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ANTIOXIDANT ACTIVITY OF YELLOW PUMPKIN NOODLES (*Cucurbita moschata* Durch) WITH TUNA BONE MEAL

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ABSTRACT

Lash yellow is one of the alternative ingredients for making dry noodle products substituted with wheat flour. The use of yellow pumpkin in making dry noodles because yellow pumpkin contains lots of carbohydrates, vitamins, and fiber. In addition to substituting yellow pumpkin, noodles can also add nutrients that are not yet present in the basic composition, namely calcium, obtained from the by-products of fish bones. The purpose of this study was to determine the effect of adding tuna bone meal on the characteristics and antioxidant activity of yellow pumpkin noodles and to find out the addition of the best tuna bone meal to produce yellow pumpkin noodles that panelists liked. The observational data were analyzed using ANOVA and Duncan's New Multiple Range Test (DNMRT) at a level of 1%. The treatment in this study was the addition of tuna bone meal (A = 2%, B = 6%, C = 10%, D = 14%, E = 18%). It turns out that the addition of tuna bone meal has a very real effect on water content, ash content, protein content, antioxidant activity, and calcium levels. All treatments meet the quality requirements of dry noodles SNI 8217-2015. Based on organoleptic tests, the best treatment is treatment A with the addition of tuna bone meal as much as 2% with an average of 5.39 organoleptic, with a moisture content value of 11.71%, ash content of 0.12%, protein content of 14.64%, antioxidant activity of 22.00% and calcium content of 18.8 mg / 100g.

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INTRODUCTION

Noodles are one of the most popular products by the wider community as a substitute for daily staple foods. Noodles are very practical to be processed into various types of dishes. Noodle products are used as a source of energy because they have high carbohydrates (Sri Rejeki et al., 2022). There are several types of noodles, namely: wet noodles, dry noodles, and instant noodles. Dried noodles are one of the most popular types of noodles after instant noodles because their shelf life is longer than wet noodles (Obadi et al., 2022). Dry noodles have a low moisture content of up to 13% so they have a relatively longer shelf life compared to wet noodles (Parvin et al., 2020). The raw material for making noodles is wheat flour which until now is still imported from other countries. Wheat flour imports in 2015 reached 33,497 tons per year and are expected to increase every year, so efforts are needed to reduce dependence on wheat flour imports as alternative ingredients to replace wheat flour by utilizing local natural resources such as sweet potatoes, cassava, and yellow pumpkin(Manurung et al., 2019). Pumpkin (*Cucurbita moschata* Durch) is a local food that is widely consumed by the community as vegetables and cakes (Arsul et al., 2019). The beneficial property of yellow pumpkin is to increase immunity. Other benefits of yellow pumpkin are treating fever, migraines, diarrhea, and kidney disease as well as helping to cure inflammations. Yellow pumpkin is widely used as a mixture of tomato sauce, preserved in dried form (dry preserved products), cooked as vegetables or compotes, processed into dodol, jam/jam, candied cakes (wet and dry), syrup, jelly, and made into flour (Arsul et al., 2019).

To increase the nutritional content of noodles, it is necessary to have other additional ingredients that are easily available. In addition to substituting with yellow pumpkin, noodles can also be added nutrients that are not yet present in the basic composition. Calcium is one of the nutrients that are important for the body. Calcium is the most abundant mineral in the body, about 99% of the total calcium in the body is found in hard tissues, namely bones and teeth. One of the side products that contain a lot of calcium that is easily obtained and utilized is fish bones. Fish bones are one of the by-products of various types of fish fillets, especially those that can be utilized for calcium content including milkfish bones, tilapia, gourami, and tuna. Tuna bones have a lot of nutrients (Satrio Wicaksono et al., 2022), (Yuliani et al., 2020). The by-products of tuna bones are used in flour which is rich in calcium and minerals. The higher the concentration of tuna bone meal added, the higher the calcium of a product (Rachma Sari & Siqhny, 2022). The calcium content in tuna bone meal is higher than the calcium content in other fish bone meal (Arsul et al., 2019). The calcium content in catfish bone meal is 13.48%, yellowfin tuna bone meal is 2.12%, catfish bone meal is 30.95% and tuna bone meal ranges 39-40%(Sugiyama et al., 2022). One aspect of the use of tuna bone meal is by adding tuna bone meal in the manufacture of functional food products to add nutrients in food, one of the food products that can be added calcium and can be accepted by the community is noodles.

