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Nutilor (Moringa Leaf and Chicken Liver Nuggets) as Food for Stunting Prevention

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ABSTRACT

Providing complementary foods for breast milk (MP-ASI) is very important because the age of >6 months to 2 years, nutrients are needed to support children's growth and development during the golden period. Nuggets are a high-protein food. Modifications were made to increase the nutritional value by adding chicken liver and Moringa leaves and substituting them with Nutilor (Moringa Leaf Liver Nuggets). The research aims to analyze panelists' nutritional value and acceptability regarding the color, aroma, taste, and texture aspects of Nutilor products, as well as knowing market analysis and product prices. The method was an experiment conducted in the Food Laboratory, Nutrition Department, Poltekkes Kemenkes Tanjung Karang. Nutilor with chicken liver substitution, namely: F1 (14%), F2 (16%), F3 (18%), F4 (20%). Organoleptic testing using the hedonic test method (color, aroma, taste, texture, and overall acceptability) was conducted with 75 panelists and one replication. The most preferred Nutilor products are analyzed for their nutritional content, determining food costs and selling prices. Data were analyzed univariately using the Likert scale method. The organoleptic test results showed that the most preferred formula was F3 (90:25), with a nutritional value per serving (60 grams), namely E 171.2 kcal, P 9.1 g, L 8.2 g, KH 16.1, fiber 0.16, iron (Fe) 2.6 mg, the selling price per portion is IDR. 5000. The preferred product is F3, and based on the Likert scale, each formula has different colors and aromas. In further research, you need to pay attention to the time and temperature when frying and measure the amount of lemon used during marination.

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INTRODUCTION

Stunting is a state of growth and development failure in infants aged (0-11) months and toddlers (12-59) who experience chronic malnutrition, especially in the first 1,000 days of life, which can be characterized by height that is not by children of the same age (Arnita et al., 2020). The toddler years, or what is commonly referred to as the golden age, is a time when humans experience rapid growth and development. At this age, children will increasingly develop thinking, speaking, five senses, and motor skills (Kartika & Rifqi, 2021). Therefore, parents need to optimize their children's growth and development during their golden age by meeting their children's nutritional needs. This is because toddlers are an age that is vulnerable to experiencing health problems. The incidence of stunting is relatively serious, associated with a considerable morbidity and mortality rate, decreased immunity so that it is easy to get sick, the risk of diabetes, the incidence of obesity, heart and blood vessel disease, cancer, stroke in old age and will deteriorate cognitive development and low-income productivity levels. Therefore, prevention and control must be addressed immediately (Rahmadhita, 2020).

Indonesia has the second highest prevalence of stunting in children under the age of five in Southeast Asia, reaching 31.8% in 2020. Based on the results of SSGI (2022), the prevalence of stunting according to TB/U in Lampung Province is 15.2%, which is lower than the national percentage (21.6%) (Ministry of Health Republic Indonesia, 2022). The 2023 SKI data shows a decrease in the national stunting rate in children under five to 21.5%. Lampung Province's stunting data 2023 amounted to 14.9%; the stunting rate is already below the national rate. However, in Lampung province there are still several districts that are still high with stunting prevalence above the provincial rate, such as West Lampung Regency 24.6%, North Lampung

Regency 23.5%, Way Kanan Regency 22.7%, Tanggamus Regency 17.1%, Central Lampung Regency 16.7%, West Coast Regency 16.1% and Pringsewu Regency 15.8% (Ministry of Health Republic Indonesia, 2023).

Consuming foods with high protein and iron can be one way to prevent stunting and anemia. Previous research has been carried out on making food products with chicken liver. For example, in making chicken nuggets with boiler chicken liver, chicken liver is an alternative food high in protein and iron (Krismaputri et al., 2013). It was found that the formula for the T0 formula sample was the most preferred, where T0 was the formula without the addition of liver. Meanwhile, the most preferred formula with the addition of liver is the FI formula with a percentage of 10%

Based on Ramadhanty's research (2022), the results of organoleptic tests showed that formula 4 was most preferred by the panelists. Formula 4 uses 16% chicken liver and mocap flour with indicators for color, aroma, taste, texture, and overall nutritional research. Formula 4 per serving (60gr) contains 3.7mg of iron. In this research, material modification was carried out by substituting chicken liver and Moringa leaves to increase iron levels, thus creating a nugget product different from those on the market.

