



CHARACTERISTICS OF RED DRAGON FRUIT SKIN DRY NOODLES (*Hylocereus polyrhizus*) WITH THE ADDITION OF TUNA FISH BONE MEAL

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ABSTRACT

Noodles are one of the carbohydrate alternatives to rice. To get healthy noodles, you need additional vegetables or fruit. Dragon fruit skin is high in antioxidants that function to ward off free radicals. The addition of tuna bone meal as an additional nutritional value in the form of potassium and mineral. The purpose of this study was to determine the best characteristics of red dragon fruit skin dry noodles with the addition of tuna fish bone meal which were the best in making dry noodles that the panelists liked. This study used a Completely Randomized Design (CRD) with 5 treatment levels and 3 replications. Observational data were analyzed using Duncan's New Multiple Range Test (DNMRT) at 1% level. The treatment in this study was the addition of tuna fish bone meal to dried red

dragon fruit skin noodles (A=2%, B=4%, C=6%, D=8%, E=10%). The results showed that the addition of tuna bone meal had highly significant different, ash content, protein content, antioxidant test and calcium content. Based on the organoleptic test, dry noodles with treatment B (Addition of 4% tuna fish bone meal) were most preferred by the panelists and met the quality requirements of SNI No 8217-2015 with a composition of water content (11,47%), ash content (0,45%), protein content (16,24%), antioxidant test (34,38%) and calcium content (30,79%).

INTRODUCTION

Instant noodles have an impact that is not good for health if consumed in excess, because they contain many preservatives and low nutritional content (Fitria, 2021a). Excessive consumption of instant noodles can cause a buildup of harmful chemicals in the body and result in damage to brain tissue cells. This condition will cause the effect of decreasing brain signal transmission which triggers diseases, such as stroke and paralysis (Risyanu *et al.*, 2019).

Another alternative to consume preservative-free noodles and the addition of vitamins is noodles made from vegetables or fruit. The principle of making vegetable or fruit noodles is the same as making other noodles. The difference is with the addition of vegetables or fruits to increase vitamins that are useful for the body. Vegetable or fruit noodles that exist today are spinach noodles, mustard, carrots and red dragon fruit. The addition of juice from vegetables or fruits not only gives an attractive color, but also increases the nutritional value of noodles (Faridah *et al.*, 2019).

Red dragon fruit is a good source of fiber, vitamins and minerals for the body. The general nutritional content found in this fruit is in the form of potassium, ferum, fiber, calcium and sodium. The content of vitamins in this fruit is also large and uniform. In general, red dragon fruit contains vitamins B1, B2 and B3 (Analianasari dan Zaini, 2016). Red dragon fruit contains betacyanin dye, high fiber and antioxidants (Enjelina *et al.* 2019). The by-products of red dragon fruit in the form of skin by 35% have not been utilized optimally and disposed of as waste (Niah dan Baharsyah, 2018), even though red dragon fruit skin extract contains antioxidants in the form of vitamin C, alkaloids and steroids (Noor dan Yufita, 2016).

Antioxidants are compounds that can inhibit oxidation reactions by binding to free radicals and highly active molecules (Nizori *et al.* 2020). Antioxidants are needed by the body to overcome and prevent oxidative stress caused by increased production of free radicals formed due to stress factors, radiation, UV rays, air pollution and the environment

In addition to red dragon fruit skin, there are several animal by-products that are easily obtained and used to increase the nutritional content of foods such as 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. One type of fish that has a high nutritional content in its bones is tuna (Hermawan, 2016). Tuna bones have a high nutritional content among fish body parts, because the main elements of fish bones are calcium, phosphorus and carbonate (Hafsiyah, 2018).

Tuna bones are used into flour that is rich in calcium and minerals. The higher the concentration of tuna bone meal added, the higher the calcium of a product (Salitus *et al.*, 2017). Fish bone meal has a high calcium content, namely manyung fish 12.8mg / 100 grams, bigeye fish 15.2 mg / 100 grams (Iwansyah, 2008) and tuna by 17.47% (Talib *et al.*, 2014). The calcium content in fish bones can be an alternative to meet the needs of calcium in the body (Bakhtiar *et al.*, 2019). Calcium in the body can be useful for the formation and maintenance of bones. Furthermore, the formation and care of skeletal tissue of the body as

well as several important activities in the body such as blood clotting, muscle contraction, maintaining hormonal balance and catalyzing biological reactions (Edam, 2016).