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RESEARCH MATERIALS AND METHODS

Materials and Tools

The main ingredients used in this study were yellow pumpkins picked in farmers' gardens in Nagari Pasia Palangai and Tuna fish bones taken directly at Ayo Bangkit Small Industry in Padang City. Other supporting ingredients are wheat flour, salt, eggs, water, and acetic acid.

The equipment used in making yellow pumpkin noodles is the basin, knife, blender, noodle milling machine (ampia), pot, scale, colander, stove, stirring spoon, and glass. Equipment used for includes: ovens, kilns, porcelain cups, kjeldahl utensils, sockets, incubators, disc paper, autoclaves, micropipettes, micrometers, *color readers*, *beaker glass*, measuring cups, herma test tubes, petri dishes, desiccators, erlenmeyer, spatulas, measuring pipettes, suction balls, knives, and plastic cups.

Research Methods

The study was conducted in stages, namely: making yellow pumpkin porridge, making tuna bone meal, and making yellow pumpkin noodles with tuna bone meal.

The procedure for making yellow pumpkin pulp

Making yellow pumpkin pulp begins with cleaning the yellow pumpkin. Yellow pumpkin cut into small, cubed-shaped pieces. Yellow pumpkin is steamed at a temperature of 100ºC for 15 minutes. Then the yellow pumpkin is crushed, and after crushing it becomes yellow pumpkin pulp.

Making Tuna Bone Meal

The manufacturing process begins with cleaning the tuna bones. The tuna fish bones are cut into small pieces. Then the initial boiling process is carried out for approximately 12 hours which is divided into 3 stages of boiling each is 4 hours. Stage 2 boiling is carried out for 3 hours using a pressure cooker. After that, rendamana with acetic acid is carried out for 12 hours, and after soaking the tuna bones are cleaned. Drying tuna bones using an oven with a temperature of 125ºC for 2 hours. Next, the tuna fish bones are coarsely ground and roasted. Then grinding using a blender to produce fine bone meal. Tuna bone meal is sifted using a 60 mesh sieve (Meiyasa & Tarigan, 2020 yang dimodifikasi).

Making Yellow Pumpkin Noodles with Tuna Fish Bone Meal

Prepare 20 gr of yellow pumpkin paste and 80 gr of red wheat flour. Then tuna bone meal as much as 2 gr, 6 gr, 10 gr, 14 gr, and 18.3 gr. After that, stirring is done by mixing wheat flour "Cakra Kembar" produced by bogasari-Indonesia, yellow pumpkin porridge, fish bone meal, salt, water, and eggs in a basin. Stirring is done to mix water with ingredients to form a uniform dough. After the dough is formed, it is allowed to stand for 10 minutes, to facilitate the formation of thin sheets. Then the dough is put in the noodle milling machine (atalas) part 1 to make the noodles flatter so that they reach a thickness of 3 mm. The dough that has been pressed so that it forms sheets is then inserted into the noodle milling machine part 2 to be further milled so that it is noodle-shaped. The noodles are dried in the oven for 3 hours at 70°C and become dried yellow pumpkin noodles with tuna bone me.

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Figure 1. Yellow pumpkin noodles

Analyst Procedures

The analysis carried out was: water content, ash content, protein content, antioxidant activity, calcium, and organoleptic (color, texture, taste, and aroma).

Analysis data

The data obtained from the observations will be analyzed statistically using the Analysis of Variance (ANOVA). If F counts ≥ F table then proceed with the Duncan New Multiple Range Test (DNMRT) at the level of 5%.

RESULTS AND DISCUSSION

Table 2. Average water content, ash content, protein content, antioxidant activity, and calcium in yellow pumpkin noodles.

