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Sensory Quality of Fresh Noodles Made with Red Dragon Fruit Peel Extract as a Natural Colorant

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Abstract

Fresh noodles are widely consumed because of their chewy texture and ease of preparation. Product development in fresh noodles can be enhanced by using natural ingredients as colorants while increasing product value, including red dragon fruit peel, which contains anthocyanin pigments. This study aims to analyze the effect of substituting red dragon fruit peel extract on the sensory quality of fresh noodles, including color, aroma, chewy texture, resistance to breaking, and taste. An experimental design was employed using a Completely Randomized Design consisting of two treatments with three replicates: 150 ml of water as the control treatment (X_1) and 150 ml of red dragon fruit peel extract as the substitution treatment (X_2). Product quality was assessed through an organoleptic test involving 30 untrained panelists using a hedonic scale. Data were analyzed using an independent samples t-test. The findings show that the substitution of red dragon fruit peel extract significantly affected all sensory quality parameters of fresh noodles. Treatment X_2 obtained higher scores than treatment X_1 across all parameters, including color (5.34), aroma (5.00), chewy texture (5.09), resistance to breaking (5.10), and taste (5.11). These results indicate that red dragon fruit peel extract can improve the sensory quality of fresh noodles as a natural colorant. The study concludes that

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the best sensory quality was achieved through the substitution of 150 ml of red dragon fruit peel extract, suggesting its potential application in fresh noodle product development.

Keywords: Fresh Noodles; Red Dragon Fruit Peel Extract; Sensory Quality; Hedonic Test; Natural Colorant

INTRODUCTION

Noodles are one of the flour-based processed food products that are very popular and widely consumed by various people. This product is known to be practical, economical, and flexible in processing and presentation (Philia et al., 2020; H. O. Putri, 2023). In general, noodles are made from a mixture of wheat flour, water, and salt, and can be modified with the addition of other ingredients to improve the quality and added value of the product (Efendi et al., 2018; Trisia et al., 2021). Based on their characteristics, noodles are differentiated into fresh noodles and dry noodles, where fresh noodles have a chewy texture and high moisture content, but have a relatively short shelf life (Li et al., 2023; Viza & Ratih, 2024). On the other hand, the nutritional content of noodles is still dominated by carbohydrates and proteins, while the content of fiber, vitamins, and antioxidants is relatively low (Gulia et al., 2023). This condition encourages the need for innovation in noodle processing, especially fresh noodles, so that it not only meets energy needs, but also has better functional value.

As public awareness of healthy and natural food consumption increases, the development of food products based on natural ingredients is becoming an increasingly actual topic in the field of food technology. Research by Sudiarta (2022) and Damiati, Masdarini, & Suriani (2024) shows that consumers tend to choose products that are not only delicious, but also contain bioactive compounds that are beneficial to health. One of the approaches that has been widely developed is the use of natural ingredients as dyes as well as a source of antioxidants, replacing synthetic materials that have the potential to pose health risks (M. A. Putri et al., 2024). In this context, red dragon fruit (Hylocereus polyrhizus) is a potential ingredient because it contains high levels of natural pigments and bioactive compounds (Ratmita et al., 2024; Riska & Jus'at, 2023). Furthermore, recent research has also begun to lead to the use of parts that have been considered waste, such as

dragon fruit peel, which turns out to have a high antioxidant content (Aisya et al., 2021; Jannah et al., 2024).

