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The Effect of the Ratio of Mocaf and Soybean Flour with Addition of Glucomannan on Physical, Chemical and Sensory Properties of Gluten-Free Wet Noodles

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Abstract. *The primary ingredient used to make noodles is typically wheat flour. However, not everyone can consume wheat flour. Gluten-free noodles are suitable for individuals who avoid gluten, particularly those with celiac disease and autism. Some ingredients used to make gluten-free noodles include mocaf, soybeans, and glucomannan. This study aims to determine the characteristics and optimal formulation of gluten-free wet noodles made from mocaf, soybean, and glucomannan flour. This research method uses a Completely Randomized Design (CRD) factorial with two factors and three replications. The first factor is the ratio of mocaf flour to soybean flour, consisting of 3 levels: 80:20 (A1), 75:25 (A2), and 70:30 (A3). Another factor is the addition of glucomannan flour, consisting of 3 levels: 2% (B1), 5% (B2), and 8% (B3). The analysis performed on these wet noodles includes physical, chemical, and sensory evaluations. The comes about of the study appeared that noodles with the ratio of mocaf flour to soybean flour 75:25 and the addition of 2% glucomannan flour (A2B1) is the best treatment based on the highest elasticity with elasticity 73.3%, water absorption 89.3%, swelling index 271%, cooking loss 8.78%, water content 36.8%, protein 6.44%, ash 1.89%, fat 0.74%, carbohydrate 50.4%, and sensory test results appearance 3.76 (somewhat like), color 3.72 (somewhat like), aroma 3.2 (neutral), texture 3.36 (neutral), and taste 3.36.*
Keywords: *Glucomannan, Gluten-Free Noodles, Mocaf, Soybean.*

1. Introduction

Noodles are one of the famous foods in Asia, including Indonesia. According to the World Instant Noodles Association (WINA), in 2023, Indonesia ranked second in instant noodles consumption after China, with 14.54 million servings (WINA, 2022). The ingredients in making noodles generally come from wheat flour. However, not everyone can eat noodles produced from wheat flour, for example, individuals with celiac disease and children with autism spectrum disorder (Rahmawati *et al*., 2023). Gluten-free noodles can be a solution for people who avoid gluten.

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Gluten-free noodles are noodles made from main components that do not involve gluten. Gluten-free noodles can be made from starch. Unlike wheat noodles, the gluten-free noodle structure is impacted by the starch gelatinization process, which creates a solid noodle arrangement. Ingredients for making gluten-free noodles include mocaf and soybean flour (Mojiono *et al*., 2016).

Mocaf (modified cassava flour) is a food ingredient that is quite flexible because it can be mixed with other flour. Mocaf is cassava flour processed using the fermentation principle of lactic acid bacteria. Mocaf flour has characteristics that resemble wheat flour, so it can be used as the main ingredient or as a substitute component in noodles, cookies, or bread (Rahmawati *et al*., 2023). Soybean flour can be utilized to extend the protein substance of gluten-free noodles. Soybean flour comprises 37.38% protein, 20.8% fat, 30.39% carbohydrate, 7.57% water, and 3.85% ash (Violalita *et al*., 2020).

Gluten-free noodles produced from compounded flour comprising of mocaf, tapioca, cornstarch, and soybean flour are acceptable to panelists but still constrained because they are less elastic (Violalita *et al*., 2020). To anticipate these noodles' weaknesses and improve their quality, especially their elasticity, glucomannan flour can be added.

Porang (*amorphophallus oncophyllus*) is a regional annual plant frequently found in Indonesian woodlands. Its root boasts a high content of glucomannan, which may provide numerous advantages as a nourishment and as a functional food (Harmayani *et al*., 2014). Glucomannan flour from porang is a type of fiber that is soluble in water. Glucomannan is considered a non-calorie food because it contains indigestible dietary fiber that has been proven beneficial for health. Glucomannan flour is moreover commonly used in the nourishment, drink, and pharmaceutical industries for thickening, texturing, gel arrangement, and water assimilation. In manufacturing low-protein wheat flour noodles, 3% konjac glucomannan produces the best texture and sensory evaluation (Zhou *et al*., 2013). Noodles with 4% porang flour and 25% water are the best substitutes for making noodles with mocaf flour (Faridah & Widjanarko, 2014).