Tuna bone meal concentration(%)	Water content (%)	Ash content (%)	Protein content (%)	Antioxidant activity (%)	Calcium (mg/100g)
A= 2	11,71	0,12	14,64	22,00	18,8
B= 6	10,71	0,2	18,43	24,38	51,7
C= 10	8,6	0,26	22,73	24,57	248,9
D= 14	6,65	0,35	25,43	27,33	340,0
E= 18	3,93	0,5	28,18	27,81	414,8

Water Content

The results of the diversity analysis showed that the difference in the addition of tuna bone meal had a very distinct effect ($P<0.01$) on the water content of yellow pumpkin noodles. Table 2 shows the moisture content of yellow pumpkin noodles ranges from 3.93% – 11.71%. The highest water content was found in treatment A of 11.71% while the lowest water content was obtained in treatment E of 3.93%. Based on DNMRT follow-up tests at the

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level of 1%, each treatment showed a very noticeable difference in the moisture content of yellow pumpkin noodles. The higher the concentration of tuna bone meal in yellow pumpkin noodles, the lower the water content.

The decrease in water content due to tuna bone meal plays a role in water absorption When making dough, so the more tuna bone meal is added, the moisture content of the dried noodles will be. The same thing was also reported by (Manurung et al., 2019), that the moisture content of crackers decreases with increasing concentrations of yellowfin tuna bone meal. Furthermore, the water content of biscuits decreases along with the increase in jangles bone meal and catfish bone meal (Zi et al., 2022).

The highest water content is found in yellow pumpkin noodles with a concentration of adding tuna bone meal by 2%, which is 11.71%, while the lowest water content is found in yellow pumpkin noodles with a concentration of adding tuna bone meal by 18%, which is 3.93%. The water content obtained in this study meets the requirements of dry noodles SNI 8217-2015 a maximum of 13%.

Ash content

The results of the diversity analysis showed that the difference in the addition of tuna bone meal had a very distinct effect ($P<0.01$) on the ash content of yellow pumpkin noodles. Table 2 shows ash content ranging from 0.12% - 0.50%. The highest ash content was found in treatment E of 0.50% and the lowest ash content was found in treatment A of 0.12%. Based on DNMRT follow-up tests at the level of 1%, each treatment showed a very noticeable difference in the ash content of yellow pumpkin noodles. The higher the concentration of tuna bone meal in yellow pumpkin noodles, the higher the ash content.

The ash content of yellow pumpkin noodles with the addition of tuna bone meal will increase with the higher the addition of tuna bone meal. This is due to the treatment of adding fish bone meal by the main constituent components of fish bones are minerals. Bones are contained living cells in the form of mineral salts. Mineral salts are components consisting of 80% calcium phosphate and the rest consist of calcium carbonate and magnesium phosphate. Research (Parvin et al., 2020), that the addition of jingles fish bone meal can increase the ash content of biscuits.

The largest ash content was found in yellow pumpkin noodles with the addition of 18% tuna bone meal concentration of 0.50%., while the smallest ash content in yellow pumpkin noodles with the addition of 2% tuna bone meal concentration of 0.12%. The ash content obtained in this study met the requirements of dry noodles SNI 8217-2015 a maximum of 0.1%.

Protein Levels

The results of the diversity analysis showed that the difference in the addition of tuna bone meal had a very real effect ($P<0.01$) on the protein content of yellow pumpkin noodles. Table 2 shows the protein content of yellow pumpkin noodles produced ranges from 14.64% - 28.18%. The highest protein content was found in treatment E at 28.18% while the lowest protein content was found in treatment A at 14.64%. Based on DNMRT follow-up tests at the level of 1%, each treatment showed a very noticeable difference in the protein levels of yellow pumpkin noodles. The more tuna bone meal added to the yellow pumpkin noodles, the higher the protein content.

The protein content of tuna bone meal is higher than the yellow pumpkin content. According to (Arsul et al., 2019) The protein content in tuna bone meal is 23.86%. This is

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according to research(Sri Rejeki et al., 2022), The addition of snakehead fish bone meal in making crackers can increase the protein content of crackers**.** Next mention that jangilus fish bone meal added in making biscuits can increase protein content. In addition, the protein content of biscuits produced tends to increase with the higher addition of yellowfin tuna bone meal (Zi et al., 2022).

