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Physicochemical and sensory properties of Lumi-lumi (Harpodon nehereus) fresh noodles fortified with natural flavours

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ABSTRAK

Latar Belakang: *Ikan endemik Lumi-lumi (Harpodon nehereus) mengandung zat gizi makro dan mikro mineral yang berpotensi memperbaiki kandungan gizi mie. Fortifikasi aneka flavor alami bertujuan memperkaya kandungan mineral dan fungsional mie.*
Tujuan: *Penelitian ini bertujuan untuk mengidentifikasi formulasi terpilih mie basah Lumi-lumi yang difortifikasi aneka flavor alami berdasarkan mutu fisik dan daya terima, serta mengidentifikasi kandungan gizi, mineral Fe, dan aktivitas antioksidan tertinggi pada perlakuan terbaik.*
Metode: *Penelitian ini bersifat eksperimen menggunakan Rancangan Acak Lengkap (RAL) satu faktor yaitu fortifikasi aneka flavor labu kuning, wortel, brokoli dan bit pada mie basah Lumi-lumi. Penentuan produk terpilih berdasarkan uji mutu fisik dan sensori tertinggi, selanjutnya identifikasi kandungan gizi, mineral Fe dan aktivitas antioksidan produk terbaik. Data mutu fisik dianalisis menggunakan uji One way ANOVA, data sensori menggunakan uji Kruskal Wallis, data kandungan gizi, mineral Fe dan aktivitas antioksidan menggunakan uji Independent Sample T-test.*
Hasil: *Hasil uji mutu fisik dan sensori produk terpilih yaitu pada mie basah Lumi-lumi yang difortifikasi ekstrak wortel dan bit. Hasil identifikasi kandungan protein, serat kasar, mineral Fe, dan aktivitas antioksidan tertinggi diperoleh pada perlakuan fortifikasi ekstrak bit, berturut-turut yakni 14,47%, 16,04%, 4.46 mg/100 g, dan 42,90%.*
Kesimpulan: *Formulasi produk terbaik diperoleh pada perlakuan mie basah Lumi-lumi yang difortifikasi ekstrak bit dengan perolehan nilai kandungan protein, serat kasar, mineral Fe, dan aktivitas antioksidan tertinggi. Produk ini berpotensi sebagai produk pangan lokal fungsional..*

KATA KUNCI*:* *lumi-lumi; harpodon nehereus; mie basah; flavor; antioksidan*

ABSTRACT

Background: *Endemic fish Lumi-lumi (Harpodon nehereus) contains macronutrients and minerals that can potentially improve the nutritional content of noodles. Fortification of various natural flavours aims to enrich noodles' mineral and functional content.*

Objectives: *This study aims to identify selected formulations of Lumi-lumi fresh noodles fortified with various natural flavours based on physical quality and acceptability, as well as identify the highest nutritional content, Fe mineral, and antioxidant activity in the best treatment.*

Methods: *This experimental study uses a single factor Complete Randomized Design (CAD), fortifying various flavours of yellow pumpkin, carrots, broccoli, and beets in Lumi-lumi fresh noodles. Determination of selected products based on the highest physical and sensory quality tests, then identification of nutritional content, Fe mineral, and antioxidant activity on the best product. Physical quality data were analyzed using the ANOVA test, sensory data using the Kruskal Wallis test, and data on nutrient content, Fe mineral, and antioxidant activity using the Independent Sample T-test.*

Results: *The results of physical and sensory quality tests of selected products are on Lumi-lumi fresh noodles fortified with carrot and beet extract. The results of the identification of the highest protein, crude fiber, Fe mineral, and antioxidant activity were obtained in the fortification treatment of beet extract, including 14.47%, 16.04%, 4.46 mg/100 g, and 42.90%.*

Conclusions: *The best product formulation was obtained in treating fresh noodles Lumi-lumi fortified with beet extract with the highest protein, crude fiber, Fe mineral, and antioxidant activity. This product has the potential to be a functional local food product.*