However, based on a state of the art study, research on the use of dragon fruit in food products is still dominated by the use of fruit pulp and applications in liquid or semi-liquid products, such as beverages and desserts (Andina et al., 2024; Andiresta et al., 2025; Mursono, 2020; Rossi et al., 2025; Setiadi & Ruswanti, 2024; Shah et al., 2025). Research by Aliya, Riyanta, & Muldiyana (2024) and Sawiji & La (2021) shows that dragon fruit peel extract has the potential as a source of antioxidants and natural dyes. However, studies that specifically tested the effect of substitution of red dragon fruit peel extract on flour-based products, especially fresh noodles, are still limited, especially in terms of sensory quality which includes color, aroma, taste, and texture. In addition, previous research has not comprehensively integrated aspects of material substitution, sensory quality, and panelist acceptance rate in a single complete study. Thus, there has been no study that has simultaneously examined the effect of substitution of red dragon fruit peel extract on the sensory quality of fresh noodles as well as the level of consumer acceptance, so this shows that there is a research gap that needs further research.

Based on this description, the natural ingredient substitution approach is seen as a relevant solution to improve the quality of fresh noodles sensorially and functionally. Therefore, this study is focused on the effect of substitution of red dragon fruit peel extract on the sensory quality of fresh noodles. The formulation of the problem in this study is how the substitution of red dragon fruit peel extract affects the color, aroma, taste, and texture of fresh noodles. This study aims to analyze the effect of substitution of red dragon fruit peel extract on the sensory quality of fresh noodles on each of these indicators. The hypothesis proposed refers to the opinion of Sugiyono (2008), namely the zero hypothesis (H_0) states that there is no effect of substitution of red dragon fruit peel extract on the sensory quality of fresh noodles, while the alternative hypothesis (H_1) states that there is a significant influence on the color, aroma, taste, and texture of fresh noodles.

This research has a scientific contribution and novelty that lies in the use of red dragon fruit peel extract as a substitute ingredient in flour-based fresh noodle products, which not only functions as a natural dyes, but also as a source of bioactive compounds. In contrast to previous research that focused on fruit pulp or non-solid products, this study emphasizes the application of dragon fruit peel waste in flour-based products with a focus

on a thorough sensory quality evaluation. In addition, this research also makes a practical contribution as an alternative to the development of fresh noodle products that are healthier, more attractive, and environmentally friendly, as well as supporting the use of agricultural waste into value-added products. Thus, this research is expected to enrich studies in the field of food technology, especially related to product innovation based on natural and sustainable ingredients.

METHODS

This study applies a pure experiment approach using a Complete Random Design (RAL) design. This study examined the effect of substitution of red dragon fruit peel extract (Hylocereus polyrhizus) on the sensory quality of fresh noodles. The treatment used consisted of two variations, namely 0 ml (X_0) as a control and 150 ml (X_1) as a treatment, each of which was carried out three times. Observations were focused on the sensory qualities of fresh noodles which included color, aroma, texture, and taste.

Sensory evaluation was carried out using a hedonic test to assess the level of panelists' preference for color, aroma, texture, and taste on a scale of 1–5 (Manuhutu, 2023). A total of 30 untrained panelists, namely Culinary students of Padang State University with normal senses and without allergies, were involved to find out the initial acceptance rate of fresh noodles with the substitution of red dragon fruit peel extract.

Materials and Tools

The main ingredients include high-protein wheat flour, chicken eggs, salt, vegetable oils, water, and fresh red dragon fruit peels. The extract is made through washing, cutting, blanching, crushing (1:1 ratio with water), and filtering using a blender. he materials used are presented in Table 1.

Table 1. Composition of Ingredients for Making Fresh Noodles with Red Dragon Fruit Peel Extract Substitution

No.	Ingredients	X_0 (0 ml)	X_1 (150 ml)
1	Wheat flour	500 g	500 g
2	Chicken eggs	50 g	50 g
3	Salt	10 g	10 g
4	Water	150 ml	0 ml
5	Vegetable oil	20 ml	20 ml
6	Red dragon fruit peel extract	0 ml	150 ml

Description:

X_0 = control (no substitution)

X_1 = 150 ml extract substitution

The equipment used in this study includes laboratory standard food measuring and processing tools, namely digital scales, blenders, mixing bowls made of stainless steel, noodle grinding machines, gas stoves, pots made of stainless steel, measuring cups, cloth filters made of fine fabric, and plastic containers (thinwall) that are food grade.

