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Acceptability and Nutritional Value of Mackerel Fish Nugget with Additions of Moringa Leaves Flour for Stunting Children Under-Five Years in West Nias Regency

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ABSTRACT

Stunting is one of a nutritional problems. Mackerel contains high protein which is important for growth. Moringa leaves contain high calcium and iron to overcome stunting. However, these two ingredients are very low in utilization as food ingredients so food diversification is carried out by making nuggets that are popular with children. The goal of this study was to determine the acceptability and nutritional value of mackerel nuggets with the addition of moringa leaf flour for stunting children in West Nias Regency. This type of research was experimental with organoleptic and proximate test. The treatment is moringa flour addition of 3%, 5%, 7%. Data were analyzed with One Way ANOVA followed by Duncan's and using Kruskal Wallis followed by the Mann-Whitney test if the data did not meet one of the conditions for the Anova test. The hedonic test results showed that there was a significant difference in aroma (p=0.033), taste (p=0.001), and texture (p=0.043) but no effect on color (p=0.639). The nutritional value test results showed that there was an effect of moringa leaf addition on the moisture content (p=0.016), ash (p=0.001), protein (p=0.001), fat (p=0.001), carbohydrate (p=0.024), calcium (p=0.001), and iron (p=0.001) of mackerel nuggets. Moringa flour addition influenced the liking of aroma, taste, and texture but had no effect on aroma and was well received by children's panelists in the category of "like" with F1 with the highest acceptance. Moringa flour addition influenced the protein, calcium, and iron levels with the highest levels in F3.

Keywords: Moringa leaf, mackerel fish, nugget, stunting, organoleptic test, nutritional content

Introduction

According to Kemenkes (2018), stunting is defined as failure to grow in children under-five who experience chronic malnutrition during the first thousand days of life. Stunting is a chronic nutritional problem characterized by a TB/U or PB/U index z-score below -2 SD. Stunting is a condition of malnutrition associated with past nutrient deficiencies, both in quality and quantity (Sutarto et al., 2018). Stunting is not apparent until the child is two years old, although it can occur since the infant is in the uterus (BSDPS, 2017). Stunting that is not accompanied by catch-up growth will interfere with physical, intellectual, cognitive, mental, and growth. Children who suffer from stunting may be more susceptible to disease (Rohmatika, 2020). In addition, stunted children are more susceptible to chronic diseases when they become adults which results in decreased productivity (De & Branca, 2016).

Currently, many countries are facing the problem of stunting nutrition. According to WHO (2023), as many as 150.8 million children under-five worldwide (22%) were stunted and 13.6 million children

were wasted in 2020. Meanwhile, the stunting rate in Indonesia, which ranks fifth in the world, dropped from 32% in 2019 to 31.8% in 2020 (World Bank, 2023). In 2018, the stunting rate in Indonesia was 11.5% for severe stunting and 19.3% for stunting (Riskesdas, 2018). The 6th highest prevalence of stunting is in North Sumatra Province with a prevalence of 21.1% (Kemenkes, 2022). The prevalence of stunting in the study area, namely West Nias Regency, was 25.67% for short nutritional status and 20.10% for very short nutritional status (Riskesdas, 2018).

Overcoming the incidence of stunting carried out at the village level includes monitoring the growth of toddlers by cadres and organizing Supplementary Food Provision (PMT) for children aged 6-59 months (Kemenkes, 2018). Providing additional food through food diversification is intended to complement nutritional needs to achieve good nutritional status (Halim et al., 2022). Nugget is one type of food that is processed as food diversification. Nugget is a meat product that is processed so that it changes its structure but still has a compact and dense texture and fibers when cut (Afiyah, 2022). Making nuggets by smoothing the meat and then mixed with spices and other ingredients to create a savory taste that makes this product attractive to the public, especially children (Winarno, 2019; Fadillah et al., 2023).