KEYWORD*:* *Lumi-lumi; Harpodon nehereus; fresh noodles; flavour; antioxidant*

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INTRODUCTION

Lumi-lumi fish (Harpodon nehereus), commonly called Bombay duck, is a demersial fish with a good chance of being developed in Meulaboh, West Aceh. The abundant availability of Lumi-lumi fish in the waters of the South West (Barsela) makes this fish one of the characteristics of Meulaboh City. Lumi-lumi fish contains various crude proteins, namely 50.64%, 81.97%, and 59.00% (1), (2), (3). It also contains dissolved protein that can be absorbed by the body at 7678.3 mg/mL and contains various macro minerals Ca, Mg, P, Fe, and Zn. However, conversely, there are challenges in processing Lumi-lumi fish. The soft texture and fishy smell cause the selling value of Lumi-lumi fish to be relatively low and less attractive to the public. Lumi-lumi fish contain 89.1% - 90% water (4) (5).

The people of Indonesia favor noodles as an alternative to rice because of their easy, fast presentation, varied side dishes, and good taste. According to World Instant Noodles Association (WINA) data in 2022, Indonesia is ranked second as the country with the most noodles consumption globally after China, reaching 14,26 billion packs (6). In general, noodles are sold with a low protein content that only comes from flour and eggs. Thus, adding Lumi-lumi fish meat and fortifying various natural flavours is expected to increase nutritional and mineral value and have antioxidant benefits for health.

This study used noodle product formulations from flavour extracts: yellow pumpkin, carrots, broccoli, and beets. The choice of yellow pumpkin (Curcubita moschata) as the flavour of Lumi-lumi fresh noodles is due to the content of nutrients, complex minerals, and β-carotene components that can function as natural yellow dyes as well as antioxidants (7). Carrots (Daucus carota L.) have a distinctive aroma, slightly more concentrated color (betasantin) than yellow pumpkin, and contain high β-carotene and carotene content (vitamin A), which is more easily absorbed after

cooking (8). Then broccoli (Brassica oleracea L.) contains a variety of important vitamins and minerals such as vitamin C, calcium, iron, and selenium, as well as other mineral content; broccoli's green color is generally used as a natural dye (9). Meanwhile, the selection of beets (Beta vulgaris L.) in the Lumi-lumi fresh noodle formulation because they contain active compounds such as carotenoids, glycine betaine, saponins, betacyanin, betanin, polyphenols, and flavonoids, the high content of beta-carotene in beets which not only acts as a natural purple dye but also acts as an antioxidant at the same time (10).

Thus, the results of this study are expected to produce the formulation of Lumi-lumi fresh noodle products with the best natural flavour extract fortification based on scoring tests with physical and sensory quality parameters of the product and fresh noodle products with the best nutritional value, Fe mineral, and antioxidants.

MATERIALS AND METHODS

This study used the Experiment method with a Single Factor Complete Randomized Design (CRD), fortifying various natural flavours in Lumi-lumi fresh noodles. There are four treatments with a ratio of wheat flour and Lumi-lumi fish composition (80%: 20%) and natural flavour extract fortification, namely: F1 = yellow pumpkin fruit extract, F2 = carrot extract, F3 = broccoli extract, F4 = beet extract. Each treatment was repeated 3 times so that 12 experimental units were obtained. Physical quality tests include rehydration power and cooking time. A total of 60 untrained panelists assessed sensory tests. Nutritional content tests include water content, ash content, protein content, fat content, crude fiber content, and carbohydrate content, then analyze Fe mineral content and antioxidant activity. The formulation of Lumi-lumi fresh noodles is as **follows:**

F1 = 80% wheat flour: 20% lumi-lumi fish + 8% yellow pumpkin extract
F2 = 80% wheat flour: 20% lumi-lumi fish + 8% carrot extract
F3 = 80% wheat flour: 20% lumi-lumi fish + 8% broccoli extract
F4 = 80% wheat flour: 20% lumi-lumi fish + 8% beet extract

The physical quality test of Lumi-lumi fresh noodles includes rehydration power and cooking time by a modified procedure (11). The measurement of rehydration power involves weighing 5 g of raw noodles as an initial weight of A (g), then boiling for ± 5 minutes after cooking, draining, and measuring the weight as B (g). Then, it is calculated using the formula:. Rehydration Force (%) = (B - A)/A x 100%, information: A (raw noodle weight (g)); B (cooked noodle weight (g)).