Research Implementation

How to make fresh noodles with red dragon fruit peel extract substitution is as follows.

1. The initial stage of research begins with cleaning all tools and materials to maintain hygiene during the processing process.

2. The skin of the red dragon fruit is washed thoroughly, then cut into small pieces to facilitate the processing process.

3. The skin of the blanching dragon fruit is mashed using a blender with the addition of water (1:1 ratio) until it becomes a pulp.

4. The blender results are filtered using a filter cloth to separate the pulp and red dragon fruit peel extract is obtained.

5. Wheat flour (500 g), eggs (50 g), and salt (10 g) are put in a mixing bowl, then mixed until homogeneous.

6. Water (for control) or red dragon fruit peel extract (for treatment) is added little by little while the dough is kneaded until well mixed and forming a dough.

7. Vegetable oil (20 ml) is added to the dough, then kneaded again until smooth and homogeneous.

8. The dough is ground using a noodle grinder until it reaches the desired thickness, then molded into noodle strips.

9. The noodles are boiled in boiling water for ±1–3 minutes until cooked, then removed and drained.

10. The cooked noodles are cooled at room temperature (±28°C). If not tested immediately, the sample is stored in a sealed container at a cold temperature (±4°C).

11. The resulting fresh noodles are then used for sensory quality testing which includes color, aroma, texture, and taste.

The stages or procedures for producing fresh noodles with the substitution of red dragon fruit peel extract are illustrated in the research process diagram shown in Figure 1.

Figure 1. Research Stage Process of the Effect of Red Dragon Fruit Peel Extract Substitution on the Sensory Quality of Fresh Noodles

Data Analysis

The data from the hedonic test results were tabulated in the form of a table, then analyzed using an independent sample t-test with the help of SPSS software version 26

(IBM Corp., USA). Before hypothesis testing is carried out, the data is first tested for normality and homogeneity as a prerequisite for parametric analysis to ensure that the data is normally distributed and has a homogeneous variance. Hypothesis testing was carried out at a significance level of 5% ($\alpha = 0.05$), with a hypothesis of zero (H_0) stating that there was no significant effect of substitution of red dragon fruit peel extract on the sensory quality of fresh noodles which included color, aroma, taste, and texture, as well as an alternative hypothesis (H_1) stating that there was a significant influence on these four aspects. The decision-making criteria were H_0 rejected and H_1 accepted if the significance value (Sig.) < 0.05 or the value |t calculated| > t table, which showed a significant effect of substitution of red dragon fruit peel extract on the sensory quality of fresh noodles. On the other hand, if the significance value (Sig.) ≥ 0.05 or |t calculate| ≤ t table, then H_0 is accepted and H_1 is rejected.

RESULTS

Data Description Difference in Quality of Fresh Noodles using 150 ml Water and Fresh Noodles Red Dragon Fruit Peel Extract Substitution 150 ml

Based on the results of data analysis obtained through organoleptic tests, an assessment was carried out on fresh noodles made using 150 ml (X1) water and fresh noodles with a substitution of 150 ml (X2) red dragon fruit peel extract. The data obtained was then described in the form of an average value to determine the difference between X1 and X2 treatment of the sensory quality of fresh noodles which included shape, color, aroma, texture, and taste. The results of the analysis of the mean panelists' evaluations of the two treatments are illustrated in the radar chart presented in Figure 2.

