools used in making snack bars are knife, spoon, 60 mesh, and 80 mesh flour sieve, stove, digital scale, oven, basin, pan, socket, copper, mold, pan, and sieve. The distribution of formulas for each catfish flour, cornflour, and Raja banana flour can be seen in table 1.

Table 1. Snack bar formulas

Material	Formula (g)		
	F1	F2	F3
Catfish flour	30	40	50
Cornflour	25	30	35
Raja banana flour	45	30	15
Rice flour	30	30	30
Margarine	10	10	10
Honey	50	50	50
Refined palm sugar	20	20	20

PROCEDURE FOR MAKING "LANGSA" SNACK BAR

In the process of making the "langsa" snack bar, it is preceded by making catfish flour, cornflour, and Raja banana flour.

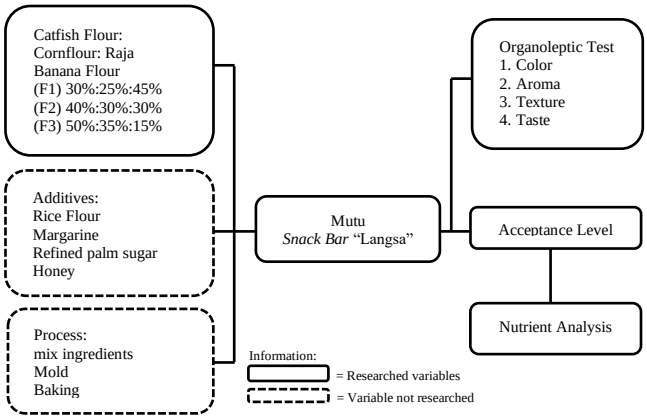
The process of making catfish flour: fresh catfish are cleaned of entrails, fins, and the tip of the head. Then given lime juice and 1 tablespoon salt and let stand for a moment. Then rinsed with running water and steam at 100ºC for 1 hour, remove and drain. Then the fillet of catfish and dried using an oven for 12 hours at a temperature of 50ºC. After drying, grind using a chopper until smooth and sieved using a 60 mesh sieve.

Corn flour manufacturing process: peeled and washed corn is shelled and dried at 50ºC for 3 hours. Then milling is carried out to separate the epidermis, institution, and endosperm. After that, it was ground again using a chopper and sieved using a 60 mesh sieve (Modified Research Andriani, Ansharullah, and Asyik 2018).

The process of making Raja banana flour: green Raja bananas are peeled from the skin, then blanching at 90ºC for 15 minutes to avoid sap. Then cut the bananas with a thickness of 1 cm, and then oven at a temperature of 60ºC for 12 hours. After drying, grind with a chopper until smooth and sieved using an 80 mesh sieve (Modified Research Nuroso 2012).

The process of making a "langsa" snack bar: weigh each catfish flour, cornflour, and Raja banana flour according to the predetermined concentration of the formula. Then add 30g of rice flour to each formula, then stir until well blended. Then melt 10g margarine, add 50g honey, and 20g refined palm sugar in each formula, then stir until evenly distributed. Mix the two doughs in the first and second steps until evenly distributed, then put on a mold and bake at 150ºC for 20 minutes. After the snack bar is cooked, then remove it from the mold and let it cool to room temperature. Snack bars are ready to be served or packaged.

Figure 1. Snack Bar Research Flow "Langsa" Snack Bar



RESULT AND DISCUSSION

Based on the results of observations made on the characteristics of color, taste, aroma, and texture produced on the F1 (30%: 25%: 45%) snack bar product, it has the criteria of yellowish-brown color, not fishy aroma, not hard texture and has a sweet taste.

The snack bar F2 (40%:30%:30%) has the criteria of yellowish-brown color, not fishy aroma, not hard texture, and sweet taste but there is a distinctive taste of catfish flour.

Meanwhile, the snack bar F3 (50%:35%:15%) has the criteria of brown color, not fishy aroma, not hard texture, and sweet taste but there is a strengthening of the typical taste of catfish flour which is more than F2 (40%: 30%:30%) product. The criteria for each formula can be seen in table 2.