The purpose of the study is to determine the characteristics and the best formulation of gluten-free wet noodles from mocaf, soybean, and glucomannan flour. The analysis carried out on these wet noodles is a physical analysis (elasticity, water absorption, swelling index, and cooking loss), chemical analysis (water content, protein, ash, fat, and carbohydrate), and sensory analysis (appearance, color, aroma, texture, and taste).

2. Materials and Method

2.1. Materials and Tools

Ingredients for making gluten-free noodles include mocaf flour, soybean flour, glucomannan flour from porang, salt, egg yolk, and water. The ingredients used in the analysis include distilled water, concentrated sulfuric acid, 0.05 N hydrochloric acid, 80% alcohol, 50% natrium hydroxide, and 4% boric acid. The tools used in making gluten-free noodles include scales, basins, knives, tablespoons, steamers, noodle molding machines, and trays. The tools used for analysis include analytical scales, ovens, evaporator cups, desiccators, spatulas, furnaces, ashing cups, Kjeldahl flasks, distillation flasks, erlenmeyer flasks, burettes, test tubes, measuring cups, droppers.

2.2. Experimental Design

This research method uses a Completely Randomized Design (CRD) factorial with two factors and three replications. The first factor was the ratio of mocaf flour to soybean flour, consisting of 3 levels: 80:20 (A1), 75:25 (A2), and 70:30 (A3). The second factor was the percentage of glucomannan flour used based on the total flour used, consisting of 3 levels: 2% (B1), 5% (B2), and 8%(B3).

2.3.Statistical Analysis

The data obtained were analyzed statistically using the ANOVA (Analysis of Variance) test. In case the impact was significant, it was taken after by the Tukey test at a 5% significance level utilizing R 4.3.1 (R foundation).

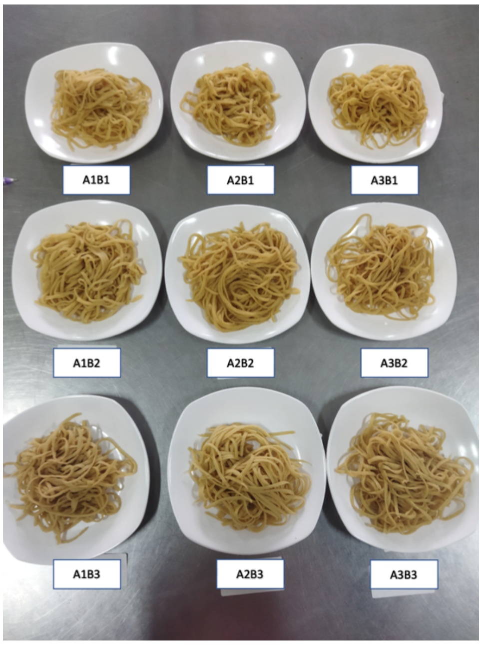

Figure 1. Gluten-Free Wet Noodles from Mocaf, Soybeans and Glucomannan

2.4. Preparation of Gluten-Free Wet Noodles from Mocaf, Soybean, and Glucomannan

Mocaf flour, soy flour, glucomannan flour (according to treatment), salt (1% of the weight of mocaf and soybean flour), and water (60% of the weight of mocaf and soybean flour) are mixed, then steamed for 20 minutes. The steamed dough is mixed with egg yolk (6% of the weight of mocaf and soy flour) and stirred until homogeneous. The dough is then thinned to a thickness of 3 mm and then molded to form noodle strands. The noodles were steamed for 5 minutes to produce wet noodles. In this study, noodles were also made with a control treatment, which was used to compare the research data. Noodles with control treatment were made from wheat flour, salt, egg yolk, and water, which were stirred, rolled, molded, and steamed to produce wet noodles. Gluten-free wet noodles from mocaf, soybeans, and glucomannan can be viewed in Figure 1.

2.5.Analysis

2.5.1 Physical Analysis

The physical analysis carried out on wet noodles included elasticity (Pontoluli *et al*., 2017), water absorption, swelling index (Rachman *et al*., 2020), and cooking loss (Anggraeni & Saputra, 2018).

2.5.2 Chemical Analysis

The chemical analysis carried out on wet noodles is a proximate analysis consisting of water, protein, ash, fat, and carbohydrate content (AOAC, 2000).