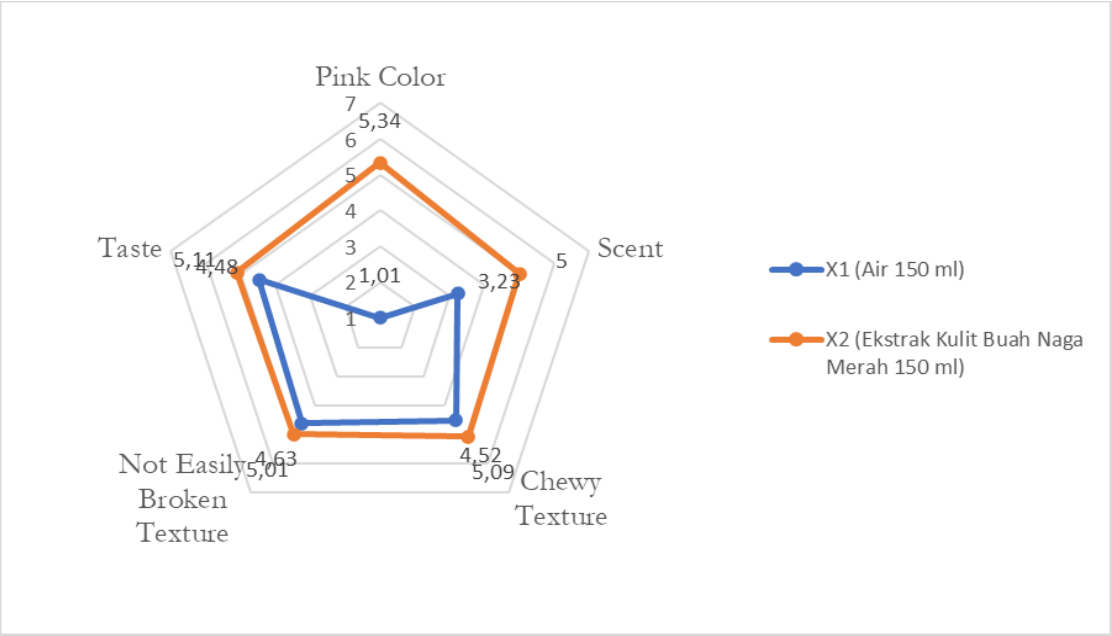

Figure 2. Sensory Radar Graph Wet Noodles Red Dragon Fruit Peel Extract Substitution

Comparison of the sensory quality of fresh noodles between treatment without 150 ml (X_1) water substitution and 150 ml (X_2) red dragon fruit peel extract substitution on the parameters of color, aroma, chewy texture, non-breakable texture, and taste is presented comprehensively in the form of a radar graph in Figure 2. Radar graphs are used to provide a comprehensive visual representation of the difference in the mean values of each sensory parameter between the two treatments.

1. Color (Pink)

Based on the radar graph on the color parameters, it can be seen that the average value of the substitution treatment of 150 ml red dragon fruit peel extract (X_2) of 5.34 is higher than the treatment without substitution (X_1) of 1.01. These results show that the substitution of red dragon fruit peel extract has a significant effect on improving the color quality of fresh noodles, resulting in a more attractive pink color than yellowish-white noodles without substitution.

2. Scent

In the aroma parameters, it can be seen that the average value of the X_2 treatment of 5.00 is higher than the X_1 treatment of 3.23. This shows that the addition of red dragon fruit peel extract contributes to improving the quality of the aroma of fresh noodles based on the panelists' assessment.

3. Texture (Chewy)

In the elastic texture parameter, it can be seen that the average value of the X_2 treatment of 5.09 is higher than the X_1 treatment of 4.52. The difference in value shows that the substitution of red dragon fruit peel extract has a positive effect on the level of chewiness of fresh noodles resulting in a better texture.

4. Texture (Not easy to break)

In the texture parameter that is not easy to break, it can be seen that the average value of the X_2 treatment of 5.10 is higher than the X_1 treatment of 4.63. This shows that the use of red dragon fruit peel extract is able to increase the elasticity of fresh noodles so that it produces a stronger texture and does not break easily.

5. Taste

In the taste parameters, it can be seen that the average value of the X_2 treatment of 5.11 is higher than the X_1 treatment of 4.63. These results show that the substitution of red dragon fruit peel extract contributes to improving the taste quality of fresh noodles so that it is more acceptable to the panelists.

