Sensory Evaluation of Fettucine Substituted with Corn Flour (*Zea mays* L.)

Evaluasi Sensoris Fettucine yang Diperkaya dengan Tepung Jagung (*Zea mays* L.)

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Abstrak

Produksi tepung jagung lokal adalah bentuk diversifikasi makanan untuk mengurangi konsumsi tepung terigu. *Fettucine* adalah produk yang terbuat dari tepung terigu. Tujuan dari penelitian ini adalah untuk menentukan penerimaan produk *fettucine* yang diperkaya dengan tepung jagung oleh konsumen berdasarkan tes organoleptik. Uji organoleptik dengan memberikan 4 sampel *fettucine* dengan variasi formula yang berbeda untuk panelis dengan kriteria yang diuji, yaitu aroma, warna, rasa dan tekstur sehingga satu formulasi terbaik diperoleh dari beberapa perlakuan. Uji sensorik menggunakan uji hedonik dengan 7 kriteria digunakan untuk menentukan tingkat kesukaan panelis. Berdasarkan hasil uji sensorik, sampel P0 (0%) memiliki nilai rata -rata tertinggi dalam warna hedonis dan uji aroma dengan kriteria yang diperoleh agak suka hingga netral. Sementara itu, sampel P1 (10%) menunjukkan skor tertinggi pada uji hedonis tekstur, rasa dan penerimaan keseluruhan dengan kriteria agak suka hingga suka. Ini menunjukkan bahwa penambahan 10% tepung jagung untuk *fettuccine* memberikan tekstur dan rasa yang optimal tanpa mengurangi karakteristik asli *fettuccin*i.

Kata kunci: evaluasi sensorik; *fettucine;* tepung jagung.

Abstract

Local corn flour production is a form of food diversification to reduce wheat flour consumption. Fettucine is a product made from wheat flour. This study aimed to determine the acceptability of fettucine products enriched with corn flour by consumers based on organoleptic tests. Methods: Organoleptic test by giving four fettuccine samples with different formula variations to panelists with the tested criteria, namely aroma, color, taste, and texture so that one best formulation is obtained from several treatments. A sensory test using a hedonic test with seven criteria was used to determine the level of favorability of the panelists. Based on the sensory test results, sample P0 (0%) had the highest mean value in the hedonic color and aroma test, with the criteria obtained from mildly liked to neutral. Meanwhile, sample P1 (10%) showed the highest scores in the hedonic test of texture, flavor, and overall acceptance with the criteria of mildly like to like. This suggests that the addition of 10% cornstarch to fettuccine provides optimal texture and flavor without compromising the original characteristics of fettuccini.

Keywords: Sensory evaluation; fettucine; corn flour.

INTRODUCTION

Globalization in the food sector has influenced significant changes in the types of staple foods consumed by various populations throughout the world, resulting in a shift in eating patterns in society. This transformation is evidenced by a growing inclination toward ready-to-eat packaged goods over traditional foods, particularly processed products derived from flour, with instant noodles being a predominant choice. Noodles remain the most popular of all types of fast food, this food is consumed because it is cheaper and very easy to make (Fitriani, 2018). Based on the official website of the World Instant Noodles Association, (2023), Indonesian instant noodle consumption in 2023 will reach 14.54 billion packs. An increase compared to 2022 which was recorded at 14.26 billion packs. Instant noodles are generally produced by the food processing industry using technology and providing various additives to preserve and provide flavor to the product.

One type of noodle is fettucine. Fettuccine is a type of pasta that has a long, flat shape. The technique for making fettuccine is relatively easier than other forms of pasta because it can be made without using tools so that all catering services, both small and large scale, can make it. Wet fettuccine pasta is made from a mixture of flour, eggs, water and salt to form a dough which is then flat without drying in the oven (Kholilullah et al, 2020). In Indonesia, the development of pasta products was initially only for the middle and upper economic classes, but now the composition of sales of domestic pasta products has changed from 5 percent to 50 percent with total production of up to 50,000 tons (Mayasti et al, 2018).