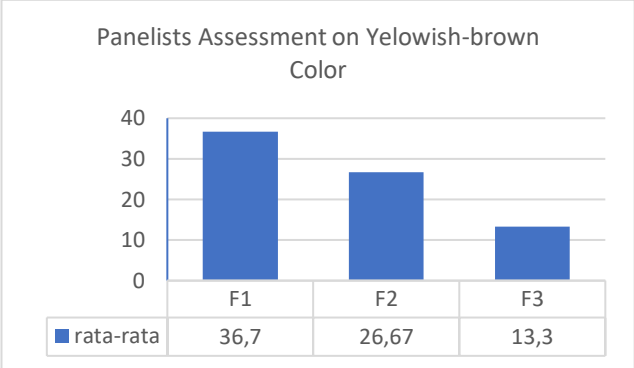
Table 2. Criteria For Each Formula of Snack Bar "Langsa" 100 Grams

Criteria	Formula		
	F1	F2	F3
Color	Yellowish-brown	Yellowish-brown	Brown
Aroma	Not Fishy	Not Fishy	Not Fishy
Texture	Not Hard	Not Hard	Not Hard
Taste	Sweet	Sweet but rises the typical taste of catfish flour	Sweet but rises the typical taste of catfish flour

Color

Color is one of the factors that influence the panelists assessment of the appearance of the product. The color criteria produced from the "langsa" snack bar product are expected to have a yellowish-brown color. Based on the results of the organoleptic assessment of the color on the "langsa" snack bar, it was found that the percentage of panelists who said the most "langsa" snack bar had a yellowish-brown color with the percentage in the F1 treatment was 36.70%, the F2 treatment was 26.67%, while in the F3 treatment has the lowest percentage of 13.33%.

Figure 2. Panelists Assessment on Yellowish-brown Color



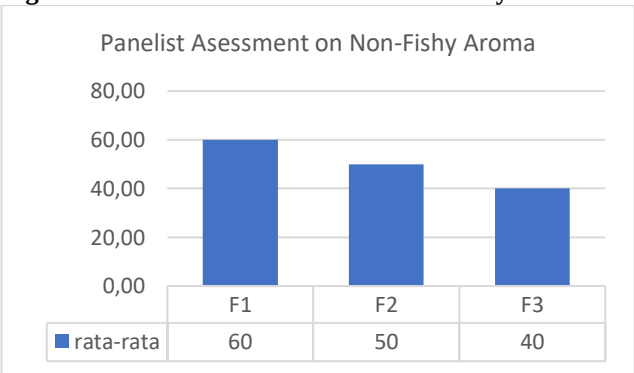
Based on the results of the Friedman statistical test, it showed a significant difference ($p < 0.05$) in the color aspect between F1, F2, and F3. The resulting "langsa" snack bars tend to be brown, this is influenced by the initial color of catfish flour which is already brownish. This is in line with research P.A.N and Ayustaningwarno (2013) which states that the whiteness of catfish meat flour has a lower value than wheat flour, so the higher the addition of catfish meat flour will produce a more brown product.

Another study stated that the more addition of catfish flour will affect the color of the resulting snack, namely the tendency to brown which is influenced by the initial color of catfish flour, which is yellowish-brown (Purwandani, Indrastuti, and Ramadhia 2013). In addition, the resulting brown color is also influenced by the Maillard reaction in the roasting process which causes the material to brown. Maillard reaction is caused by the reaction between reducing sugars and amino acids at high temperatures for a long time (Rahmi et al. 2021).

Aroma

The aroma produced from the "langsa" snack bar product is expected to have a non-fishy aroma. The results of the organoleptic assessment of the aroma of the "langsa" snack bar obtained the highest percentage of panelists stating the product had a non-fishy aroma with a percentage of 60.00% in F1 treatment. The F2 treatment has a percentage of 50.00% and the F3 treatment has the lowest percentage, which is 40.00%.

Figure 3. Panelists Assessment on Non-Fishy Aroma

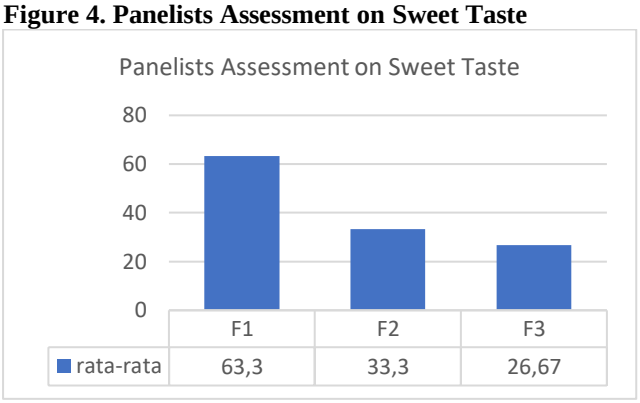


Based on the results of the Friedman test, there was no significant difference ($p > 0.05$) in the aroma aspect between the F1, F2, and F3 treatments. This is influenced by the "langsa" snack bar which has a non-fishy aroma caused by the use of margarine, sugar, and honey which reduces the fishy aroma of catfish meat flour and the distinctive aroma of cornflour and Raja banana flour. Aroma is also influenced by the roasting process, namely to get an interesting taste and a distinctive aroma (Putri, Hermanto, and Ulfah 2021).