RESEARCH MATERIALS AND METHODS

Materials and Tools

The main ingredients in this study were wheat flour and dragon fruit skin. Other supporting ingredients are salt, eggs, water and acetic acid.

The tools used in making dry noodles consist of a basin, knife, blender, noodle milling machine (ampia), pot, scale, colander, stove, stirring spoon and glass. Tools used for chemical analysis consist of: oven, gegep, erlenmeyer, porcelain dish, analytical balance, ash solution, HCl, H₂SO₄, filter paper, kjedahl flask 500 ml, distillation device, burette 50 ml, measuring pipette 5 ml, Erlenmeyer 50 ml, drip pipette, beaker 250 ml and fume hood, vortek, ultrasonic, test tube, and spectrophotometer.

Research methods

The research was conducted in 3 stages, namely: making red dragon fruit skin juice, making tuna bone meal and the process of making red dragon fruit skin noodles with tuna bone meal

The procedure for making red dragon fruit juice

The making of red dragon fruit peel extract begins with cleaning the red dragon fruit peel thoroughly with water. The red dragon fruit peel is then cut into small pieces. It is then blended with water in a 1:1 ratio. After the peel is completely crushed, the red dragon fruit peel pulp is strained to obtain the red dragon fruit peel extract (Enjelina *et al.*, 2019 yang dimodifikasi).

The procedure for making tuna bone flour

The procedure for making tuna bone flour begins with cleaning the meat from the fish bones. Then, it undergoes washing with clean water. Next, it's cut into small pieces. Subsequently, an initial boiling phase lasting 12 hours is conducted, consisting of 3 boiling stages, each lasting 4 hours at a temperature of 100°C. Following this, a second boiling phase lasting 3 hours is carried out using a pressure cooker. Then, it's washed with water three times. After that, the fish bones are soaked in 3% concentration acetic acid for 12 hours to reduce fat and protein content. Next, size reduction and cleaning are performed. It undergoes drying using an oven at 125°C for 2 hours. After oven drying, coarse grinding is done followed by roasting. Then, fine grinding is carried out using a blender to produce fine bones. It's then sifted using a 60 mesh sieve. Tuna fish bone flour is produced (Meiyasa & Tarigan, 2020 yang dimodifikasi).

The making of dried noodles from red dragon fruit peel with tuna bone flour.

The making of dried noodles from red dragon fruit peel with tuna bone flour starts with preparing wheat flour according to the procedure. Then, it's placed in a container while adding red dragon fruit peel extract, salt, and egg yolk, and mixed thoroughly until well combined. Next, tuna bone flour is added according to the treatment (2%, 4%, 6%, 8%, and 10%) and then stirred until evenly distributed. Afterward, the mixture is homogenized for 30 minutes. Then, the prepared mixture is fed into the noodle machine (ampia) part 1 to flatten the noodles until they reach a thickness of 3 mm. The pressed dough, now formed into new sheets, is then fed into the noodle machine (ampia) part 2. Next, it is rolled until it forms noodles and cut into 30 cm lengths. Then, gather the noodle pieces. Subsequently, the noodles are dried in an oven at 70°C for 3 hours. Dried noodles (Engelen *et al*, 2020 yang dimodifikasi).



Figure 1. Noodles from red dragon fruit peel

Analysis Procedure

The analyses conducted include: moisture content, ash content, protein content, antioxidant activity, calcium, and organoleptic (texture, smell, colour, and taste) analyses.

Data Analysis

The data obtained from the observations will be statistically analyzed using the Duncan's New Multiple Range Test (DNMRT) at a 5% significance level.

Result and Discussion

Table 1. Mean values of moisture content, ash content, protein content, calcium, and antioxidant activity in red dragon fruit peel noodles.

Concentration of tuna fish bone flour (%)	Moisture content (%)	Ash content (%)	Protein content (%)	Antioxidan activity	Calcium (mg/g)
A= 2	12,32	0,30	13,33	33,14	16,85
B= 4	11,47	0,45	16,24	34,38	30,79
C= 6	10,71	0,55	19,39	35,51	124,77
D= 8	7,57	0,68	23,39	37,69	192,99
E= 10	4,17	0,97	26,66	39,40	243,99

Moisture Content

The diversity analysis results indicate that the addition of tuna bone flour has a significantly different effect ($P < 0.01$) on the dry noodle moisture content of red dragon fruit skin. Table 1 shows the dry noodle moisture content of red dragon fruit skin with the addition of tuna bone flour ranging from 4.17-12.32%. The lowest moisture content was found in treatment E (with 10% addition of tuna bone flour), while the highest moisture content was found in treatment A (with 2% addition of tuna bone flour). Based on the advanced DNMRT test at a 1% level, all treatments showed a very significant difference in the dry noodle moisture content of red dragon fruit skin with the addition of tuna bone flour.