METHOD

This research was carried out using an experimental method: adding chicken liver and Moringa leaves to the nuggets. The result was products with the following concentrations of liver and Moringa leaves: F1 (14%: 5%), F2 (16%: 5%), F3 (18%: 5%), and F4 (20%: 5%).

The hedonic test research was located at the Taste Laboratory, Nutrition Department, Tanjung Karang Health Polytechnic, Bandar Lampung.

The tools used in making nutilor are a food processor, digital scale, basin, spoon, knife, stove, pan, and silk. The ingredients used in making nutilor are wheat flour, tapioca flour, moringa leaves, ground chicken meat, boiler chicken liver, eggs, ice water, granulated sugar, salt, and palm oil. How to make: Mix ground chicken meat, wheat flour, cornstarch, chicken egg, ground garlic, ground onion, and salt; stir until evenly mixed, put it in a baking dish, and steam. Once cooked, remove and cool, cut into pieces, and coat with breadcrumbs individually, then fry.

They carried out organoleptic tests in the taste testing laboratory of the Tanjungkarang Health Polytechnic Nutrition Department, including color, aroma, taste, texture, and overall acceptability. Nutilor samples weighing around 30 grams per serving were presented to the panelists. There were 75 untrained organoleptic test panelists. The criteria of nutrition students from Poltekkes Kemenkes Tanjung Karang are that they are willing to be panelists, not allergic, and not color blind.

The test results were analyzed using all Likert and hedonic tests related to the level of liking, namely like it very much, like it, tolerable, do not like it, and really do not like it. To assess the nutritional content, use the Indonesian Food Composition Table. Iron content was examined at the Technology and Innovation Center Laboratory, Universitas Lampung using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). This research was conducted in June 2024. After that, the nutritional value of the product per serving was calculated.

This research has ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Tanjung Karang No. No. 545/KEPK-TJK/X/2024.

RESULTS

Nutilor Formula Organoleptic Test Results

After conducting Nutilor research with the essential ingredients, namely chicken meat and wheat flour, substituting chicken liver, and adding Moringa, an analysis was carried out, including organoleptic tests (color, aroma, taste, texture, and overall acceptability). This Nutilor product has a reddish color due to the addition of chicken liver and moringa leaves in each formula. The aroma of the product is delicious. The texture of this product is soft. The weight of 1 nugget is 30g. The following is a picture of the Nugget Formula:

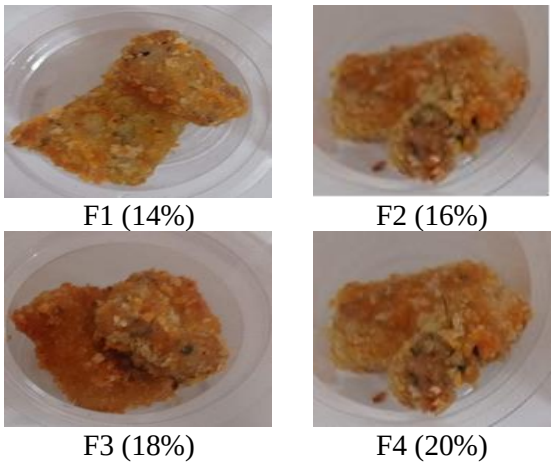

Figure 1. Nutilor (Moringa leaf and chicken liver nuggets)

Organoleptic assessment is a test method using the five human senses to measure the acceptability of food. Identifying color, aroma, taste, texture, and acceptability (Agusman, 2019). Organoleptic tests using hedonic tests were carried out to obtain the most preferred nutilor.

Table 1. Panelists' assessment of the color of nutilor products

Assessment Criteria	Formula Product			
	F1 (%)	F2 (%)	F3 (%)	F4 (%)
Really do not like	0	0	0	0
Dislike	0	0	0	4.0
Tolerable	21.3	13.3	12.5	18.7
Likes	53.3	58.7	46,2	56.0
Really like it	25.3	28.0	41.3	21.3
Amount	100	100	100	100

Table 1 shows the assessment results of the panelists' preference levels for all color formulas. Formula 3 was the most liked, with a percentage of 41.3%. The average level of panelists' liking based on the Likert scale value can be seen in Figure 2.