Taste

The taste criteria of the "langsa" snack bar product are expected to have a sweet taste. The results of the organoleptic assessment of the taste of the "langsa" snack bar, the percentage of panelists who stated that the most "langsa" snack bar had a sweet taste with the percentage of F1 treatment was 63.33%. The F2 treatment was 33.33% and the F3 treatment had the lowest percentage, which was 26.67%.

Figure 4. Panelists Assessment on Sweet Taste



Based on the results of the Friedman test, there was a significant difference ($p < 0.05$) in the taste aspect between F1, F2, and F3 treatments. This is influenced by the emergence of a distinctive taste of catfish flour due to its high amino acid content, meaning that the more catfish flour added will affect the resulting taste. Amino acids that play a role in the formation of the taste of catfish are arginine, methionine, valine, phenylalanine, tyrosine, and tryptophan (Alno et al. 2018).

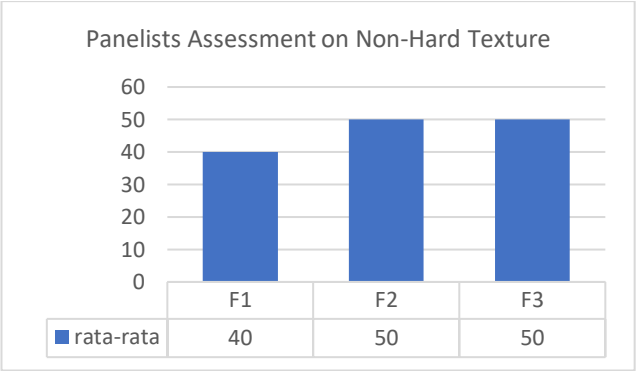
Nastiti and Christyaningsih (2019), also stated that the addition of catfish flour to processed food will affect the taste of the food so that additions with strong flavors (flavors) can be used as an alternative to reduce the strong taste of processed food modified catfish flour. In the "langsa" snack bar product, palm sugar and honey are added to give the snack bar a sweet taste. This is in line with research which states that the more addition of catfish flour to the product, the less sweet the resulting taste, and the typical fish taste of catfish change the taste of the product (Pratama et al. 2007).

Texture

The criteria for the texture produced from the “langsa” snack bar are expected to have not hard criteria. The results of the organoleptic assessment of the "langsa" snack bar showed that most panelists stated that the "langsa" snack bar had a not hard texture with the percentage in the F2 and F3 treatments, namely 50.00%. While the F1 treatment has the lowest percentage of 40.00%

Friedman test results showed that there was no significant difference ($p > 0.05$) in the texture aspect between F1, F2, and F3 treatments. In general, the resulting texture tends not to be hard. This is influenced by fat which has a shortening effect on baked goods, the fat will break down its structure and then will coat the starch from other flours. According to Nastiti and Christyaningsih (2019), catfish body flour contains high fat. So that the more addition of catfish flour the less hard the resulting texture.

Figure 5. Panelists Assessment on Not Hard Texture

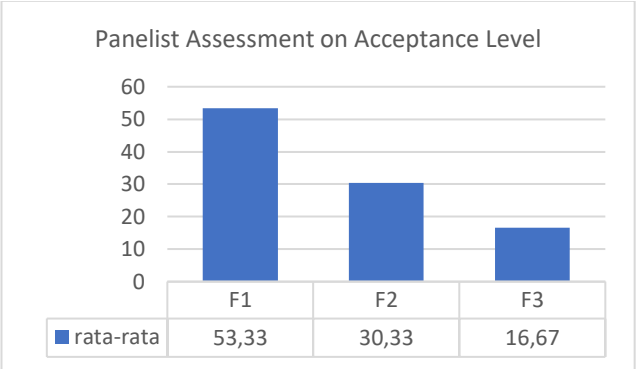


In addition, the texture of the snack bar can be affected by the addition of margarine which has a shortening effect on baked goods so that the product has a less hard texture. Furthermore, in the "langsa" snack bar, honey is added which functions as a binder and affects the tenderization process. Honey will make the texture of the resulting snack bar easier to break but easy to bite (Kusumastuty, Fandianty Ningsih, and Rio Julia 2015).