The cooking time of fresh noodles uses the principle of time analysis by measuring the duration until the noodles form a white line when pressed using two sheets of glass. As much as 5 g of raw noodles are weighed, then 150 ml of water is brought to a boil in a beaker glass and boiled for 3 minutes. The sample is inserted into a beaker glass, and the stopwatch is activated while the sample is in boiling water. Every one minute, a string of noodles is taken, which is then pressed with two pieces of glass. Cooking is optimal if a white line has formed when the noodles are packed using two sheets of glass.

The receptivity (sensory) test of Lumi-lumi fresh noodles using the hedonic method with a rating scale on the organoleptic test form (1-5), namely: 1 = very dislike, 2 = dislike, 3 = somewhat dislike, 4 = like, and 5 = very like. In hedonic testing, this study refers to previous research, which is modified; the parameters tested include appearance, color, taste, aroma, texture, and overall acceptance (12). The organoleptic (hedonic) test form is referred to by previous researchers and is modified (13). The number of untrained panelists was 60.

The nutritional content test of fresh noodles Lumi-lumi refers to the Official Methods of Analysis of AOAC International 20th.ed (2016), which includes water, ash, protein, fat, fiber, and carbohydrate content (14). Test the Fe mineral content of Lumi-lumi fresh noodles using the ICP OES method with Fe wavelength = 238.204 nm and Y wave = 371.029 nm. Samples were prepared as much as 0.5 g using HNO3 and 7.5 mL HCl solutions, internal addition of yttrium standard 100 mg/L in a 50 mL measuring flask,

filtering the solution with a 0.20 µm RC / GHP syringe filter. The comparison standards are Iron Standard Solution 1000 mg/L. Calculation of metal/mineral levels in the sample using the following formula: Mineral Metal Content (ppm, mg L, mg Kg) = $^{Aspl-a}/b \times V \times fp/ W^{spl}$ or V^{spl}, information: Aspl : Sample intensity; a : Intercept of standard calibration curves; b : Slove from the standard calibration curve, fp: Dilution factor; V : Volume end of test solution (mL); Wspl : Test portion weighing weight (g); Vspl : Test portion pipetting volume (mL).

The antioxidant activity content test using the 1,1 diphenyl-2-picrylhydrazyl (DPPH) method (15). Lumi-lumi fresh noodle samples of as much as 1 g were prepared in a blank solution consisting of a mixture of 0.2 mL ethanol and 3.8 mL DPPH, then vortexed and incubated for 30 minutes. Measurement of antioxidant activity using a 515 nm wavelength UV-VIS spectrophotometer. The results of the Lumi-lumi fresh noodle antioxidant activity test will be calculated using the following formula: % Antioxidant activity = Absorbance of the stamp – Absorbance of the sample/Stamp absorbance x 100%.

Data Analysis

The research data was analyzed using SPPS version 20. Physical quality data were analyzed using analysis of variance (ANOVA) with a significance value (P<0.05), if there is a significant difference, the Tukey test continues. Sensory data were analyzed using the Kruskal Wallis test with a significance value (P<0.05); if there is a significant difference, the Mann-Whitney test continued to see significant differences in sensory parameters of each treatment. The nutritional content, Fe mineral, and antioxidant activity data results were analyzed using the Independent Sample T-test with a significance value (P<0.05) to identify the best formulation.

RESULTS AND DISCUSSIONS

Physical quality of Lumi-lumi fresh noodles

The results of the analysis of the rehydration power of noodles and fresh cooking time of various natural flavours between treatments were not significantly different (P>0.05) presented in **Table 1**

Table 1. Physical quality analysis of fresh noodles Lumi-lumi fortification of various natural flavours

Parameter	Treatment				*P value*
	F1	F2	F3	F4	
Rehydration Power (%)	68.96±3.07[a]	73.50±2.38[a]	67.20±7.00[a]	65.20±7.47[a]	0.353
Cooking Time (minutes)	2.06±0.04[a]	2.07±0.05[a]	2.12±0.04[a]	2.11±0.03[a]	0.293

*The data presented consists of mean ± standard deviation. Different letter notations in the same row show a noticeable difference (P<0.05).