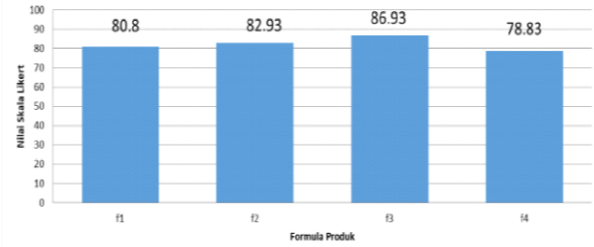

Figure 2. Panelists' Likert scale value of product color

The figure 2 shows that the panelists liked the four formulas, but formula 3 was the highest, with a value of 86,93.

The aroma assessment of Nutilor products is carried out using the sense of smell, which is assessed using the hedonic quality test. The percentage of organoleptic assessment results can be seen below.

Table 2. Panelists' assessment of the aroma of nutilor products

Assessment Criteria	Formula Product			
	F1 (%)	F2 (%)	F3 (%)	F4 (%)
Really do not like	0	0	0	0
Dislike	0	1.3	0	2.7
Tolerable	14.7	18.7	14.7	28.0
Likes	54.7	53.3	45.3	52.0
Really like it	30.7	53.3	45.3	52.0
Amount	100	100	100	100

The results of assessing the panelists' preference for aromas in all formulas showed that formula 3 was the most preferred, with a percentage of 45.3%. The average level of panelists' liking based on the Likert scale value can be seen in Figure 3.

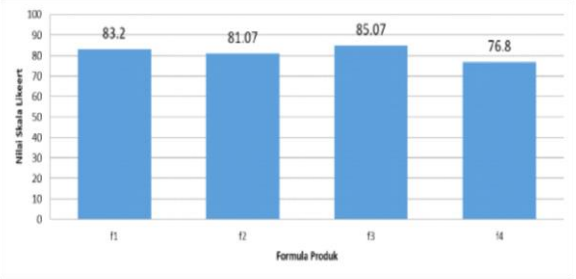

Figure 3. Panelists' Likert scale value of product aroma

Based on Figure 3, the panelists liked Formula 4, but Formula 3 had the highest level of liking, with a value of 85.07.

The taste of nuggets with the substitution and addition of chicken liver and Moringa leaves is observed using the sense of taste. The taste value is assessed using the hedonic test.

Table 3. Panelists' assessment of the flavor of nutilor products

Assessment Criteria	Formula Product			
	F1 (%)	F2 (%)	F3 (%)	F4 (%)
Really do not like	0	0	0	0
Dislike	0	1.3	0	4.0
Tolerable	18.7	25.3	14.7	28.0
Likes	58.7	37.3	44.0	46.7
Really like it	22.7	36.0	41.3	21.3
Amount	100	100	100	100

The percentage results of the panelists' liking level assessment of all formulas showed that formula 3 was the most preferred, with a percentage of 44.0%. The average level of panelists' liking based on the Likert scale value can be seen in Figure 4.

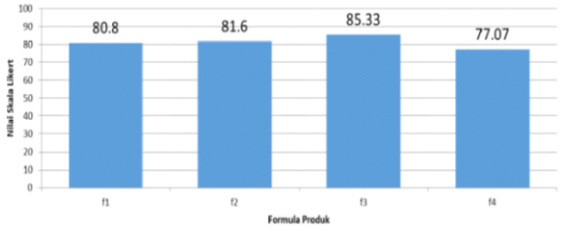

Figure 4. Panelists' Likert scale value of product flavor

Figure 4 shows that the panelists like the four formulas, but Formula 3 is the most preferred, with a value of 85.33.

Texture observations on nutilor were carried out using the sense of touch, which was assessed using the hedonic test.

Table 4. Panelists' assessment of the texture of nutilor product

Assessment Criteria	Formula Product			
	F1 (%)	F2 (%)	F3 (%)	F4 (%)
Really do not like	0	0	0	0
Dislike	0	5.3	0	6.7
Tolerable	17.3	14.7	16.0	21.3
Likes	56.0	50.7	45.3	49.3
Really like it	26.7	29.3	38.7	20.0
Amount	100	100	100	100

The results of the percentage assessment of the panelists' level of preference for texture showed that Formula 3 was the most preferred, with a percentage of 38.7%. The average level of panelists' liking based on the Likert scale value can be seen in the picture.

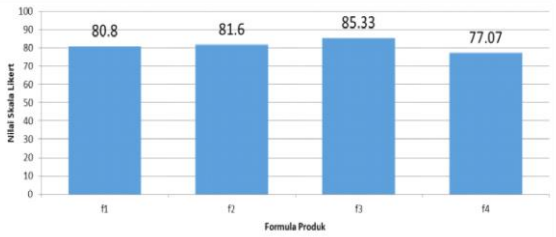

Figure 5. Panelists' Likert scale value of product texture

Figure 5 shows that the panelists liked the four formulas, but Formula 3 had the highest level of liking, with a value of 84.53.