Acceptance Level

In this study, based on the organoleptic results of the panelists, the percentage of panelists who mostly said they liked the "langsa" snack bar in the F1 treatment was 53.33% said they liked it, the F2 treatment had a percentage of 30.00% said they liked it, while the F3 treatment had the lowest percentage of 16.67% said they liked it**.**

Figure 6. Panelists Assessment on Acceptance Level



Based on Friedman test results showed a significant difference ($p < 0.05$) between treatments F1, F2, and F3. The factors that influence the panelists' likes or dislikes of the product can be seen from the level of preference because it is influenced by all criteria including color, aroma, taste, and texture. Then it was found that the presentation of the panelists who liked the "langsa" snack bar the most was the F1 treatment, so the formula with the F1 treatment (30%: 25%: 45%) could be the chosen product.

THE NUTRITION COMPOSITION OF SNACK BARS

Based on the level of preference, in general, snack bar products with F1 treatment were the most preferred treatment by panelists, so snack bar products with F1 treatment could be the chosen product. The following are the results of the analysis of the nutritional composition of snack bar products with F1 treatment with a comparison of the formula of catfish flour: cornflour: Raja banana flour by 30%:25:45% in table 3.

Table 3. Nutritional Composition of Selected "Langsa" Snack Bar (F1).

Nutritional composition	RDA Adolescent Girls*	F1 Product (100g)**	%RDA
Energy (kcal)	2250	341.58	15%
Protein (g)	60	11.36	18%
Fat (g)	65	4.66	7.1%
Carbohydrate (g)	360	64.07	17%
Iron (mg)	18	4.71	26%
Vitamin A (µg)	600	264	44%

*) Recommended Dietary Allowances (RDA), 2019
**) Results of Laboratory Analysis of PT. SIG

Table 4. Serving Nutritional Composition (56g) Snack Bar "Langsa"

Nutritional composition	RDA Adolescent Girls *	F1 Product (56g)**	%RDA
Energy (kcal)	2250	191	8%
Protein (g)	60	6.5	10%
Fat (g)	65	3	5%
Carbohydrate (g)	360	36	10%
Iron (mg)	18	3	16%
Vitamin A (µg)	600	132	22%

*) Recommended Dietary Allowances (RDA), 2019
**) Modification of serving (56g) Laboratory Analysis Results of PT. SIG

Energy

Energy is one of the products of carbohydrate, protein, and fat metabolism. Adolescence is the second period of growth, during this period an adequate amount of energy intake is necessary to avoid negative effects on cognition, reduced somatic growth, and delays in sexual maturation (Gaona-Pineda et al. 2018). Research shows that there is a significant relationship between inadequate energy intake and the incidence of anemia (Mahmudiono et al. 2019). If left continuously in the long term, young women will be exposed to chronic energy deficiency which is one of the causes of anemia (Lestari, Sari, and Wulandatika 2020).

Based on the results of the nutrient analysis conducted at PT. Saraswanti Indo Genetech energy contained in 100 grams of the "langsa" snack bar is 341.58 kcal. According to the RDA table (2019), young women need 2250 kcal of energy in a day. The "langsa" snack bar product per serving (56g) contains 191 kcal of energy by consuming the "langsa" snack bar product, it can contribute 8% of energy from the adequacy of adolescent girls every single consumption.

The energy content of the "langsa" snack bar is higher than the quality requirements of USDA 25048, Snacks, Nutri-Grain Fruit and Nut Bar (120%), and SNI 01-4216-1996. This is because the selected "langsa" snack bar product has the main ingredients consisting of flours including catfish flour, cornflour, Raja banana flour, margarine, palm sugar, and honey as energy contributors.

Protein

Proteins are polypeptide macromolecules composed of several L-amino acids linked by peptide bonds (Probosari 2019). Protein is a source of amino acids that are needed for the growth process and also as a source of energy. The role of protein to overcome iron deficiency anemia is to play a role in the process of transporting iron in the body (Cahyati, Simanjuntak, and Rizal 2020). If protein intake is lacking, it will result in inhibited iron transport resulting in iron deficiency (Lutfiah, Adi, and Atmaka 2021).

Based on the results of the nutrient analysis conducted at PT. Saraswanti Indo Genetech, the protein contained in 100 grams of the "langsa" snack bar is 11.36 grams. According to the RDA (2019), adolescent girls need 60 grams of protein a day. The "langsa" snack bar product per serving (56g) contains 6.5 grams of protein by consuming the "langsa" snack bar product, can contribute 10% of protein from the adequacy of adolescent girls every single consumption.

The protein content of the “langsa” snack bar is higher than the quality requirements of USDA 25048, Snacks, Nutri-Grain Fruit and Nut Bar (9.3%), and SNI 01-4216-1996. This is because the selected "langsa" snack bar product has a more dominant concentration of catfish flour so that it contains high protein in 100 grams.