This is because tuna bone flour has a low moisture content, so the tuna bone flour will absorb the water in the dough, the more addition of tuna bone flour, the smaller the dry noodle moisture content will be. Compared to wheat flour, the moisture content of tuna bone flour is lower. Wheat flour has a moisture content of 14.5%. (Badan Standarisasi Nasional, 2009). Maulida (2005) It is stated that the moisture content of the biscuits decreases with the increasing concentration of yellowfin tuna bone flour.

Another factor that influences the moisture content of a product is the production process and storage conditions of the product. Moisture content will affect the quality of dry noodles, especially their shelf life, where excessively high moisture content in a product will cause it to deteriorate quickly. The presence of water allows for the growth and proliferation of microbes (Fitria, 2021b)

Ash Content

The diversity analysis results indicate that the addition of tuna bone flour has a significantly different effect ($P < 0.01$) on the ash content of dry noodles made from red dragon fruit skin with the addition of tuna bone flour. Table 1 shows that the highest ash content is found in treatment E (with 10% addition of tuna bone flour), and the lowest ash content is found in treatment A (with 2% addition of tuna bone flour). Based on the advanced DNMRT test at a 1% level, all treatments show a very significant difference in the ash content of dry noodles made from red dragon fruit skin with the addition of tuna bone flour.

The ash content of red dragon fruit skin noodles increases with higher concentrations of added tuna bone flour. This is because of the addition of minerals present in the tuna bone flour added to a product, as the main components of fish bones are minerals. Thus, this element causes the ash content in dry noodles made from red dragon fruit skin to increase.

Menurut Stevani (2015) The ash content increases as the amount of snakehead fish bone flour increases in the production of wet noodles. The ash content of dry noodles made from red dragon fruit skin with the addition of tuna bone flour is relatively low, ranging from 0.30-0.97%, and has met the quality standards for dry noodles (SNI 8217:2015), which is a maximum of 3%.

Protein Content

The diversity analysis results indicate that the addition of tuna bone flour has a significantly different effect ($P < 0.01$) on the protein content of dry noodles made from red dragon fruit skin with the addition of tuna bone flour. Table 1 shows that the protein content of dry noodles made from red dragon fruit skin with the addition of tuna bone flour ranges from 13.33% to 26.66%. The highest protein content is found in treatment E (with 10% addition of tuna bone flour), and the lowest protein content is found in treatment A (with 2% addition of tuna bone flour). Based on the advanced DNMRT test at a 1% level, all treatments show a very significant difference in the protein content of dry noodles made from red dragon fruit skin with the addition of tuna bone flour.

The more tuna bone flour added to red dragon fruit skin noodles, the higher the protein content in the red dragon fruit skin noodles. The protein content of tuna bone flour is higher compared to wheat flour. According to SNI (2009), the protein content in wheat flour is 7.0%. According to Nasir *et al.* (2020), the protein content in red dragon fruit skin is 8.98%. Meanwhile, the protein content in tuna bone flour is 23.86%. (Thalib, 2009). This is in line with Pratama research (2014) that adding jangilus fish bone flour in biscuit production can increase protein content.

Protein is a crucial nutrient for the body as it not only functions as fuel but also serves as a building and regulating material (Fitria, 2021a). Pratama (2014) mentioning that the measured protein content is influenced by the amount of moisture lost from the ingredients, the measured protein value will increase as the amount of lost water increases. According to SNI 8217-2015, the minimum protein content for dry noodles is 8%. Therefore, dry noodles made from red dragon fruit skin with the addition of tuna bone flour have met the requirements of SNI 8217-2015.

Antioxidant Activity

The diversity analysis results indicate that the addition of tuna bone flour has a significantly different effect ($P < 0.01$) on the antioxidant test of dry noodles made from red dragon fruit skin with the addition of tuna bone flour. Table 1 shows that the antioxidant test of dry noodles made from red dragon fruit skin with the addition of tuna bone flour ranges from 33.14% to 39.40%. The highest antioxidant level is found in treatment E (with 10% addition of tuna bone flour), and the lowest antioxidant level is found in treatment A (with 2% addition of tuna bone flour).