Observations of the overall acceptability of nuggets with the substitution and addition of chicken liver and Moringa leaves were carried out on all indicators of color, aroma, taste, and texture, which were assessed using the hedonic test.

Table 5. Panelist assessment of overall acceptability of the product

Assessment Criteria	Formula Product			
	F1 (%)	F2 (%)	F3 (%)	F4 (%)
Really do not like	0	0	0	0
Dislike	0	1,33	0	4
Tolerable	14.67	17.33	17.33	21.33
Likes	54.67	52.0	42.67	50.67
Really like it	26.67	25.33	34.67	20.0
Amount	100	100	100	100

The results were obtained based on the percentage results of the panelists' liking level assessment of all formulas. Formula 4 is the most liked, with a percentage of 34.67%. The average level of panelists' liking based on the Likert scale value can be seen in Figure 6.

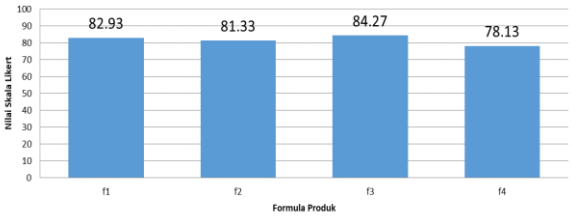

Figure 6. Panelists' Likert scale values against overall acceptance of product

Figure 6 shows that the panelists like the four formulas, but Formula 3 is the most preferred formula with 84.27%.

Analysis of nutrient content

The nutritional content calculation is carried out only on the most preferred formula, formula 3, with manual TKPI (Indonesian Food Composition Table) calculations.

Table 6. Nutrient content in nutilor per serving

Nutrient Content	Formula		Changes (%)
	F0	F3	
Energy (Kcal)	171.1	171.2	0.05
Protein (gram)	8.5	9.1	7.1
Fat (gram)	8.5	8.2	-3.5
Carbohydrate (gram)	15.3	16.1	5.2
Iron (mg)	0.54	2.6	381.4
Fiber	0.03	0.17	433.3

Desc: 1 portion=60gram

Based on Table 6, it was found that the energy contained in formula 0 (control) was 171.1, protein 8.9gr, fat 7.7gr, carbohydrates 25.9gr and Fe 0.54mg, fiber 0.03gr. Meanwhile, the most preferred formula, 3, contains 164.8kcal of energy, 9.1gr of protein, and 8.2gr of fat. Carbohydrates 13.9gr and Fe 2.6gr, fiber 0.17gr. It can be concluded that there is an increase in nutrients in formula 3, namely protein (7.1%), iron (381.4%), and fiber.

Standard food costs range from 30 – 40%. Standard food costs for nuggets are set at 40% based on the food costs that have been determined, so the selling price for nuggets can be determined by substituting and adding chicken liver and Moringa leaves per fruit, namely IDR. 2,500 and Rp. 5,000 per portion

DISCUSSION

Aroma

Aroma is a fragrance emitted by food that has a strong attraction so that it can stimulate the sense of smell and arouse the appetite of someone who smells the aroma of the food (Setyaningsih et al., 2010). The distinctive aroma produced by the chicken liver component is fishy. Therefore, researchers conducted a boiling process of chicken liver by adding galangal, lemongrass, and bay leaves to minimize the aroma.

Based on the organoleptic aroma test on all formulas, it was stated by the panelists that the formula with the highest score was formula 3, namely the nutilor product with 18% chicken liver substitution and the addition of 25 grams of moringa leaves.

Meanwhile, the less preferred aroma formulation is formula 4, which substitutes chicken liver for 20% and adds 25 grams of Moringa leaves. Nutilor is the least preferred formulation with the most chicken liver substitutions because it has a distinctive aroma of chicken meat, chicken liver, and Moringa leaves and is slightly fishy.

This is based on the panelists' statement that using chicken liver in making nutilor affects the aroma; the more chicken liver content in a product, the fishier the aroma will be. However, the most preferred Nutilor product is the one that uses 18% chicken liver.