Overall, the shape of the radar graph area showed that the 150 ml (X_2) red dragon peel extract substitution treatment had a larger area area than the non-substitution treatment (X_1). This shows that the substitution of red dragon fruit peel extract provides an overall improvement in the sensory quality of fresh noodles on all observed parameters.

To further substantiate the sensory data analysis results, a visual comparison of the two fresh noodle products is presented in Figure 3.

Red Dragon Fruit Peel Extract Substitution 150 ml

Red Dragon Fruit Peel Extract Substitution 150 ml

Figure 3. Visual Comparison of Fresh Noodles Without Substitution and with Red Dragon Fruit Peel Extract Substitution 150 ml

Visually, noodles without substitutions are yellowish-white, while noodles with dragon fruit peel extract are more attractive in pink. The shape of both is the same, but the substituted noodles look fresher, thus increasing the visual appeal of the product.

Hypothesis Testing

The results of the independent sample t-test showed that all sensory quality parameters of fresh noodles (color, aroma, texture, and taste) had a value of |t calculated| > t table (2.00172) and Sig. < 0.05. This shows a significant difference between fresh noodles using 150 ml (X_1) water and fresh noodles with a substitution of 150 ml (X_2) red dragon fruit skin extract. Overall, the mean value of X_2 was higher than X_1 in all parameters, so it can be concluded that the substitution of red dragon fruit peel extract had a significant effect on improving the sensory quality of fresh noodles.

A summary of the results of the t-test analysis of all sensory quality parameters of fresh noodles is presented in the following table 3.

Table 3. Summary of the Fresh Noodle Quality Test

No	Parameter	X_1	X_2	t-value	t-table	Sig.
1	Color	1.01	5.34	-58.052	2.00172	0.05
2	Aroma	3.23	5.00	-9.234	2.00172	0.05
3	Chewy texture	4.52	5.09	-4.557	2.00172	0.05
4	Not easily broken	4.63	5.10	-3.996	2.00172	0.05
5	Taste	4.48	5.11	-4.832	2.00172	0.05

Based on the data in the table, all sensory quality parameters showed a greater |t count| value than the t table, so it can be concluded that there is a significant difference between the X_1 and X_2 treatments in each aspect tested. These findings confirm that the substitution of red dragon fruit peel extract has a real effect on improving the sensory quality of fresh noodles, which will be discussed in more depth in the discussion section.

DISCUSSION

This study aims to obtain scientific data on the effect of substitution of red dragon fruit peel extract on the sensory quality of fresh noodles through three repetitions. Based on the results of the hypothesis test using an independent sample t-test, all parameters show the value of |t calculate| > t table (2.00172) and the significance value < 0.05, so H_0

is rejected and H_a is accepted. This proves that there is a significant difference between controlled fresh noodles (150 ml of water) and fresh noodles with the substitution of 150 ml red dragon fruit peel extract in terms of color, aroma, texture, and taste. Thus, the substitution of red dragon fruit peel extract has a real effect on improving the sensory quality of fresh noodles.

In comparison with previous studies, several limitations can be identified. For instance, research by Ghosh et al. (2024); Joshi et al. (2025); Singh et al. (2023) mainly focused on the role of natural pigments in enhancing color without comprehensively examining other sensory attributes such as aroma, texture, and taste simultaneously. Similarly, Chen et al. (2025); Sipos et al. (2021), emphasized aroma characteristics but did not integrate a full sensory evaluation across multiple parameters. Furthermore, studies such as Guiné (2022); Lesme et al. (2020); Nufus (2023), primarily investigated texture aspects, particularly elasticity, without linking them to overall product acceptability. Research conducted by Mao & Stocker (2024); Parker et al. (2024) also tended to focus on structural stability without incorporating sensory perception holistically. In addition, Andrade et al. (2024), examined taste improvement using natural ingredients but did not specifically utilize dragon fruit peel extract nor combine it with a controlled experimental comparison as implemented in this study. Therefore, the present study offers a more comprehensive analysis by integrating multiple sensory parameters within a single experimental framework.