Based on the advanced DNMRT test at a 1% level, all treatments show a very significant difference in the antioxidant content of dry noodles made from red dragon fruit skin with the addition of tuna bone flour. This indicates that the more tuna bone flour added, the higher the antioxidant content in the red dragon fruit skin noodles. This is because tuna bone flour contains minerals. Additionally, in the process of making dry noodles using red dragon fruit skin, it causes the dry noodles to have antioxidants.

According to Winarsi (2007), antioxidants are essential for the body as they play a role in inhibiting free radicals and improving the body's resistance. Natural antioxidants are abundant in food ingredients, one of which is red dragon fruit skin. According to Nurliyana *et al.* (2010), in 1 mg/ml of red dragon fruit skin, it can inhibit $83.48 \pm 1.02\%$ of free radicals. According to Jaafar *et al.* (2009), red dragon fruit skin has a higher antioxidant potential than its flesh.

Calcium

Calcium is a crucial mineral for the human body. Its primary function is to fill bone density. Calcium also plays a role in tooth formation. It is required for blood clotting, nerve transmission, muscle stimulation, blood pH balance, and maintaining water balance. Calcium also plays a significant role in enzyme reactions, blood pressure, and preventing colon cancer, making it essential for life and health (Wirakusuma, 2007)

Fish bones are a byproduct of fish processing that can be reused in the form of products and food ingredients. Tuna fish bones can be utilized to produce flour rich in calcium. Adding tuna bone flour can provide calcium to dry noodles made from red dragon fruit skin. This is because tuna bone flour has a high calcium content.

Table 1 shows the calcium content of dry noodles made from red dragon fruit skin with the addition of tuna bone flour ranging from 16.85% to 243.99%. The highest calcium content is found in treatment E (with 10% addition of tuna bone flour), and the lowest calcium content is found in treatment A (with 2% addition of tuna bone flour). This indicates that the higher the percentage of added tuna bone flour, the higher the calcium content in the dry noodles made from red dragon fruit skin with the addition of tuna bone flour. This is because fish bones contain a high mineral calcium content, thus increasing the calcium content in the dry noodles made from red dragon fruit skin.

Based on the research results, it is evident that the calcium content of tuna bone flour in these dry noodles is higher (16.85% to 243.99%) compared to the research reported by Trilaksani *et al.* (2006), which is around 23.72% to 39.24%. The calcium needs of individuals aged 19 and above 65 are higher than those of children, which is 800 mg/day. To prevent osteoporosis, calcium needs to be met from a young age (Adawiyah and Selviastuti, 2014).

Sensory Analysis

Organoleptic testing is conducted through sensory evaluation, which involves tasting the flavor, aroma, color, taste, and texture. This test is carried out by preparing samples according to the treatment formulations. Subsequently, testing is conducted on 30 untrained panelists.

Table 2. Summary of sensory evaluation scores of red dragon fruit skin noodles

Treatment (%)	Value					Description
	Texture	Smell	Colour	Taste	Avarage	
A	5,06	4,86	3,40	4,70	4,50	Moderately
B	4,93	4,56	4,46	4,66	4,65	Like
C	4,80	4,23	4,96	4,06	4,51	Moderately
D	4,76	2,93	3,93	1,30	3,48	Dislike
E	3,96	2,80	4,83	1,16	3,18	Dislike

Explanation : The taste rate scale includes the following values 7=extremely like 6=very like 5=like 4=moderately like 3=dislike 2=very dislike 1=extremely dislike

Texture

Texture Texture is a material consisting of size, shape, quantity, and constituent elements of a substance that can be perceived by the senses of touch and taste, including the sense of mouth and sight (Antara and Wartini, 2014). Table 2 indicates the highest texture rating for dried red dragon fruit noodles with the addition of tuna bone flour in treatment A (Addition of 2% tuna bone flour) at 5.06 (like). Meanwhile, the lowest texture rating is found in treatment E (Addition of 10% tuna bone flour) at 3.96 (somewhat like). The addition of 2% tuna bone flour (treatment A) to dried red dragon fruit noodles represents the most preferred specification and texture by the panelists due to its dry texture. The higher the concentration of tuna bone flour added to the production of dried noodles, the more influence it has on the texture of the dried noodles becoming hard and not elastic. This is caused by the hard texture of the tuna bone flour, so if more tuna bone flour is added, it will greatly affect the texture of the red dragon fruit skin noodles. Najibullah et al (2013) stated that the addition of fish bone flour to a processed product can increase its hardness.