The aroma of nutilor with the addition of chicken liver and Moringa leaves revealed differences in the scores for each panelist. The most preferred formula is formula 3, with a panelist assessment percentage of 45.3% (like very much), while the average level of panelists' liking based on the Likert scale value for formula 3 is 85.07 with very like criteria.

Taste

Taste is one component of organoleptic tests. Taste is one of the determining factors in consumer acceptance of products using the sense of taste. To minimize the fishy taste produced by Moringa leaves, the researchers conducted a blanching process for 5 minutes. In addition, researchers also boiled chicken liver by adding galangal, lemongrass, and bay leaves to minimize the fishy taste produced by chicken liver.

It is important in the results of consumer assessments of a product's quality. Consumers can accept a product if it has a taste that matches their wants. The results of the organoleptic test on taste showed that the taste results for nutilor based on the assessment by the panelists of all the formulas were only the taste of chicken liver, which was very noticeable to the taste buds, while Moringa leaves were not.

The formula with the highest rating for taste is formula 3, which is nutilor with an 18% liver substitution and the addition of 25 grams of Moringa leaves. In the organoleptic test results for the taste of nutilor with the addition of chicken liver and Moringa leaves, the scores of each panelist differed.

Texture

The results of the organoleptic test of texture contained 4 formulas. The elasticity of the nutilor can be affected by the use of added binders, which is an egg. The formula with the highest rating is formula 3, which is nutilor with 18% chicken liver substitution and the addition of 25 grams of moringa leaves.

Formula 3, based on the panelist assessment percentage, gets a score of 41.3% (like very much), while the result of the average level of panelist liking based on the Likert scale value for formula 3 is 85.33 with the criteria very like texture is a sensory factor related to the level of hardness and softness of a product. The way to feel the texture of a food product is by using the sense of touch, one of which is the mouth, namely by using the tongue and other parts of the mouth, or you can also use your hands to feel the texture of a food product. Texture can also be a determinant of quality that needs to be considered (Haryanti & Zueni, 2015).

Overall acceptance is the value panelists give to nutilor samples based on color, aroma, taste and texture parameters. Overall acceptance of nutilor was obtained by the formula with the highest rating based on the Likert scale, namely formula 3, which has a slightly brownish color, the aroma of chicken meat with a slightly fishy smell from the chicken liver, a savory taste of chicken meat and a slightly fishy taste from the chicken liver with the addition of spices so that the taste is unique and distinctive, the texture tends to be softer.

The formula with the lowest rating is formula 4 (20% chicken liver substitution), which has a browner color, a meaty aroma, no fishy smell of chicken meat, a savory taste, and solid. According to the panelists, this formula is less popular because Nutilor is the same as other Nutilor. Formula 4 tastes like chicken liver and has the fishy smell of chicken liver.

The product was still acceptable to the panelists because Formula 3 only used 18% of the raw materials for chicken liver. Even though the color assessment is less favorable because the color is slightly brownish, the greater use of chicken liver can also reduce the hardness level in the food and provide a soft texture so that it crumbles easily, making the texture of F3 the most preferred. From these results, there is an opportunity to add Moringa leaves to nutilor products.

Moringa oleifera is a medicinal plant that can be used as a functional and natural food additive. This plant belongs to the Moringacea family, closed seed plants that include 12 other species. This plant is widely cultivated in the Middle East, Africa, and Asia (Farid & Hegazy, 2020; Hisam et al., 2018).

Moringa has been used for centuries in over 80 countries, and research on its nutritional value has been conducted since 1970. In 1998, the World Health Organization (WHO) promoted this plant as an alternative supplement to treat nutritional deficiencies (Mahmood et al. 2010).

Nutilor formula nutrient content

Based on organoleptic test research on Nutilor products, the overall acceptance results were Formula 3, with the highest score (80) on the Likert scale with 18% chicken liver added. The results of the analysis of Formula 3 are the most preferred. Analysis of the nutrients tested includes energy, protein, fat, carbohydrate content analysis, and iron.

Energy is a source of energy needed by the human body. If the energy intake in the body is insufficient or excessive, it can cause metabolic problems. Excess energy in the body will be stored as fat, but if there is a shortage, fat, and protein catabolism will occur in the body and is dangerous. Calories can also be interpreted as a unit used to measure the value of power or energy, the calorie content in a food, and depends on the carbohydrate, protein, and fat content of the food itself (Graha, 2010).