Mackerel is a fish with a high protein content so it is useful as a nutritious food for children. Currently, mackerel fish is widely used as processed food such as fish balls, pempek, and otak-otak (Wahab et al., 2021). The omega-3 content in mackerel is very useful because it can help the formation of brain nerve cells and increase intelligence during children's growth (Aripudin et al., 2021). Mackerel has 76.5% water content, 21.4% protein, 0.61% carbohydrate, 0.56% fat, and 0.93% ash content (Nugroho et al., 2014). The research area is a coastal area with high potential for mackerel but low utilization because fishermen sell their catches outside the area. In completing nutritional needs not only mackerel fish but also must be accompanied by consumption of vegetables. Several studies have proven that Moringa plants are useful as an alternative in overcoming nutritional problems (Shija et al., 2019).

Moringa leaves are included in food ingredients that are known in the world as superfoods because they have a high content of nutrients and phytochemicals so they are very beneficial for the human body (Winarno, 2018). Aminah et al. (2015) mentioned that moringa leaves can be converted into flour, powder, or extract in use as a nutritional enhancer in food products. Research shows that moringa leaves contain essential amino acids and minerals (Natsir et al., 2019). Moringa leaf flour in the amount of 100 g has a protein content 2 times higher than yogurt and calcium 4 times higher than milk (Winarno, 2018; Krisnadi, 2015). Meanwhile, moringa leaves contain zinc 6 times higher than almonds and iron 25 times higher than spinach leaves. Moringa leaf flour has a protein content of 28.44%, fat of 2.74%, carbohydrates of 57.01%, fiber of 12.63%, and calcium of around 1600 to 2200 mg (Muliawati et al., 2019). Calcium levels in moringa flour are very beneficial for the growth period of toddlers (Singh et al., 2018). However, the implementation of using moringa leaves as an additional nutrient for toddlers is still lacking despite its abundant availability.

Several studies have been conducted to see the characteristics, acceptability, and nutritional value of products given additional moringa flour (Letiora et al., 2020; Suhaemi et al., 2021; Halim et al., 2022; Rahmawati & Ansokowati, 2022). Several hedonic test studies that have been conducted show that the most chosen products are the addition of 20% fresh moringa leaves in chicken nuggets (Sholihah & Hajidah, 2022); squid nuggets with the addition of 10% moringa flour (Syahfitri & Susanti, 2022); beef nuggets with the addition of 2% moringa flour (Hadiansyah et al., 2020); and chicken nuggets with the addition of 1% moringa flour (Priyono et al., 2022). Another study by Pramono et al. (2021) revealed that protein levels and calcium levels increased and the acceptability was affected by adding moringa flour on lemuru fish nuggets. Mackerel-based nuggets have been shown to improve the nutritional status of stunted children (Cholifah et al., 2023). Nadimin et al. (2021) reported that moringa flour can be used to improve the nutritional status of toddlers and prevent stunting with the recommended use of being added to toddler food. Research by Musa et al. (2022) and Saranani et al. (2023) has shown

the effect of giving mackerel nuggets with moringa on improving the nutritional status of toddlers as a specific nutritional intervention to prevent stunting.

Based on this situation above, it is necessary to conduct research on mackerel nuggets (*Scomberomorus commersoni*) with the addition of *Moringa oleifera* flour as a form of development of local food ingredients with high nutritional value that can be used as healthy food to overcome nutritional problems in children. This study's target is to determine the nutritional value and acceptability of moringa leaves addition on mackerel nugget products.

Material and Methods

This research is experimental at the nugget formulation development stage and pseudo-experimental at the hedonic test stage. The research design used a completely randomized design (CRD) with 3 levels of treatment and 3 repetitions (triplo). The treatment was the addition of different moringa flour to the fish nugget formula, namely F0 (0%), F1 (3%), F2 (5%), and F3 (7%). This study was approved by the ethics committee before the hedonic test was conducted on the panelists. Data were analyzed using the One Way Anova test for normally distributed and homogeneous data and then continued with the Duncan test, if data were not normally distributed or homogeneous were analyzed using the Kruskal Wallis then continued in the Mann-Whitney test (Mishra et al., 2019).