Rehydration power is the ability of noodles to absorb water after a gelatinization event (16). The highest average result of fresh noodle rehydration power was carrot extract treatment with an average of 73.50%, followed by yellow pumpkin extract treatment with an average of 68.96%, broccoli extract with an average of 67.20%, and the lowest in beet extract treatment with an average of 65.20%. The high rehydration power of fresh noodles Lumi-lumi fortification of various flavours is caused by the use of high-protein wheat flour and protein content in Lumi-lumi fish, the protein content in the constituent ingredients of noodles affects the ability of noodle dough to bind water during the boiling process. This is reinforced by the statement by previous researchers (7) that the higher protein content in noodles causes the formation of a complex bond between protein and starch, which affects the water absorption process. Cooking time is needed for noodles to be fully cooked by removing the white dot in the middle of the noodle strands during the cooking process (16). The shorter the cooking time, the less solids are lost in the water during cooking. Conversely, the longer the cooking time, the more water content contained in the noodles; this affects the texture and taste, and the resulting noodles are easily damaged (17).

The results of the identification of cooking time showed that the cooking time was shorter,

namely in the treatment of yellow pumpkin extract for 126 seconds, followed by carrot extract for 127 seconds, beet extract for 131 seconds, and broccoli pull for 132 seconds. However, statistically, it shows no real difference. This is thought to be due to the composition of flour, fish, and eggs that are added equally between treatments. The gluten content present in wheat germ, as well as protein in the raw materials for making noodles contribute to the ripening time. This is reinforced by the statement by previous researchers (16) that the content of gluten and protein in food has a real effect on the length of noodle cooking; the higher the protein content, the longer the noodle cooking process. Fresh noodles with various natural flavours before and after cooking can be seen in **Figure 1**; raw noodles are shown in Figure (a), and cooked noodles are shown in Figure (b).

(a)

Yellow pumpkin fruit extract (F1) **Carrot extract (F2)** **Brocolli extract (F3)** **Beet extract(F4)**

(b)

Figure 1. Lumi-lumi fresh noodles before cooking (a) and after cooking (b)

Acceptability (sensory)

The results of the analysis of the acceptability of Lumi-lumi fresh noodles fortified with various natural flavours are presented in **Table 2**. In terms of appearance parameters, significant differences were obtained between treatments ($p<0.05$). The appearance of the formulation most preferred by panelists was found in the carrot extract fortification treatment with an average value of 4.21 with the criteria of liking, followed by beet extract with an average value of 3.71 (like), broccoli extract with an average value of 3.51 (somewhat like) and yellow pumpkin extract with an average value of 3.43 (somewhat like). Overall, fresh noodles with various fortified flavours have a normal appearance like fresh noodles in general, without any significant difference compared to fresh noodles, so panelists can accept it when choosing their preferred formulation. In the color parameter, significant differences were obtained between treatments ($p<0.05$). The color aspect assessment of the panelists gave the highest

score on carrot extract fortification treatment with an average value of 4.31 with like criteria, followed by beet extract with an average value of 3.71 (like), broccoli extract with an average value of 3.50 (somewhat like) and yellow pumpkin extract with an average value of 3.38 (somewhat like). The color of the noodles favored by the panelists was light orange (not thick and not pale).

Table 2. Sensory analysis of fresh noodles Lumi-lumi fortification of various natural flavours

Parameter	Treatment				*P value*
	F1	F2	F3	F4	
Appearance	3.43±0.93[a]	4.21±0.88[b]	3.51±1.17[a]	3.71±1.18[a]	
Color	3.38±1.02[a]	4.31±0.77[b]	3.50±1.04[a]	3.71±1.19[a]	
Aroma	3.68±1.03[a]	4.15±0.65[c]	3.13±1.34[b]	3.68±1.17[a]	0.000
Taste	2.85±1.07[a]	3.50±1.15[c]	3.05±1.17[b]	3.45±1.18[b]	
Texture	3.23±1.11[a]	4.00±0.92[b]	3.95±1.12[b]	3.95±1.04[b]	
Overall	3.15±0.95[a]	3.93±0.97[b]	3.73±1.17[b]	3.68±1.06[b]	

*The data presented consists of mean ± standard deviation. Different letter notations in the same row show a noticeable difference (P<0.05).