Chicken liver has an energy content of 261 kcal per 100 grams and chicken meat has an energy content of 298 kcal per 100 grams (Persatuan Ahli Gizi Indonesia, 2020). In the 3 nugget formula with chicken liver and mocaf flour substituted (18%). The decrease in energy occurs because chicken meat's energy content is higher than chicken liver's.

Amertaningtyas (2014) states that the energy content in food is not only supported by one nutritional component; several components, such as carbohydrates, protein, and fat, are involved in energy formation.

Not only energy. The human body, namely protein, needs other nutrients. Protein is part of all living cells and is the largest part of the body after water. One-fifth of the body is protein, half is muscle, one-fifth is cartilage, one-tenth is skin, and the rest is other tissues and body fluids. Protein has a unique function that cannot be replaced by other nutrients, namely, building and maintaining cells and body tissues. (Almatsier. 2015)

Based on Table 6, nuggets with the substitution and addition of chicken liver and Moringa leaves. Formula 3 has a protein contribution of 16.5% to the RDA of adolescent girls aged 10-12 and 14% for those aged 13-18.

Besides energy, protein, carbohydrates, and fat are also really needed by the human body. Fat metabolism in the body becomes energy, which can break down body fat stores in the form of triglycerides (Almatsier, 2015). Fat also has a function as a source of energy, a means of transporting fat-soluble vitamins, saving protein, providing a feeling of fullness and deliciousness, as a lubricant, maintaining body temperature, and protecting body organs (Almatsier, 2015)

Based on this research, as with energy, protein, and carbohydrate content, fat calculations are also found in nuggets by substituting and adding chicken liver and Moringa leaves using TKPL. Chicken liver has a fat content of 16.1 grams per 100 grams, while chicken meat has a fat content of 25 grams per 100 gr. Apart from that, Moringa leaves have a fat content of 1.6 grams per 100 grams, and wheat flour has a fat content of 1 gram per 100 grams. In formula 3 (nuggets with substitution and addition of chicken liver and Moringa leaves as much as 18%), there was a decrease in fat due to the fat content in the ingredients for making nuggets, namely chicken liver and Moringa leaves, which was less than chicken meat fat and wheat flour.

This follows the statement from Yuliana et al. (2021) that adding more chicken liver substitutions causes the value of the fat content to decrease. The decrease in fat content can also be caused by heating, where the fat and meat juices melt during steaming.

Carbohydrates are important because they are the primary natural source for humans and animals and are relatively cheap. All carbohydrates come from plant growth through photosynthesis. They function as an energy source, flavoring food, saving protein, regulating fat metabolism, and helping to excrete waste (Almatsier, 2015).

The increase in carbohydrate content in formula 3 (nuggets with 18% chicken liver substitution and the addition of 25 gr Moringa leaves).In nuggets, it is manageable because substitution has no natural effect on nutilor carbohydrate levels, whereas Moringa leaves are added as a filler to make nutilor. Iron is the most abundant mineral in humans and animals (Almatsier, 2015). Iron in the body can combine with protein so that it can receive and release oxygen and carbon dioxide in the body. Iron in the body varies significantly according to age, gender, nutritional status, and iron reserves (Almatsier, 2015). The iron content in nutilor is 2.6 mg per serving, which weighs 60 grams.

Cost analysis

The food cost of Nutilor products is foods high in iron protein, namely IDR. 5,000 for each portion of nutilor. Apart from its delicious taste, nutilor is very easy to make, and the ingredients are not difficult to obtain. Nutilor, high in protein and iron, are very good for consumption by children and adults. When compared with nuggets on the market for Rp. 6000 per portion, The price of nutilor is IDR 5,000 per portion. This price is close to nuggets on the market. The price of nutilor can still be competitive in the market because it has the advantage of high protein and iron content.

CONCLUSION

The most preferred Nutilor is Formula 3 with 18% chicken liver substitution and the addition of 25gr of Moringa leaves. The most preferred nutritional content of Nutilor per portion of 60gr is equivalent to 2 pieces. Using TKPI 2020, the energy content is 171.2kcal, protein 9.1gr, fat 8.2gr, carbohydrates 13.9 g and iron (Fe) 2.6mg. The most preferred standard food cost at Nutilor is IDR. 5,000 per portion weighing 60 grams (equivalent to 2 pieces).

In further research, nutritional analysis can be carried out using proximate tests in the laboratory. Next, you can pay attention to the marinating process of chicken livers to reduce the fishy aroma of the product by measuring the lemon juice and soaking time. So, when frying, you have to pay attention to the temperature and the frying process to get the right color.

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