a. Color Quality of Fresh Noodles

Color is an early visual indicator that influences the attractiveness of a product (Sylvia & Muladi, 2025). The mean value of the color increased from 1.01 (X1) to 5.34 (X2), with the results of the t-test showing a significant difference ($|t\ count| > t\ table$), so H_0 was rejected andH_a accepted. This increase is due to the content of anthocyanin pigment in the skin of dragon fruit which gives it a purplish-red color. These findings are in line with Faridah, Holinesti, Azhar, Cahyani, & Syukri (2020) and Sipahelut (2022) that natural pigments can increase color intensity and product attractiveness.

b. The Quality of Fresh Noodle Aroma

Aroma plays an important role in the acceptance of Suyanto, Hersoelistyorini, Arinachaque, Imam, & Khamdi (2023) products. The mean value increased from 3.23 (X1) to 5.00 (X2), with significant differences based on the t-test, so H_0 was rejected andH_a was

accepted. This increase is influenced by the distinctive aroma of dragon fruit peel extract. These results are supported by Daliansyah, Hariyadi, & Desi, 2022) and Linangsari, Sandri, Lestari, & Noorhidayah, 2022) who state that natural ingredients can improve the aroma characteristics of food products.

c. Chewy Texture Quality of Fresh Noodles

The chewy texture is the main characteristic of Tarwendah noodles (2021). The mean value increased from 4.52 (X1) to 5.09 (X2), with significant t-test results. This suggests that the substitution of the extract affects the structure of the dough thereby increasing the chewiness. These findings are in line with Atiqoh, et al., (2021) and Susanti & PS (2024) that the composition of the ingredients affects the elasticity of the product.

d. Texture Quality Not Easy to Break Fresh Noodles

The texture does not break easily showing the strength of the noodle structure (Bethany, et al., 2024). The average score increased from 4.63 (X1) to 5.10 (X2), with significant differences. Extract substitution helps to improve the structural stability of the noodles. It is supported by Anggraweni, Sari, Herpandi, & Yuliarti (2022) and Ulfira, Noviasari, & Lubis (2022) that natural additives can strengthen the structure of noodles.

e. Fresh Noodle Taste Quality

Taste is the main factor in consumer acceptance Rifqi, Rohmayanti, Sania, & Hapsari, (2023). The mean value increased from 4.48 (X1) to 5.11 (X2), with significant ttest results, so H_0 was rejected andH_a accepted. This increase is due to the contribution of dragon fruit peel extract to the taste characteristics. These findings are in line with Mubarak & Mulyadi (2024) and Jaenuri, et al., (2025) who state that natural ingredients can improve the taste quality and acceptability of products.

Overall, the substitution of red dragon fruit peel extract was proven to have a real effect on improving the sensory quality of fresh noodles on all parameters tested.

CONCLUSION

The findings of this study show that the replacement of red dragon fruit peel extract in Fresh noodle production significantly improves all sensory attributes of color, aroma, texture, and taste. Organoleptic tests with 30 panelists showed that 150 ml (X_2)

substitution resulted in the highest sensory scores, mainly improving color, followed by aroma, chewiness, damage resistance, and taste. Analysis of independent sample t-tests confirmed significant differences between control and substitution treatments, suggesting that the extract effectively improved overall sensory quality. This study determined the potential of red dragon fruit peel extract as a natural additive to improve the quality of Fresh noodles while promoting local foodstuffs. For further development, the extract preparation must optimize pigment retention, and the formulation and processing of the noodles must be controlled to maintain the desired texture. Future research is recommended to explore variations in extract concentration, nutritional content, and shelf life to expand its application in food innovation.

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