So, the fresh noodles of carrot extract are preferred by panelists compared to the fresh noodles of yellow pumpkin extract; this is due to the color in the formulation of fresh noodles Lumi-lumi fortification of pale yellow pumpkin extract. This is in line with the research of the hedonic test of fresh noodles, the addition of mackerel fish meal and carrot juice that was most liked by panelists, the more the addition of carrot juice, the increasing panelists' preference for noodles (18).
In the aroma parameter, significant differences were obtained between treatments ($p<0.05$).

The aroma aspect assessment from the panelists gave the highest score on carrot extract fortification treatment with an average value of 4.15 with like criteria, followed by beet extract with an average value of 3.68 (likes), yellow pumpkin extract with an average value of 3.68 (likes), and broccoli extract with an average value of 3.13 (somewhat likes). The aroma of fresh noodles with the fortification of various flavours that the panelists least liked was the fresh noodles of broccoli extract; this was caused by the distinctive aroma of broccoli and unpleasant so that it masked the distinctive Aroma of fish that the panelists tended to dislike. This result is in line with the research of the distinctive smell of broccoli can dominate the Aroma of cat tongue cake and beat the Aroma of fat from flour; the more substitution of broccoli powder, the stronger the Aroma of broccoli cookie dough (19). In the Taste parameters, significant differences were obtained between treatments ($p<0.05$). The assessment of taste aspects from the panelists gave the highest score on the carrot extract fortification treatment with an average value of 3.50 with the criteria of liking, followed by beet extract with an average value of 3.45 (somewhat like), broccoli extract with an average value of 3.05 (somewhat like) and yellow pumpkin extract with an average value of 2.85 (somewhat like). Lumi-lumi fresh noodles have a taste like fresh noodles in general, carrot extract is preferred by panelists because of the sweet taste produced by sugar in carrots (12).

In the Texture parameters, significant differences were obtained between treatments ($p<0.05$). The assessment of texture aspects from panelists gave the highest score on carrot extract fortification treatment with an average value of 4.00 with the criteria of likes, followed by beet extract with an average value of 3.95 (likes), broccoli extract with an average value of 3.95 (likes) and yellow pumpkin extract with an average value of 3.23 (somewhat likes). In the overall acceptance parameters, significant differences were obtained between treatments ($p<0.05$). The assessment of the overall aspect from the panelist gave the highest score on the carrot extract fortification treatment with an average value of 3.93 with the criteria of likes, followed by broccoli extract with an average value of 3.73 (likes), beet extract with an average of 3.68 (likes), and yellow pumpkin extract with an average value of 3.15 (somewhat likes).

Scoring test

Determination of the best product of Lumi-lumi fresh noodles fortified with various flavours

based on the best results from physical and organoleptic quality parameters presented in **Table 3**. The determination is carried out by the scoring method. The score starts from numbers 1 to 4, with the highest score value of 4, which shows the parameter value better.

Table 3. Selection of the best formulation based on the results of the hedonic test of fresh noodles Lumi-lumi fortification of various flavours

Organoleptic	Treatment			
	F1	F2	F3	F4
Appearance	1	4	2	3
Color	1	4	2	3
Aroma	2	4	1	3
Taste	1	4	2	3
Texture	1	4	2	3
Overall	1	4	3	2
Total	**7**	**24**	**12**	**17**

*Remarks: (F1) yellow pumpkin extract, (F2) carrot extract, (F3) broccoli extract and (F4) beet extract. Numbers 1-4 mean that the higher the number, the higher the value of fresh noodles Lumi-lumi based on predetermined parameters.

Based on the results of the **Table 3** scoring test, the best products were obtained, namely the treatment of fresh noodles Lumi-lumi carrot extract (F2) and fresh noodles Lumi-lumi beet extract (F4), with a total score of 24 and 17, respectively. Next, the identification of nutritional value, Fe mineral, and antioxidant activity was carried out.