The equipment used in this study to make products included knives, basins, grinders, stirrers, baking sheets, steaming pans, molds, spatulas, pans, serving plates, and equipment used for proximate tests in the laboratory. The materials used in this study include fresh mackerel fish obtained from fishermen of Hinako Village, West Nias Regency, moringa flour obtained from the "Flozindo Herbs and Spices" Factory with pure specifications of 100% green moringa leaves, wheat flour, cornstarch, margarine, garlic, onions, sugar, salt, pepper, chicken eggs, panir flour, cooking oil, and materials used to conduct proximate tests in the laboratory. The formula was made with a modified recipe from research by Vidayanana et al. (2020) which is also adjusted to the needs of children under-five years based on the Recommended Dietary Allowance (AKG) according to the 2019 Permenkes.

Table 1. Formulation of mackerel fish nugget with moringa leaf addition

Material	Treatment			
	F0	F1	F2	F3
Mackerel Fish	29,3 %	29,3 %	29,3 %	29,3 %
Wheat Flour	23,5 %	23,5 %	23,5 %	23,5 %
Maizena Flour	2,3 %	2,3 %	2,3 %	2,3 %
Margarine	5,8 %	5,8 %	5,8 %	5,8 %
Garlic	3,4 %	3,4 %	3,4 %	3,4 %
Onion	5,8 %	5,8 %	5,8 %	5,8 %
Sugar	1,4 %	1,4 %	1,4 %	1,4 %
Salt	2,1 %	2,1 %	2,1 %	2,1 %
Pepper	0,2 %	0,2 %	0,2 %	0,2 %
Chicken Egg	13,9 %	13,9 %	13,9 %	13,9 %
Bread Crumb	2,3 %	2,3 %	2,3 %	2,3 %
Total	**100 %**	**100 %**	**100 %**	**100 %**
Moringa Leaf Flour	0 g	3 g	5 g	7 g

Modification of research by Vidayanana et al. (2020)

Making of mackerel nugget

Making nuggets using the formulation from Vidayanana et al. (2020) as in Table 1. Modifications in the use of moringa flour, wheat flour, and cornstarch and the basic ingredients in the form of

mackerel fish. The manufacturing process begins with cleaning the mackerel fish using running water and then separating the meat from the bones. Next, the fish meat is ground for ± 1 minute at a temperature below 15°C. Moringa leaf flour was added according to each treatment. Then mix with other ingredients including wheat flour, cornstarch, margarine, eggs, garlic, onions, sugar, salt, and pepper, and then stir until homogeneous. Next, the dough is molded in a pan and steamed for 15 minutes over medium heat. After that, the nuggets were left to cool and then cut into 1x3 cm rectangles. Some of the products were taken for nutritional value analysis samples and others were continued to the breading process with bread crumb. The last stage is frying for 1 minute over medium heat and then serving for hedonic testing (Vidayanana et al., 2020).

Hedonic test

A hedonic test was conducted to assess the acceptability of color, taste, aroma, and texture characteristics. Nugget samples were coded and randomly presented to 25 untrained panelists who were children aged 6-9 years. Panelists were provided with mineral water between assessments of each sample to neutralize the taste buds. The hedonic test rating scale uses four categories, namely 1 = very dislike, 2 = dislike, 3 = like, and 4 = very like. Panelists will conduct hedonic tests in a room consisting of a preparation section, a tasting section, and a waiting room (Novitasari et al., 2021).

Nutritional value test

The proximate test was conducted at Chem-Mix Pratama laboratory in Yogyakarta. The parameters assessed included protein content, calcium content, and iron content. Protein levels were tested using the kjeldahl method (Rosaini et al., 2017), calcium levels using the Atomic Absorption Spectroscopy (AAS) method (Sowmya et al., 2015), and iron levels using the UV-Vis spectrophotometric method (Andriani, 2022).

Results and Discussion
Hedonic test

The hedonic test results showed that the addition of moringa flour gave significantly different sensory acceptance ($p<0.05$) in aroma, taste, and texture but not significantly different ($p>0.05$) in nugget color (Table 2). There was an increase in the liking of aroma and flavor in F1 compared to the other treatments (F0, F2, and F3). Aroma and flavor in F2 and F3 had the same preference value as F0, but F1 had the same preference value as F0. Overall, toddler panelists have a dominant level of preference for F1 compared to other treatments.