Smell

The aroma of food determines its deliciousness. The assessment of the aroma of food cannot be separated from the function of the olfactory senses. Unlike the sense of taste, the sense of smell is not dependent on vision, hearing, and touch. The aroma perceived by the nose and brain is generally a mixture of four main aromas: fragrant, sour, rancid, and burnt (Winarno, 2012). Table 2 indicates the highest aroma rating for dried red dragon fruit noodles with the addition of tuna bone flour in treatment A (Addition of 2% tuna bone flour) at 4.86 (like), while the lowest liking rating is found in treatment E (Addition of 10% tuna bone flour) at 2.80 (dislike). The addition of 2% tuna bone flour to dried red dragon fruit noodles represents the most preferred specification and aroma by the panelists because it has an aroma that is not fishy compared to other treatments. The higher the percentage of tuna bone flour added, the more the aroma of dried red dragon fruit noodles smells fishy. This is because of

the fishy aroma of the tuna bone flour. The more tuna bone flour added, the more pronounced and sharp the aroma becomes, as seen in treatments D and E. Treatment E has a higher aroma rating than all other treatments, so it is not preferred by consumers. The aroma preferred by the panelists is found in treatment A (addition of 2% tuna bone flour) (like). This fishy smell is caused by the increasing addition of tuna bone flour to the dried noodles. This is in line with the statement (Maulida, 2005) that the aroma produced by a product with the addition of tuna bone flour depends on the amount of tuna bone flour used. The higher the concentration level of tuna bone flour added, the lower the liking level of the panelists for the aroma of dried noodles.

Colour

Color in food ingredients can serve as a measure of quality; it can also act as an indicator of freshness or ripeness. If a food product has good nutritional value, tastes delicious, and has excellent texture, but its color is unappealing, it may give the impression that the food product has deviated from its expected standards. (Winarno, 2012).

Table 2 indicates the highest color assessment for dried red dragon fruit noodles with the addition of tuna bone flour in treatment C (6% addition of tuna bone flour), which is 4.96 (like), while the lowest color assessment is found in treatment A (2% addition of tuna bone flour) at 3.40 (dislike). The addition of 6% tuna bone flour to dried red dragon fruit noodles represents the most preferred specification and color by the panelists. In treatments A and B, the resulting color of the dried red dragon fruit noodles is pale; in treatment C, the resulting color is purplish-pink, while in treatments D and E, the color becomes darker. This is caused by the addition of tuna bone flour. The more tuna bone flour added, the darker the color of the dried noodles. The higher the use of tuna bone flour, the lower the acceptance level of the color of the red dragon fruit noodles.

Furthermore, the brown color of the dried noodles is caused by the Maillard reaction during the drying process at 70°C. The Maillard reaction occurs due to the reaction between reducing sugars and amino acids, resulting in browning of the food material. This is supported by Winarno (2004) opinion, which is caused by the Maillard reaction, a reaction between sugar and starch that causes the color to darken.

Taste

The taste of a food is one of the main factors that determine consumer acceptance of a product. The taste of food is a combination of tongue stimulation, smell, and experience in consuming certain types of food (Winarno, 2012). Table 2 indicates the highest taste rating for dried red dragon fruit noodles with the addition of tuna bone flour in treatment A (2% addition of tuna bone flour), which is 4.70 (like), while the lowest rating is found in treatment E (10% addition of tuna bone flour) at 1.16 (very strongly dislike). The most preferred taste by the panelists is one that does not have a fishy taste.

The addition of 2% tuna bone flour to dried noodles is the specification and taste most preferred by the panelists because it has a non-fishy taste compared to other treatments. The higher the percentage of tuna bone flour added, the more fishy the taste of the dried red dragon fruit noodles with the addition of tuna bone flour becomes. As stated by (Darmawangsyah *et al.*, 2018), the higher the level of addition of tuna bone flour, the lower

the liking level of the panelists for the taste of the evaluated food product due to the dominant fishy taste.

CONCLUSION

The addition of tuna bone flour has a significant and varied effect on the moisture content, ash content, protein content, antioxidant test, and calcium content of dried red dragon fruit noodles with the addition of tuna bone flour. Based on the results of the organoleptic test, the best treatment for dried red dragon fruit noodles with the addition of tuna bone flour is treatment B (4% addition of tuna bone flour) with an organoleptic score of 4.65, with moisture content of 11.47%, ash content of 0.45%, protein content of 16.24%, antioxidant content of 34.38%, and calcium content of 30.79%.

RECOMMENDATION

Based on the conducted research, the author recommends for future research to conduct testing for metal contamination, microbial contamination, and observation of the shelf life of dried red dragon fruit noodles with the addition of tuna bone flour.

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