Nutrition content

The results of the nutritional content analysis of Lumi-lumi fresh noodles fortified with various natural flavours are presented in **Table 4.** The results of the statistical test of the moisture content of fresh noodles are a significant difference (P<0.05). The average water content in the best formulations of F2 and F4 is 45.46% and 54.29% which meet the requirements for maximum moisture content in cooked fresh noodles according to SNI 2987 of 2015, which is a maximum of 65%.

The results of statistical tests showed a significant difference in ash content (P<0.05), the average ash content in the best formulations of F2 and F4 was 0.68% and 0.46%. The ash content test is the total ash content of Lumi-lumi fresh noodle products.

Table 4. Analysis of the nutritional content of fresh noodles in the best formulations

Parameter	F2	F4	*P value*
Water content (%db)	45.46±1.07^{a}	54.29±0.39^{b}	0.003
Ash content (%db)	0.68±0.02^{b}	0.46±0.00^{a}	0.001
Fat content (%db)	5.60±0.47^{a}	8.43±0.21^{b}	0.006
Protein content (%db)	11.81±0.75^{a}	14.77±0.03^{b}	0.003
Crude fiber content (%db)	8.65±0.77^{a}	16.04±0.46^{b}	0.001
Carbohydrate content (%db)	27.79±1.73^{b}	6.02±0.67^{a}	0.000

Information:
The data presentation in the table is the average of 3x repetitions ± standard deviations
Different letter notations in the same column and row show a noticeable difference (P<0.05).

Furthermore, the results of statistical tests showed a significant difference in fat content (P<0.05), the average fat content in the best formulations of F2 and F4 was 5.60% and 8.43%. According to SNI 01-2987-1992, the maximum fat content requirement for fresh noodles is around 7%. Based on this, the fat content in Lumi-lumi beet extract fresh noodles (F4) exceeds the

requirements of the existing fat content. This is in line with previous researchers with the results of research on high-fat content in control formulation fresh noodles (F0), which is 9.55% (20). The high-fat content in Lumi-lumi fresh noodles occurs because of the fat content in eggs and fish in the noodle dough-making process and the cooking oil in fresh noodles after boiling so that the noodles do not clump or stick when served.

The results of statistical tests showed a significant difference in protein levels ($P<0.05$), the average protein levels in the best formulations of F2 and F4 were 11.81% and 14.77%. According to SNI 2987 of 2015, the minimum protein content contained in cooked noodles is 6.0%, so the results of the protein content test in Lumi-lumi fresh noodles meet the requirements for protein levels in fresh noodles. The protein content in fresh noodles is influenced by the ingredients used, especially high-protein flour (21). In addition, Lumi-lumi fresh noodles also use animal protein in the form of chicken eggs and Lumi-lumi fish meat, which are rich in macro and micronutrients (minerals). Using high-protein ingredients (fish meat) can improve the nutritional quality of fresh noodles in terms of their protein content (22).

Protein plays a vital role in the human body, namely in the growth and maintenance of cells and tissues, as the main source of energy after carbohydrates and fats, and as a building agent and regulator. In addition, protein also plays an essential role in regulating enzymes in the body's metabolic processes and body hormones from the dangers of toxic substances (23). In children, protein plays a role in physical activity; the more active, the higher the need for protein. Protein intake is the most impactful factor on children's activities in elementary school; less protein intake in high-risk children is 2,623 times as low physical activity compared to adequate protein intake (24). Protein also increases hemoglobin levels; the higher the protein intake, the higher the hemoglobin levels, thus preventing anemia in adolescent girls (25). The study's results by previous researchers stated a significant relationship between protein intake and the incidence of KEK in brides-to-be; this is illustrated by the size of a person's LiLA (26). Protein intake is also closely related to stunting in Baduta; infants with a history of nutrient intake (protein) that is less than needed have a 20 times greater risk of stunting (27). The fiber and carbohydrate content analysis showed a significant difference ($P<0.05$) between the treatment of F2 and F4 formulations, respectively, 8.65% and 16.04% of crude fiber values. Then, by 27.79% and 6.02% carbohydrate value

.