Color

The color component is used to determine the quality and level of acceptance of a food ingredient (Amir et al., 2018). The color of a food that is less attractive or has deviated from the color should affect acceptance even though it has a good taste and good texture. In determining the quality of a food ingredient, visually the color factor will take precedence over other factors (Winarno, 2019). The results of the color liking test did not differ in all treatments, indicating that all treatments had the same level of liking by panelists with an average value of 3.23 (very like). This is in line with research conducted by Pramono et al. (2021) which reported that there is irrelevant between the acceptability of the color of lemuru fish nuggets and moringa leaf flour addition. Research by Suhaemi et al. (2021) showed an average value of color liking in duck nuggets of 3.65 which is the category of like, while in this study the results were in the category of very like.

Moringa leaves contain high chlorophyll and lipoxidase contents that produce a green color in the leaves (Krisnadi, 2015). Moringa leaves addition will affect the color of the nuggets to be greenish so it is expected to reduce the level of liking. The acceptance of the nugget color significantly decreased with the higher moringa flour addition that produced a dark green color (Suhaemi et al., 2021).

However, panelists considered there was no problem with the color of the nuggets produced. This is due to the use of coating (bread crumb) on the nuggets so that the outer color of the nuggets in the four formulas is not much different. Bread crumbs used as a coating for nuggets affect the outer color of the nuggets produced (Simanjuntak & Pato, 2020). In addition, the frying process also causes the color of the nuggets in the four treatments to be not much different, namely golden brown (Afrisanti, 2010; Permatasari & Rahayuni, 2013).
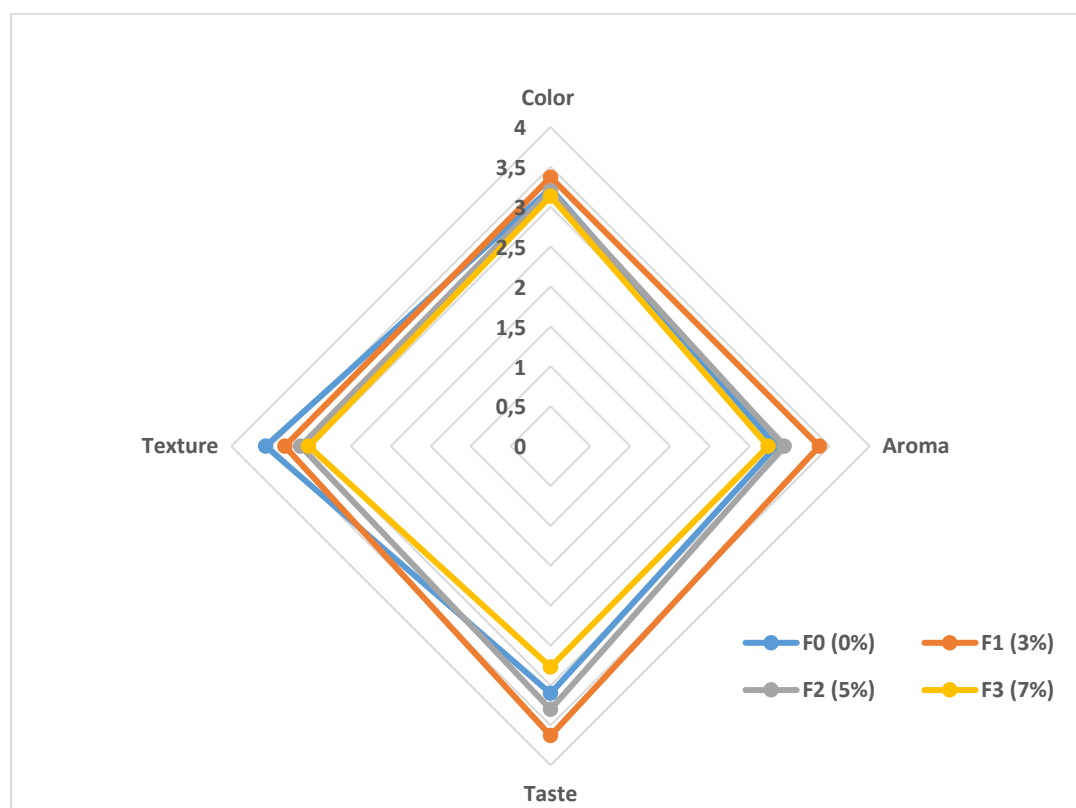