The increasing preference for pasta consumption in Indonesia could undermine national food security due to its primary ingredient, flour, being largely imported (Elwin et al., 2022). This reliance has escalated industrial dependence on wheat, a resource that cannot be cultivated within the country (Aini, 2020). To mitigate this issue, it is essential to complement Indonesia’s wheat consumption trends with strategies aimed at diversifying diets and fostering the production of alternative local flours (Saputra et al., 2021). Diversifying food sources involves encouraging communities to incorporate a broader range of staple foods into their diets, thereby reducing reliance on imports through the promotion and development of local food production (Aini, 2020). Corn flour, as one example, represents a viable alternative to wheat and can play a pivotal role in supporting Indonesia's food diversification initiatives. Corn is the most widely produced cereal globally, playing a crucial role in supplemental food sources. Along with wheat and rice, it contributes to 42.5% of the total caloric intake in human diets (Dongmo et al, 2020).

Flour-based products have the advantage that they can be stored longer, are easy to mix, can be enriched with nutrients, and are easy to process into further processing. Apart from that, corn flour has health benefits. Because corn flour does not contain gluten, it can be consumed by people suffering from gluten intolerance. According to Mejía-Teran et al, (2024), corn flour can be used to make healthy food because it has a high resistant starch content and a low glycemic index. Corn endosperm can be used as an alternative food product as a substitute for wheat flour because it is gluten free (Hasan et al, 2020).

Several studies on corn flour processing have been conducted (Euan et al, 2024), (Karimi et al, 2021), (Triandita et al, 2020), (Resti et al, 2024). Corn contains 69.70 - 72.95% carbohydrate, 9.14 - 13.02% protein, 3.47 - 5.1% fat, 2.17 - 2.72% crude fiber, and 1.13 - 2.04% ash content depending on the variety (Sinay et al, 2021). The results of research by Setyowati et al (2014) showed that wheat flour has a crude fiber of 0.4 - 0.5%, so the addition of corn flour is expected to increase the fiber content in making fettucine. In addition, corn flour can replace wheat flour in making fettucine because it is rich in starch, has high water absorption, and provides natural color. However, because it does not contain gluten, additional ingredients are needed to keep the dough elastic and not easily broken. According to (Sutrisno, 2009) the fat content in corn flour is lower than wheat flour, the fiber content is higher and it is enriched with fortified nutrients. The low fat content in corn flour can make corn flour last longer because it is not easily rancid due to fat oxidation. Because of the advantages, benefits and nutritional content of corn flour, corn flour is suitable for substitution and diversification, especially in the processing of fettuccine pasta products.

METHODS

Materials

Corn flour and high-protein wheat flour was purchased from an online marketplace. Eggs, salt and palm oil purchased at UD.Fenny. The tools used include pasta machines, scales, beakers and thermometers.

Fettucine production

The recipe and materials of fettucine enriched with 0% (P0), 10% (P1), 20% (P2), 30% (P3) corn flour are shown in Table 1. All ingredients that have been weighed are mixed until smooth. Mixing process done using a food processor for about 5 minutes until smooth. The dough that has become smooth is placed in a closed container and rested in the refrigerator for 30 minutes. then the dough is cut or flattened using a pasta machine until it reaches a thickness of around 1 mm (or on scale number 5 on a pasta machine).

Table 1. Recipe of fettucine enriched with corn flour

Ingredients	P0 (g)	P1 (g)	P2 (g)	P3 (g)
Wheat Flour	150	135	120	105
Corn flour	0	15	30	45
Egg	80	80	80	80
Salt	3	3	3	3
Palm oil	15 ml	15 ml	15 ml	15 ml

Note: material units in gram

Table 2. Hedonic scale to test the level of liking for fettucine

Hedonic Scale	Numberic Scale
Very like	7
Like	6
Moderately like	5
Neutral	4
Moderately doesn't like	3
Doesn't like	2
Very doesn't like	1

This process is carried out so that the dough obtains the same thickness. After being flattened, the dough is cut into fettuccine shapes using a knife. The pasta is boiled for about 3-4 minutes in boiling water. Pasta is immediately drained and packed in an airtight container.