Fe Mineral

Analysis of iron (Fe) mineral content was carried out on formulations F2 (Lumi-lumi fresh noodles carrot extract) and F4 (Lumi-lumi fresh noodles beetroot extract) presented in the graph below

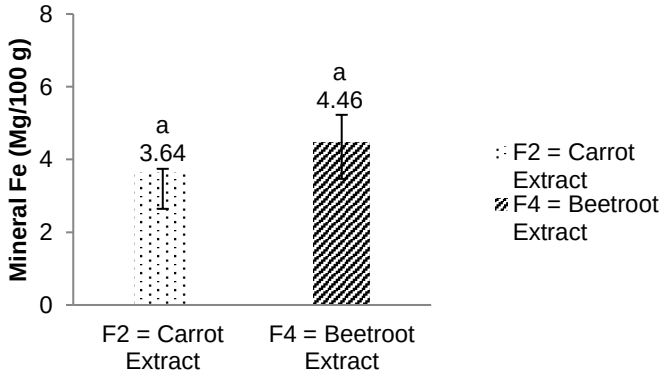

Figure 2. Graph the average iron (Fe) mineral content in the best-formulated Lumi-lumi fresh noodles.

The results of the Fe mineral analysis between F2 and F4 treatments showed no significant difference (P>0.05), as presented in Figure 2. The average iron (Fe) levels of F2 and F4 were 3.64% and 4.46%.

Iron in the body has essential functions for the nervous system, including myelination, neurotransmitters, dendrithogenesis, and nerve metabolism. Iron deficiency in infants affects growth, cognitive function, and behavior. In adolescents, iron becomes a source of energy for muscles that impact physical endurance and ability to work. Iron deficiency during pregnancy can increase the risk of perinatal and infant mortality (28).

Antioxidant activity

Antioxidant activity content was analyzed on formulations F2 (Lumi-lumi fresh noodles carrot extract) and F4 (Lumi-lumi fresh noodles beetroot extract), presented in the graph below.

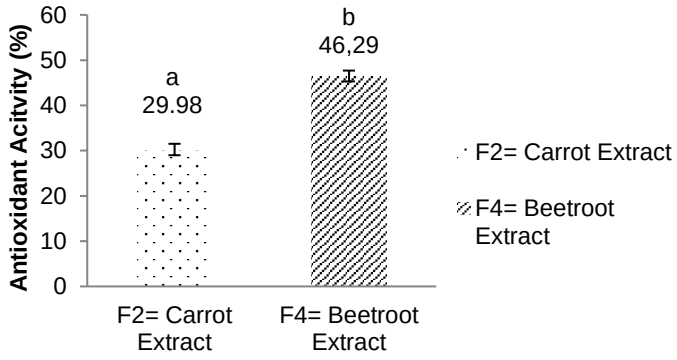

Figure 3. Graph the average antioxidant activity content in the best-formulated Lumi-lumi fresh noodles.

In the results of antioxidant activity (Figure 3), there was a significant difference (P<0.05) between treatments with F2 and F4 respectively, namely 29.98% and 42.90%. High levels of antioxidant activity in F4 (beet extract) are thought to contain many bioactive components that act as antioxidants. Beets contain flavonoids 360-2760 mg/kg, betacyanin 840-900 mg/kg, betanin 300-600 mg/kg, ascorbic acid 50-868 mg/kg, and carotenoids 0.44 mg/kg (29). Such compounds act as antioxidants.

Antioxidant compounds are reported to be effective in inhibiting the development of colon cancer cells (30) and hypertension in the elderly (31), and the flavonoid content in beets is known to prevent cognitive disorders and neurodegenerative diseases (32).

CONCLUSIONS AND RECOMMENDATIONS

The results of the physical and sensory quality tests of selected products are on fresh noodles fortified with carrot and beet extract. Then the results of identifying protein content, crude fiber, Fe mineral, and the highest antioxidant activity were obtained in the fortification treatment of beet extract, covering 14.47%, 16.04%, 4.46 mg / 100 g, and 42.90%.

Thus, Lumi-lumi fresh beetroot noodles are recommended as functional local food products because they contain Fe mineral and high antioxidant activity.

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