Fat

Fats found in food have a variety of biochemical and physiological functions including producing energy, aiding the absorption of other nutrients, and contributing to cardiovascular health (Downs et al. 2020). In addition, fat also plays an important role in the metabolism of nutrients, especially in the absorption of carotenoids, vitamins A, D, E, and K. Low fat intake in adolescent girls will prolong the menstrual cycle, thus triggering anemia (Wahyun, Sari, and Rahmawati 2019).

Based on the results of the nutrient analysis conducted at PT. Saraswanti Indo Genetech, the fat contained in 100 grams of the "langsa" snack bar is 4.66 grams. According to the RDA table (2019), young women need 65 grams of fat a day. The "langsa" snack bar product per serving (56g) contains 3 grams of fat by consuming the "langsa" snack bar product, it can contribute 5% of fat from the adequacy of adolescent girls every single consumption.

The fat content of the “langsa” snack bar is lower than the quality requirements of USDA 25048, Snacks, Nutri-Grain Fruit and Nut Bar (10.91%), and SNI 01-4216-1996. The low-fat content is caused by cornflour and Raja banana flour which have low-fat content, in the "langsa" snack bar the fat only comes from catfish flour and margarine.

In addition, in general, the processing of products that are processed through heating can reduce the fat content in foodstuffs, the decrease in fat content in snack bars can be caused by the process of coating catfish and roasting snack bars (Ikhsan, Muhsin, and Patang 2018).

Carbohydrate

Carbohydrates are the main source of energy for the body. The main function of carbohydrates that can be digested by the body is to provide energy for cells. including brain cells whose work depends only on the supply of carbohydrates in the form of glucose (Nantel 1998: Cummings and Stephen 2007).

Based on the results of the nutrient analysis conducted at PT. Saraswanti Indo Genetech, carbohydrates contained in 100 grams of the "langsa" snack bar are 64.07 grams. According to the RDA table (2019), young women need 360 grams of carbohydrates a day. The "langsa" snack bar product per serving (56g) contains 36 grams of carbohydrates by consuming the "langsa" snack bar product, can contribute 10% of carbohydrates from the adequacy of adolescent girls every single consumption.

The carbohydrate content of the “langsa” snack bar complies with the quality requirements of USDA 25048, Snacks, Nutri-Grain Fruit and Nut Bar (64%), and SNI 01-4216-1996.

Iron

Iron plays a very important role in the production of red blood cells in the body (Bianchi 2016). Adolescent girls need adequate iron intake. Iron deficiency in adolescents can be due to various reasons including low iron intake from food and loss during menstruation. If there is a continuous iron deficiency in adolescent girls, the body is not able to produce red blood cells properly and causes anemia (Juffrie, Helmyati, and Hakimi 2020). Iron in food can be in the form of heme (iron from animal protein) and non-heme (iron from plant protein) (Skolmowska and Głąbska 2019).

Based on the results of the nutrient analysis conducted at PT. Saraswanti Indo Genetech, the iron contained in 100 grams in the "langsa" snack bar is 4.71 grams. According to the RDA table (2019), young women need 18 grams of iron a day. The "langsa" snack bar product per serving (56g) contains 3 grams of protein by consuming the "langsa" snack bar product, can contribute 16% of the energy of adolescent girls every single consumption.

When compared with commercial snack bar products, the "langsa" snack bar has a higher iron content than commercial snack bars on the market, because the "langsa" snack bar can meet the nutritional adequacy of 16%/day (56g). Based on BPOM (2016) states that a portion of processed food is said to be a source of iron content if it has 2 times 7.5% of the Nutrition Label Reference (ALG) 100 grams in its solid form. The "Langsa" snack bar product per 100 grams contains 4.71 grams of iron or 21% of the ALG iron, the "Langsa" snack bar can be called a snack bar with an iron source.

Vitamin A

Vitamin A is a fat-soluble vitamin, and cannot be produced by the body. Vitamin A in the body acts as an immunomodulator and acts to increases erythropoietic activity so that it can increase iron levels (ferritin) and can reduce the risk of anemia in adolescent girls (Khalid et al. 2020).

Based on the results of the nutrient analysis conducted at PT. Saraswanti Indo Genetech, vitamin A contained in 100 grams in the "langsa" snack bar is 264 g. According to the 2019 Nutrient Adequacy Rate (RDA) table, young women need 600 µg of vitamin A in a day. The "langsa" snack bar product per serving (56g) contains 132 g of vitamin A by consuming the "langsa" snack bar product, it can contribute 22% of vitamin A from the adequacy of adolescent girls every single consumption.