The largest protein content is found in yellow pumpkin noodles with the addition of 18% tuna bone meal concentration of 28.18%, while the smallest protein content is found in yellow pumpkin noodles with the addition of 2% tuna bone meal concentration of 14.64%. Protein levels obtained in this study meet the minimum requirements of SNI 8217-2015 10%.

Antioxidant Activity

The results of the diversity analysis showed that the difference in the addition of tuna bone meal had a very distinct effect ($P<0.01$) on the antioxidant activity of yellow pumpkin noodles. Table 2 shows the antioxidant activity of yellow pumpkin noodles produced ranging from 22.00% - 27.81%. The highest antioxidant activity was found in treatment E of 27.81% while the lowest antioxidant activity was found in treatment A of 22.00%. Based on DNMRT follow-up tests at the level of 1%, each treatment showed a significant difference in the antioxidant activity of yellow pumpkin noodles. The higher the concentration of tuna bone meal in yellow pumpkin noodles, the higher the antioxidant activity content.

According to (Yuliani et al., 2020) Intake of foods that contain lots of vitamins C, E, and beta-carotene as well as phenolic compounds and flavonoids can protect us from free radical attacks because these compounds act as natural antioxidants. The content of antioxidants in food will cause free radical inactivation that can stop or delay the oxidation process. Yellow pumpkin contains α-carotene, β-carotene, lutein, and zeaxanthin. The content of beta carotene is 6.9 mg per 100 grams. Beta carotene has the ability as an antioxidant that can play an important role in stabilizing carbon-nucleated radicals. The activity of beta carotene can prevent the occurrence of plaque or cholesterol deposits in the blood vessels (Liu et al., 2022).

Calcium Levels

Calcium is the most abundant mineral in the body and is among the most important. The body needs calcium to form and repair bones and teeth, help nerve function, muscle contraction, and blood formation, and play a role in heart function. All calcium that enters the body (through food or intake) is mostly stored by the body and is not removed through urine or feces (Zi et al., 2022).

Fish bones are a by-product of fish processing that can be reused in the form of products and foodstuffs. Tuna bones can be used as an ingredient in making flour that is rich in calcium. Table 2 shows the average calcium levels in tuna bone meal addiction treatment ranging from 18.8-414.8mg/100g. The lowest calcium level was obtained in the treatment of adding tuna bone meal concentration as much as 2%, which was 18.8 mg / 100g while the highest calcium content value was obtained in adding fish bone meal as much as 18%, which was 414.8 mg / 100g.

This shows that fish bones contain high calcium minerals that increase the calcium levels of yellow pumpkin noodles produced. The more tuna bone meal is added, the higher the calcium mineral yellow pumpkin noodles. Fish bones contain a lot of calcium in the form of calcium phosphate as much as 14% of the total bone composition. This complex form of calcium phosphate is found in bones and can be absorbed by the body well around 60-70%

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(Edam, 2018).

The calcium levels of yellow pumpkin noodles at concentrations of 2%, 6%, 10%, 14%, and 18% tend to increase with the increase in tuna bone meal concentration. The higher the concentration of tuna bone meal, the more calcium in the yellow pumpkin noodles. The results of this study are in line with those conducted by (Satrio Wicaksono et al., 2022), The addition of yellowfin tuna bone meal can increase walnut macron calcium levels. The same is also explained (Obadi et al., 2022), The addition of the concentration of snakehead fish bone meal and catfish bone meal in the manufacture of biscuits can increase calcium levels.

Organoleptic Test

The organoleptic test was conducted through sensory assessment by observing the texture, color, and aroma of yellow pumpkin noodles by 25 untrained panelists.

Table 3. Recapitulation of organoleptic test values of yellow pumpkin noodles

Treatment (%)	Value					Information
	Aroma	Color	Taste	Texture	Average	
A	5,18	5,37	5,69	5,34	5,39	Like
B	4,58	5,26	5,30	5,25	5,09	Like
C	3,88	5,13	4,20	5,16	4,59	Like
D	3,48	4,44	3,46	4,46	3,96	Kinda like
E	2,77	3,53	2,61	3,41	3,08	Dislike

Remarks :taste values include 7 = very, very like 6=very like 5=like 4=somewhat like 3=dislike 2=strongly dislike 1=very, very dislike

Aroma

The aroma of food determines the deliciousness of that food. The assessment of the aroma of a food is inseparable from the function of the sense of smell. Unlike the sense of taste, the sense of smell does not depend on sight, hearing, and touch. The scent received by the nose and brain is generally a mixture of four main scents, namely, sour, rancid, and burnt (Satrio Wicaksono et al., 2022).