Figure 1. Radar Diagram of Hedonic Test Results of Mackerel Fish Nugget with Moringa Leaf Addition

Aroma

Aroma is a component that determines the quality of food that can be accepted by consumers. Aroma is closely related to the sense of smell, which also acts as a marker of product damage such as foul odor caused by product damage. Food odor greatly affects the deliciousness of food. A food ingredient that has a unique and attractive aroma will arouse consumer appetite (Winarno, 2019; Amir et al., 2018). The results of the aroma liking test showed different results with the highest level of aroma liking in F1 (very like). This result is in agreement with the research of Rahmawati and Ansokowati (2022) which states that there is an effect of the addition of moringa leaf powder on the level of liking for the aroma of chicken nuggets which is still preferred by consumers in moringa leaf addition with certain concentrations.

The content of lipoxidase enzyme in moringa leaves produces a languid aroma that will affect the aroma of the nuggets produced (Krisnadi, 2015; Ilona & Ismawati, 2015). The higher the proportion of moringa leaf powder addition, the stronger the strong aroma in chicken nugget products (Hamidiyah et al., 2019). This decreases liking because the languorous aroma produced is less favored by panelists (Agusta et al., 2020; Cahyaningati & Sulistiyati, 2020). However, in this study, the addition of moringa leaves in F2 and F3 had the same aroma as F0, and panelists preferred F1 over other treatments. The nuggets may have a balanced aroma of mackerel and moringa flour due to the right proportion. This is supported by Pramono et al. (2021) which says that the aroma of moringa and lemuru is balanced so

that no material has a stronger aroma than the others. Furthermore, it was also stated that the best aroma-liking value in the lemuru fish nugget formula was 20% of moringa flour addition with an aroma-liking value of 3.44 (preferred category). In this study, the best formula is 3% of moringa flour addition which had a higher acceptance of 3.37 (very like category).

Taste

Taste is a sensory property resulting from the mixture of food components that can be sensed by the sense of taste. The taste of food is influential because it affects consumer acceptance (Nurlaila et al., 2018). Despite the fact that other parameters have good values, if the taste parameter is not good, consumer acceptance will remain low. Taste consists of five types, namely salty, sour, sweet, bitter, and savory (Soekarto, 2012). The results of the taste preference test showed different results with the highest level of taste preference in F1, but F2 and F3 had the same taste preference as F0. These results are in line with research by Al-Mardiyah and Astuti (2019) which reported the outcome of moringa leaf addition on the level of liking for the taste of chicken nuggets. Likewise Pramono et al. (2021) on lemuru fish nuggets with a better level of liking and acceptable by panelists (usual-like) at a certain level of moringa flour addition.

Moringa leaves contain tannin compounds that cause astringency and phenol and alkaloid compounds that cause bitterness (Dianti & Simanjuntak, 2023). The higher the addition of moringa leaves, the more it increases the astringency and bitterness in food products which causes a decrease in taste preference by panelists (Syamsiah et al., 2022; Nurlaila et al., 2016; Cahyaningati & Sulistiyati, 2020). Panelists in this study liked F2 and F3 to the same extent as F0 but preferred F1 because of the 3% moringa flour addition. These results indicate a balance in the composition of moringa flour and the meat source used to produce a harmonious blend of flavors and not dominate each other (Azizah et al., 2015). Panelists with the addition of fish tend to dislike a slightly fishy taste and moringa flour with a bitter taste (Pramono et al., 2021; Winnarko & Mulyani, 2020). In this study, the average value of F1 flavor liking was 3.63 with a very like category, not much different from research by Syahfitri and Susanti (2022) and Vidayanana et al. (2020) which showed the average value of taste preference in the like category of 3.68 and 3.6.

Texture

Texture or consistency of the food is obtained from a mixture of several physical properties, namely shape, size, elements, and amount of material formation that can be detected by the sense of taste and touch so that it is also a component of taste assessment (Amir et al., 2018; Midayanto & Yuwono, 2014). Good food texture will produce good taste in food (Suryatmoko, 2010). The results of the texture favorability test showed different results. In this study, there was a decrease in the level of liking in F2 and F3 compared to F0, but F1 had the same level of liking as F0. These results are in line with research by Iman (2023) which declares that moringa leaves addition affects the texture of sagela nuggets.