When compared to commercial snack bar products, the "langsa" snack bar has a higher vitamin A content than commercial snack bars on the market, because the "langsa" snack bar can meet the nutritional adequacy of 22% per serving (56g). Based on BPOM (2016) states that a portion of processed food is said to be high in vitamin A if it has 2 times 15% of the ALG per 100 grams in solid form. In the "langsa" snack bar product per 100 grams containing 264 g of vitamin A or 44% of the ALG vitamin A, the "langsa" snack bar can be called a snack bar with high vitamin A content.

CONCLUSION

The product selected based on the results of organoleptic tests and the level of preference and according to the specified product, criteria was the formula of catfish flour: cornflour: Raja banana flour with a concentration of (F1) 30%:25%:45% has a yellowish-brown color, a sweet taste, a non-fishy aroma, and has a not hard texture.

Based on the analysis of nutritional value, the selected "langsa" snack bar product has a nutritional value per portion (56g) of 191 kcal of energy, 6.5g of protein, 3g of fat, 36g of carbohydrates, 3 mg of iron and 132 g of vitamin A. With the recommendation of consuming 2 servings of "langsa" snack bars per day, it can meet the nutritional adequacy rate for adolescents of 16% energy, 20% protein, 10% fat, 20% carbohydrates, 32% iron (Fe), and 44% vitamin A. recommended in a day.

REFERENCE

Alno, Muammar, Nia Kurniawati, Evi Liviawaty, and Jawa Barat. 2018. "Substitusi Tepung Daging Buah Lindur Terhadap Tingkat Kesukaan Bakso Lele (Substitution of Lindur Fruits Flour on the Preferences Level of Catfish Meatballs) Program Studi Perikanan , Fakultas Perikanan Dan Ilmu Kelautan , Universitas Padjadjaran , Jala." *Jurnal Perikanan Dan Kelautan* 8(1):66–79.

Andriani, Wa Ode Risky Ayu, Ansharullah, and Nur Asyik. 2018. "Karateristik Organoleptik Dan Nilai Gizi Snack Bar Berbasis Tepung Beras Merah (*Oryza Nivara*) Dan Tepung Jagung (*Zea Mays* L.) Sebagai Makanan Selingan Tinggi Serat." *Jurnal Sains Dan Teknologi Pangan (JSTP)* 3(6):1448–59.

Bianchi, Vittorio Emanuele. 2016. "Role of Nutrition on Anemia in Elderly." *Clinical Nutrition ESPEN* 11:e1–11. doi: 10.1016/j.clnesp.2015.09.003.

[BPOM] Badan Pengawas Obat dan Makanan Republik Indonesia. 2016. "Peraturan Kepala Badan Pengawas Obat Dan Makanan Republik Indonesia Nomor 13 Tahun 2016 Tentang Pengawasan Klaim Pada Label Dan Iklan Pangan Olahan." *Bpom* 1–16.

[BPOM] Badan Pengawas Obat dan Makanan Republik Indonesia. 2016. "Peraturan Kepala Badan Pengawas Obat Dan Makanan Republik Indonesia Nomor 9 Tahun 2016 Tentang Acuan Label Gizi." *Badan Pengawasan Obat Dan Makanan Republik Indonesia* 1–28.

Cahyati, Dwi Putri, Betty Yosephin Simanjuntak, and Ahmad Rizal. 2020. "Peningkatan Kadar Hemoglobin Remaja Putri Dengan Pemberian Kukis Pelangi Ikan Gaguk (Arius Thalassinus)." *Jurnal Kesehatan* 11(2):223. doi: 10.26630/jk.v11i2.2133.

Cañete, Ana, Elena Cano, Ramón Muñoz-Chápuli, and Rita Carmona. 2017. "Role of Vitamin a/Retinoic Acid in Regulation of Embryonic and Adult Hematopoiesis." *Nutrients* 9(2):1–18. doi: 10.3390/nu9020159.

Cummings, J. H., and A. M. Stephen. 2007. "Carbohydrate Terminology and Classification." *European Journal of Clinical Nutrition* 61:S5–18. doi: 10.1038/sj.ejcn.1602936.

Dinas Kesehatan Republik Indonesia. 2013. "Hasil Riset Kesehatan Dasar 2013." *Kementerian Kesehatan RI* 1–268.

Downs, Bernard W., Jean-Ronel Corbier, Neal Speight, Steve Kushner, Ted Aloisio, Manashi Bagchi, and Debasis Bagchi. 2020. *Anemia: Influence of Dietary Fat, Sugar, and Salt on Hemoglobin and Blood Health*. INC.