Organoleptic test for sensory evaluation

Sensory evaluation testing is based on the modified method of (Fiorentini et al, 2020). Sensory assessment is known to be based on organoleptic results with hedonic tests. Panelists tested the color, taste, aroma, texture, and overall value of the fettuccine. This fettucine was presented to the panelist's table in the following manners: fettucine enriched with corn flour (P0, P1, P2, P3), mineral water to neutralize the mouth, and a questionnaire form to assess the fettucine. The results of the sensory test use a hedonic test with 7 criteria and a numerical scale namely scale 7 (very liked) - scale 1 (very dislike) were used to determine the level of panelists' liking for the fettucine product being made. The panelists used were 31 students who were students of the Faculty of Agricultural Technology, Udayana University. The hedonic scale used in this research can be seen in Table 2.

RESULTS AND DISCUSSION

The results of the organoleptic test on the quality parameters of fettucine with the addition of corn flour, namely aroma, color,

texture, taste, and overall acceptance can be seen in Figure 1.

Aroma of Fettucine

The results of the research showed that the average aroma value ranged from 4.0 to 4.8. The panelist's liking level was highest in the P0 (0%) treatment, which was 4.8. Meanwhile, the panelist's assessment with the lowest score was in the P3 (30%) treatment, which was 4.0 regarding the level of the panelist's liking for the aroma of fettucine-enriched corn flour. The decrease in aroma preference occurred along with the increasing use of corn flour in the dough. This is probably caused by the complex and distinctive aroma of corn flour after being processed into fettuccine. The incorporation of corn flour into processed foods, such as dry noodles, can result in the development of an undesirable odor.

This phenomenon may be attributed to the milling process of yellow corn kernels into yellow corn flour which involves the separation of hull, endosperm, germ, and tip cap. However, the germ contains high levels of unsaturated fat, resulting in a stale aroma in the yellow corn flour (Rosiani, 2013). The results of this study are similar to Arum et al, (2021), there was a decrease in the aroma score as the percentage of added corn flour increased, ranging from 3.97 - 3.53. The volatile compounds contributing to the aroma of corn after heat treatment consists of (E)-2-nonenal, 1-octen-3-ol, beta-myrcene, dimethyl trisulfide, 1-(4,5-dihydro-2-thiazolyl)-ethanone, and D-limonene. Thermal processing causes a significant increase in unsaturated fatty acids, such as oleic and linolenic acids, as a result of oxidative cleavage of the fatty acid molecules (Zhang et al., 2023).

Color of Fettucine

Color is a major and crucial parameter in evaluating food quality. Based on the hedonic test results, the highest average score for color was found in sample P0 (0%) with a value of 5.4, while the lowest score was found in sample P3 (30%) with a value of 4.5. The mean scores ranged from 5.4 to 4.5, which is considered moderately acceptable to neutral. Based on the color test results, panelists tended to like fettuccine without the addition of corn flour. This could be due to the addition of cornstarch causing the color of the noodles to be light brown. Similarly, Onwurafor et al (2020) reported that increasing the proportion of corn flour and mung bean malt flour caused a decrease in the acceptability of noodle color. Fettuccine dough experienced a noticeable color change after the boiling process with the addition of corn flour. This phenomenon supports observations made by Musita (2016), which indicated that exposure to high temperatures can cause carotenoid degradation, thereby reducing the intensity of carotene-based colors.