Table 3 shows the highest aroma rating for yellow pumpkin noodles in treatment A at 5.18 (likes), and the lowest rating for yellow pumpkin noodles is in treatment E, at 2.77 (dislikes). This is due to the concentration of fish bone meal used, the aroma produced is getting fishy along with the addition of tuna bone meal. According to (Wang et al., 2022), The distinctive aroma in fish bone meal is difficult to remove and tends to mask the distinctive aroma of additional ingredients mixed in the manufacture of biscuits. The E treatment is caused by a very disliked aroma because the high concentration of tuna bone meal results in a fishy smell on yellow pumpkin noodles.

Color

Color is one of the important aspects of meeting human tastes. Color in food can be a

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measure of quality, color can also be an indicator of freshness or maturity if a food product has good nutritional value, tasty and excellent texture, but if it has an unsightly color it will give the impression that the food product has deviated (Liu et al., 2022)

Table 3 shows the highest color rating for yellow pumpkin noodles in treatment A at 5.37 (likes), the lowest rating for yellow pumpkin noodles is found in treatment E, at 3.53 (somewhat liked). This is due to the concentration of tuna bone meal used in making yellow pumpkin noodles. In this study, the color of the yellow pumpkin noodles produced has changed from its original color, which is yellow to brownish yellow, this is due to the addition of tuna bone meal which has a darker flour color compared to other flours. The higher the use of tuna bone meal, the lower the acceptance rate of yellow pumpkin noodle color.

Taste

The taste of a food is one of the main factors that determine consumer receptivity to a product. The taste of food is a combination of tongue stimulation, aroma, and experience in consuming types of food (Liu et al., 2022).

Table 3 shows the taste assessment of yellow pumpkin noodles with the addition of tuna bone meal. From these results, the taste value of yellow pumpkin noodles ranged from 2.61% to 5.69%. The highest rating for yellow pumpkin noodles was in treatment A, which was 5.69 (very like), and the lowest rating for yellow pumpkin noodles was in treatment E, which was 2.61 (dislike). This is because the fishy taste of tuna bone meal dominates in yellow pumpkin noodles. From the results of the research obtained, the panelists preferred yellow pumpkin noodles with a smaller concentration of tuna bone meal, namely (2%) in treatment A.

Texture

The appearance of a product affects the acceptance or rejection of a product. Table 3 shows the texture assessment of yellow pumpkin noodles with the addition of tuna bone meal. From these results, the hardness texture value ranged from 3.41 to 5.34. The highest rating for yellow pumpkin noodles was in treatment A which was 5.34 (likes) the lowest rating for yellow pumpkin noodles was in treatment E which was 3.41 (dislikes).

The addition of 18% tuna bone meal to the yellow pumpkin noodles obtained results that were not liked by the panelists, this is because the more bone meal added, the harder the yellow pumpkin noodles produced. This is due to the hard texture of tuna bone meal, so if more tuna bone meal is added, it is very disturbing to the texture of yellow pumpkin noodles.

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CONCLUSION

The comparison of the addition of tuna bone meal has a very real effect on the water content, ash content, protein content, antioxidant activity, calcium, and organoleptic levels of yellow pumpkin noodles. Based on the results of organoleptic tests, the best treatment is treatment A with the addition of tuna bone meal as much as 2% with an average of 5.39 organoleptic, with values of water content (11.71%), ash content (0.12%), protein content (14.64%), antioxidant activity (22.00%) and calcium content (18.8 mg / 100g).

SUGGESTION

The suggestion for further research is to determine the shelf life of yellow pumpkin noodles with the addition of tuna bone meal to improve the quality of noodle products made from local raw materials

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