Ernawati, Fitrah, NFN Sandjaja, and Moesijanti Soekatri. 2013. "Status Vitamin a Dan Zat Besi Anak Indonesia." *Gizi Indonesia* 36(2):123. doi: 10.36457/gizindo.v36i2.140.

Gaona-Pineda, Elsa B., Fabiola Mejía-Rodríguez, Lucía Cuevas-Nasu, Luz M. Gómez-Acosta, Eduardo Rangel-Baltazar, and Mario E. Flores-Aldana. 2018. "Dietary Intake and Adequacy of Energy and Nutrients in Mexican Adolescents: Results from Ensanut 2012." *Salud Pública de México* 60(4, jul-ago):404. doi: 10.21149/8009.

Hurrell, Richard, and Ines Egli. 2010. "Iron Bioavailability and Dietary Reference Values." *American Journal of Clinical Nutrition* 91(5):1461–67. doi: 10.3945/ajcn.2010.28674F.

Ikhsan, Muhammad, Muhsin Muhsin, and Patang Patang. 2018. "Pengaruh Variasi Suhu Pengering Terhadap Mutu Dendeng Ikan Lele Dumbo (*Clarias Gariepinus*)." *Jurnal Pendidikan Teknologi Pertanian* 2(2):114. doi: 10.26858/jptp.v2i2.5166.

Juffrie, Mohammad, Siti Helmyati, and Mohammad Hakimi. 2020. "Nutritional Anemia in Indonesia Children and Adolescents: Diagnostic Reliability for Appropriate Management." *Asia Pacific Journal of Clinical Nutrition* 29(December):S18–31. doi: 10.6133/apjcn.202012_29(S1).0003.

Jus'at, Idrus, . Sandjaja, . Sudikno, and Fitrah Fitrah. 2014. "Hubungan Kekurangan Vitamin a Dengan Anemia Pada Anak Usia Sekolah." *Gizi Indonesia* 36(1):65–74. doi: 10.36457/gizindo.v36i1.117.

Kemenkes RI. 2018. "Hasil Riset Kesehatan Dasar 2018." *Badan Penelitian Dan Pengembangan Kesehatan* 198.

Khalid, Sidra, Maria Aslam, Fatima Syed, Muhammad Imran, Barira Saad, and Sana Noreen. 2020. "An Insight to Vitamin A : A Neglected Vitamin EAS Journal of Nutrition and Food Sciences An Insight to Vitamin A : A Neglected Vitamin." (June). doi: 10.36349/easjnfs.2020.v02i03.016.

Kusumastuty, Inggita, Laily Fandianty Ningsih, and Arliek Rio Julia. 2015. "Formulasi Food Bar Tepung Bekatul Dan Tepung Jagung Sebagai Pangan Darurat (Formulation of Rice Bran Fluor and Corn Fluor as Emergency Food Product)." *Indonesian Journal of Human Nutrition* 2(2):68–75.

Lestari, Pratiwi Puji, Bening Prawita Sari, and Darmayanti Wulandatika. 2020. "Education About Anemia And Nutrition In Adolescent Girls." *International Journal of Community Development* 3(1):1–4.

Lutfiah, Annisa, Annis Catur Adi, and Dominikus Raditya Atmaka. 2021. "Modifikasi Kacang Kedelai (Glycine Max) Dan Hati Ayam Pada Sosis Ayam Sebagai Alternatif Sosis Tinggi Protein Dan Zat Besi." *Amerta Nutrition* 5(1):75. doi: 10.20473/amnt.v5i1.2021.75-83.

Mahmudiono, Trias, Stefania Widya Setyaningtyas, Ilham Akhsanu Ridlo, Qonita Rachmah, and Triska Susila Nindya. 2019. "Consumption of Iron Supplement and Anemia Among Indonesian Adolescent Girls." *Global Journal of Health Science* 11(2):64. doi: 10.5539/gjhs.v11n2p64.

Nantel, G. 1998. "Carbohydrates in Human Nutrition. Report of a Joint FAO/WHO Expert Consultation."

FAO Food and Nutrition Paper 66:1–140.

Nastiti, Aliffah Nurria, and Juliana Christyaningsih. 2019. "Pengaruh Substitusi Tepung Ikan Lele Terhadap Pembuatan Cookies Bebas Gluten Dan Kasein Sebagai Alternatif Jajanan Anak Autism Spectrum Disorder
<i>[Effect of Catfish Flour Substitution towards Gluten-Free and Casein-Free Cookies as an Alternative Sna." *Media Gizi Indonesia* 14(1):35. doi: 10.20473/mgi.v14i1.35-43.

Nuroso, Agus. 2012. "Studi Pembuatan Tepung Pisang." *Jurnal Teknologi Peranian* 1(2):1–9.