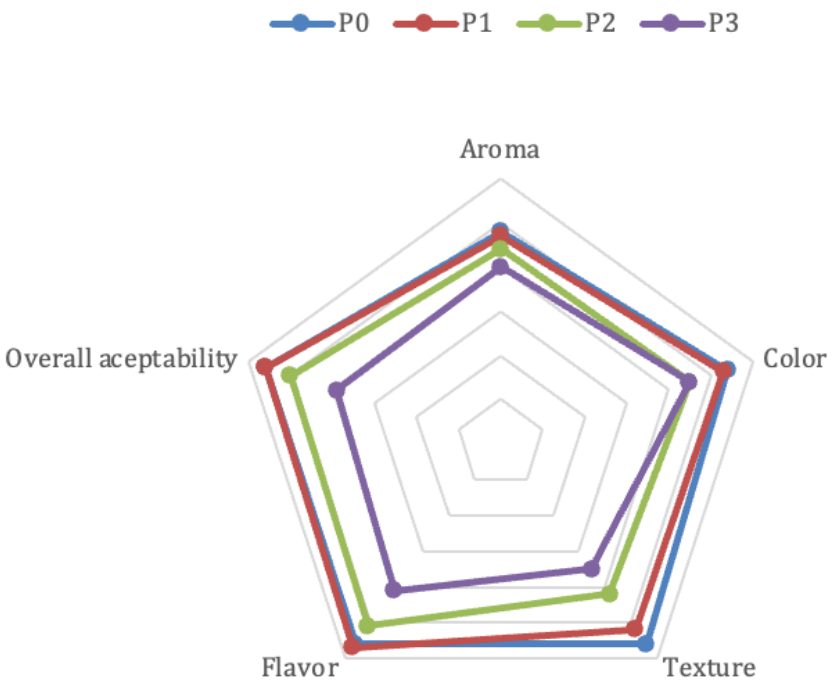

Fig. 1. Score the organoleptic test of fettucine substituted with corn flour

Texture of Fettucine

Texture is one of the essential things in food because it can attract consumers so they can consume the food safely and quickly. Based on the results of the hedonic test, the texture of sample P0 (0%) has the highest value with an average of 5.6, followed by samples P1 (10%), P2 (20%), and P3 (30%) with an average of 5.2; 4.2; and 3.5 respectively. Overall results indicate that the textures of samples P0 and P1 are more in line with the preferences of the majority of panelists. A decrease in the concentration of flour within the sample results in a denser texture of the fettuccine, subsequently reducing its texture quality. This effect is attributed to the presence of gluten in wheat flour, a protein that imparts elasticity and chewiness to pasta.

Flavor of Fettucine

Flavor is a crucial attribute of a product, as it significantly influences panelists' preferences and overall acceptance of the final product. Based on the results of the hedonic taste test, the highest values were obtained sequentially, namely in samples with codes P1 (10%), P0 (0%), P2 (20%), and P3 (30%) with average values respectively, namely 5.7; 5.6; 5,1; 4,1. These results indicate an increase in the preference

value for the taste of fettucine when corn flour was added at a concentration of 10% compared to the control treatment which was without the addition of corn flour.

However, there was a decrease in the liking value along with the addition of corn flour which can be seen in samples P2 and P3. The addition of not too much concentration can help increase the panelist's taste acceptance scores. However, increasing the concentration of added corn flour causes an excessively sweet taste which is generally not characteristic of the taste of fettucine pasta. An alternative study identified a heightened sweet taste in artisanal tortillas, which was linked to the conventional techniques utilized in their preparation (Iuga et al, 2019). The sweetness of tortillas is derived from soluble sugars found in the grain, primarily located in the germ, with their concentration differing among various corn varieties (Lara et al, 2018).

Overall acceptability of Fettucine

The overall assessment represents the final evaluation, encompassing the integrated perception of all sensory attributes associated with a product. According to Sistanto et al. (2014), the overall assessment of food products is very important because consumers preferred the product. The overall assessment includes a combination of assessments including color, taste, aroma, and texture. Based on the data obtained, the highest average value was in treatment P0 (0%) with a value of 5.6, and P1 (10%) with a value of 5.6. while the lowest average value was in treatment P3 (30%) with a value of 3.9.

Overall acceptance with the highest values in treatments P0 and P1 shows that fettucine without the addition of corn flour and fettucine enriched with 10% corn flour produced sensory characteristics that were preferred by the panelists. This can be caused by the balance between taste, texture, and aroma which remains similar to fettucine on the market without being dominated by the aroma or taste typical of excessive corn flour. Thus, P0 and P1 treatments can be considered optimal formulations for fettucine products enriched with corn flour that can be widely accepted by consumers. Onwurafor et al. (2020) reported that incorporating maize flour at a concentration of up to 20% resulted in the highest sensory evaluation scores for the overall acceptance of noodles. Comparable findings were also reported by Shobha et al, (2015) that a combination of up to 50% maize flour was considered the best for color, appearance, taste, elasticity, and overall acceptability on noodles.

CONCLUSIONS

This research shows that fettucine enriched with corn flour up to 10% can be accepted by consumers based on hedonic tests of texture, taste and overall acceptability. Fettucine enriched with corn

flour may provide nutritional advantages to consumers compared to controls. This shows that the addition of 10% corn flour to fettuccine provides optimal texture and taste without reducing the original characteristics of fettuccine.

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