Setiaboma et al. (2021) stated that moringa leaves contain non-polysaccharide compounds that affect the formation of tissue structure, resulting in a dense but brittle product texture if the addition is too high. The high fiber content in moringa also causes a brittle nugget texture, the higher moringa powder addition, the less compact or brittle the nuggets produced will be easily broken (Hamidiyah et al., 2019; Pramono et al., 2021). Meanwhile, panelists tend to prefer a soft and chewy texture (Hapsari et al., 2022). In this study, the highest taste preference was in F0 and F1 with an average value of 3.57 and 3.33. Research by Pramono et al. (2021) and Syahfitri and Susanti (2022) reported that the highest texture-liking value was in the control formula and the formula with the lowest level of moringa addition.

Nutritional value test

The nutritional value test results revealed that the addition of moringa flour gave significantly different nutritional content ($p<0.05$) in protein, calcium, and iron levels. Overall, nutritional value increased with the highest value in F3 for protein, calcium, and iron levels (Table 2).

Table 2. Nutritional Value Test Results of Tenggiri Fish Nugget with Moringa Leaf Addition

Nutritional Value	F0	F1	F2	F3	Sig.
Protein (g/100g)	9.23 ± 0.052[a]	9.72 ± 0.097[b]	10.03 ± 0.038[c]	10.49 ± 0.172[d]	0.001
Calcium (mg/100g)	18.65 ± 0.018[a]	46.58 ± 0.028[b]	83.75 ± 0.046[c]	106.64 ± 0.036[d]	0.001
Iron (mg/100g)	7.57 ± 0.084[a]	8.58 ± 0.110[b]	9.18 ± 0.114[c]	9.88 ± 0.114[d]	0.001

Notes: *a,b,c = similar letter notation indicates no significant difference at the Duncan test level.

Protein content

Protein content is a source of amino acids including the elements C, H, O, and N (Latifah, 2022). Protein in food ingredients acts as a binder to increase water content, gelling, and emulsifier in food ingredients (Das et al., 2021). Protein content is controlled by the dehydration of the material, the higher the protein content, the higher the amount of water lost (Sebranek, 2009). The protein content in fish nuggets based on SNI 7758: 2013 is at least 5% so the four formulas in this study have met the established SNI standards.

The outcome of the protein nutritional value test showed different results with the highest protein content in F3. This result is in line with Pramono et al. (2021) who reported significant differences in the protein content of lemuru fish nuggets with the addition of moringa leaf flour. The average protein content of mackerel nuggets with moringa flour ranged from 9.23%-10.49%, with the highest content in F3 and the lowest in F0. This showed that the higher the protein content of the nuggets was when the higher the addition of moringa flour. The increase in protein occurred due to the addition of protein from moringa flour. Moringa leaf flour contains 18 amino acids including arginine histidine, tryptophan, lysine, phenylalanine, threonine, methionine, leucine, valine, and isoleucine. (Nnam, 2009; Krisnadi, 2015). This research is supported by Suhaemi et al. (2021) also reported the same thing along with moringa leaf flour addition, which will increase the protein content of chicken nuggets and duck nuggets.

Calcium content

Calcium belongs to a group of micronutrients that have many important roles in the body (Aulin, 2000). Sources of calcium in the diet include meat, vegetables, poultry, grains, fish, nuts, fruits, milk, cheese, eggs, and yogurt. Several studies have shown that the addition of calcium sources in food has been shown to increase total calcium intake (Calvo et al., 2004; Rafferty et al., 2007; Poliquin et al., 2009). Valentina et al. (2014) mentioned the importance of adding calcium to food to improve children's nutritional status.