P.A.N, Imandira, and Fitriyono Ayustaningwarno. 2013. "Pengaruh Substitusi Tepung Daging Ikan Lele Dumbo (Clarias Gariepinus) Dan Tepung Ubi Jalar Kuning (Ipomoea Batatas L.) Terhadap Kandungan Zat Gizi Dan Penerimaan Biskuit Balita Tinggi Protein Dan B-Karoten." *Journal of Nutrition College* 2(1):89–97. doi: 10.14710/jnc.v2i1.2102.

Pasricha, Sant Rayn, Jason Tye-Din, Martina U. Muckenthaler, and Dorine W. Swinkels. 2021. "Iron Deficiency." *The Lancet* 397(10270):233–48. doi: 10.1016/S0140-6736(20)32594-0.

Pratama, Angga Eka, Rosyid Ridho, Nadya Adharani, and Any Kurniawati. 2007. "Suplementasi Tepung Ikan Lele Dumbo (Clarias Gariepinus) Untuk Meningkatkan Kandungan Protein Pada Kue Terang Bulang." 0:18–25.

Probosari, Enny. 2019. "Pengaruh Protein Diet Terhadap Indeks Glikemiks." *Journal of Nutrition and Health* 7(1):33–39. doi: 10.14710/jnh.7.1.2019.33-39.

Purwandani, Ledy, Erning Indrastuti, and Muflihah Ramadhia. 2013. "Fortifikasi Tepung Ikan Lele Snack Dari Pati Jagung (Zea Mays)." *Vokasi* IX:175–79.

Putri, Nanda Nathasya Yunica, Restu Amalia Hermanto, and Ardhika Ulfah. 2021. "Analisis Kandungan Serat Dan Uji Hedonik Pada Produk Snack Bar Tepung Beras Merah (*Oryza Nivara* L) Dan Kacang Hijau (Phaseolus Radiatus L)." *Journal of Holistic and Health Sciences* 4(2):129–36. doi: 10.51873/jhhs.v4i2.85.

Rahmi, Yosfi, Adelya Desi Kurniawati, Rahma Micho Widyanto, Ayuningtyas Dian Ariestiningsih, Addien Zahratul Al Farahi Aisyi, Annisa Nafilata Ruchaina, Evita Virginia Sihombing, Fanny Bella Istira, Izzatun Nafsiyah, Katarina Dian Permatasari, Ririk Dwi Anjani, Stephani Anggita Yuli Maharani Simanjuntak, and Yunda Aulia Rahma. 2021. "The Sensory, Physical and Nutritional Quality Profiles of Purple Sweet Potato and Soy-Based Snack Bars for Pregnant Women." *Journal of Public Health Research* 10(2):390–98. doi: 10.4081/jphr.2021.2241.

Skolmowska, Dominika, and Dominika Głąbska. 2019. "Analysis of Heme and Non-Heme Iron Intake and Iron Dietary Sources in Adolescent Menstruating Females in a National Polish Sample." *Nutrients* 11(5). doi: 10.3390/nu11051049.

Syahwal, Sajiman, and Zulfiana Dewi. 2018. "Pemberian Snack Bar Meningkatkan Kadar Hemoglobin (Hb) Pada Remaja Putri." *AcTion: Aceh Nutrition Journal* 3(1):9. doi: 10.30867/action.v3i1.90.

Thamin, Halida, and Suchi Avnalurini Sharief. 2020. "Perbandingan Pemberian Tablet Fe Dan Vitamin C Dengan Tablet Fe Dan Vitamin A Terhadap." *Jurnal Penelitian Kesehatan Suara Fonkes* 11(2):1–5.

[USDA] US Department of Agriculture. 2018. "USDA National Nutrient Database for Standard Reference, Legacy."

Wahyun, Sri, Sang Ayu Kompiang Mira Arum Sari, and Dyah Karunia Rahmawati. 2019. "Hubungan Asupan Lemak Dan Zat Besi Dengan Kejadian Anemia Saat Menstruasi Pada Mahasiswa Di Asrama Kebidanan UNW Ungaran." *Pro Health Jurnal Ilmiah Kesehatan* 1(1):25–30.

Wijiindyah, Ayutha, Syaiful Anwar, and Sri Hetty Susetyorini. 2012. "Pemanfaatan Tepung Daun Kelor (Moringa Oleifera Lamk) Dengan Pretreatment Asam Dan Tepung Ikan Lele Terhadap Pemulihan Anemia Secara in Vivo." *Jurnal Gizi Klinik Indonesia* 9(2):73. doi: 10.22146/ijcn.15382.