The results of the calcium nutritional value test showed different results with an increase in calcium levels along with the addition of moringa flour and the highest calcium levels in F3. The average calcium content in this study was in a fairly large range, between 18.65 mg to 106.64 mg. These results are in parallel with research by Pramono et al. (2021) which states that there is a significant difference between treatments of moringa flour addition to lemuru fish nuggets with an increase in calcium levels along with the addition of the proportion of moringa flour. The increase in nugget calcium occurs due to the addition of calcium from moringa flour. Rahmi et al. (2019) and Saputri et al. (2019) said that the high calcium content in moringa flour also increased the calcium level in the product (Rahmi et al., 2019; Saputri et al., 2019). Moringa leaf flour contains 2003mg/100g of calcium or four times higher than that found in milk (Krisnadi, 2015).

Iron content

Iron is an essential micronutrient that is used in the formation of hemoglobin (red blood cells), myoglobin (oxygen-carrying protein to muscles), collagen (protein in cartilage, bones, and connective tissue), and enzymes (Harvey et al., 2007; Farid et al., 2019). In addition, iron also plays an important role in the body's defense system. Iron contributes to various metabolic processes including DNA synthesis, oxygen transport, and electron transport (Abbaspour et al., 2014).

The results of the iron nutritional value test showed different results with iron levels between treatments. Increasing the addition of moringa flour causes an increase in iron levels and is highest in F3. These results are in parallel with research by Vidayana et al. (2020) which reported that there was a significant variance in iron in catfish nuggets added with moringa leaves. Layli (2020) also mentioned a similar thing that iron levels in nuggets were getting higher along with the addition of moringa flour. The average range of iron levels in this study is between 7.57 mg to 9.88 mg. Research by Vidayana et al. (2020) also showed the highest catfish nugget iron was found in the treatment with the highest moringa level formulation and the lowest catfish nugget iron in the lowest moringa level formulation. This is supported by Krisnadi (2015) who reported the iron level in moringa flour as much as 28.2mg/100g to increase the iron content of nuggets.

The best formula

The nutritional value test results showed that F3 was the formula with the best nutritional content. The hedonic test results show that F3 is still preferred by toddlers with an average value of 2.91 (like) so it can still be recommended for use even though F1 has an overall advantage with a higher favorability value. The best formulas (F1 and F3) were compared with the daily nutritional needs that refer to the Recommended Dietary Allowances (RDA) or AKG (Permenkes, 2019) in Table 3.

Table 3. Adequacy of Daily Food Requirements per 100g Nugget Best Formulation

Nutri-tion	Nutritional Value		Daily Food Require-ments for 1-3 Years	Satisfaction of Daily Food Re-quirements for 1-3 Years		Daily Food Require-ments for 1-3 Years	Satisfaction of Daily Food Re-quirements for 1-3 Years	
	F1	F3		F1	F3		F1	F3
Protein	9.72 g	10.49 g	20 g	48,6%	52,4%	25 g	38,8%	41,9%
Calcium	46.58 mg	106.64 mg	65 mg	7,2%	16,4%	1000 mg	4,6%	10,6%
Iron	8.58 mg	9.88 mg	0,7 mg	122,5%	141,1%	10 mg	85,8%	98,8%

Nugget F1 and F3 as much as one serving (100g) can already meet the requirements of iron to the normal category (90%-119%) but protein and calcium intake has not met the standard of AKG 2019. According to Ernawati et al. (2016), toddlers' protein needs are obtained not only from animal food but also from vegetable food. Similarly, calcium intake needs are divided into two, animal and vegetable. Vegetable sources of calcium include green vegetables, grains, and nuts. Although the nugget already contains enough nutrients, toddlers must consume other food intake to meet their nutritional needs.

Conclusion

The evaluation of the hedonic test showed that the level of color preference in all treatments is in the category of like to very like. The fragrance and flavor categories on F0, F2, and F3 show the same preference values but preference on F1 is the highest among treatments. The texture category on F2 has the same reference value as F0 but preferences on F3 and F2 are below F0. Based on the hedonic test, the best formula was obtained F1. The nutrition test assessment results revealed that adding leaf

flour increased the level of protein, calcium, and iron with the highest increase occurring at F3. This means that the best recipe based on the nutritional test is F3. Although the greatest liking is at F1, F3 still has a liking value in the liking category so it can still be accepted and developed as a local food processing to meet the nutrition needs of stunting food.

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