2.5.3 Sensory Analysis

Sensory analysis was carried out using the hedonic method on 25 slightly trained panelists. parameters tested include appearance, color, aroma, texture, and taste with a scale of 1 (dislike), 2 (dislike somewhat), 3 (neutral), 4 (somewhat like), and 5 (like).

3. Result and Discussion

3.1. Physical Analysis

3.1.1. Elasticity

The statistical outcome using ANOVA at a 95% confidence level present that the use of glucomannan flour, the addition of the ratio of mocaf flour to soybean flour, and the interaction between the use of the mocaf and soybean flour ratio with the addition of glucomannan flour has a significant effect on noodles' elasticity. The highest elasticity in the A2B1 treatment was 73.3%. The lowest elasticity in the A1B1 treatment was 43.3%. Compared to the control, noodles from wheat flour had an elasticity of 54%. Wheat flour noodles rely on the performance of gluten protein to form a firm and elastic noodle texture. However, the starch gelatinization process influences gluten-free noodles to form a firm structure (Mojiono *et al*., 2016). The elasticity of gluten-free wet noodles made from mocaf, soybean, and glucomannan can be viewed in Table 1.

Glucomannan compounds can form elastic gels to hold water firmly. Hydrocolloid gels are formed from a three-dimensional gel matrix or primary molecular network. Primary molecules expand throughout the volume of the gel shaped by caching some water, effecting the noodle more elastic (Winarno, 2004). Adding glucomannan affects the material's structural properties, such as hardness and elasticity. Increasing soybean flour also influences the elasticity of the noodles (Zhou *et al*., 2013). Protein plays a role in the formation of noodle elasticity because protein can bind water, which creates noodle elasticity (Kardina & Eka, 2018). The highest elasticity was the A2B1 treatment; when the rise of soy flour and glucomannan is increased, the elasticity of the noodles decreases. Including more glucomannan can increment the sum of fiber in wet noodles, increasing water absorption and reducing the noodles' elasticity. As a result, the noodles are easily broken (Rosida *et al*., 2022). The more porang glucomannan flour is added, the more it causes a break of the protein-starch matrix of the noodle dough and causes the elasticity of the noodles to decrease (Faridah & Widjanarko, 2014).

Table 1. The Elasticity of Gluten-Free Wet Noodles from Mocaf, Soybean, and Glucomannan

Ratio Mocaf Flour: Soybean Flour (%)	Glucomannan Flour (%)			
	2 (B1)	5 (B2)	8 (B3)	Mean
80:20 (A1)	43,30 d	44,40 d	54,40 bcd	47,37 c
75:25 (A2)	73,30 a	58,90 bc	56,70 bcd	62,97 a
70:30 (A3)	65,60 ab	44,40 d	51,10 cd	53,70 b
Mean	60,73 a	49,23 b	54,07 b	(+)

Description: numbers followed by the same letter in the same column or row are not significantly different according to the α 5% Tukey test. (+): there is an interaction between factors

3.1.2. Water Absorption

The statistical results using ANOVA at a 95% confidence level showed that use of glucomannan flour significantly affects water absorption. In contrast, the ratio of mocaf flour to soybean flour did not significantly affect water absorption. The interaction between the utilization of the mocaf and soybean flour ratio with the expansion of glucomannan flour influences the water absorption of gluten-free wet noodles. The maximum water absorption in the A3B3 treatment was 158%. In contrast, the minimum water absorption in the A2B1 treatment was 89.3%. Compared to the control, wheat flour noodles had a water absorption of 129.69%. The water absorption of gluten-free wet noodles from mocaf, soybeans, and glucomannan can be seen in Table 2.

Table 2. Water Absorption of Gluten-Free Wet Noodles from Mocaf, Soybeans, and Glucomannan

Ratio Mocaf Flour: Soybean Flour (%)	Glucomannan Flour (%)			
	2 (B1)	5 (B2)	8 (B3)	Mean
80:20 (A1)	92,60 c	113,00 bc	120,00 a	108,53 a
75:25 (A2)	89,30 c	116,00 bc	147,00 ab	117,43 a
70:30 (A3)	108,00 bc	107,00 bc	158,00 a	124,33 a
Mean	96,63 b	112,00 b	141,67 a	(+)

Description: numbers followed by the same letter in the same column or row are not significantly different according to the α 5% Tukey test. (+): there is an interaction between factors

Water absorption is the capacity of noodles to catch water optimally. The higher the addition of glucomannan, the higher the water absorption. This happens because glucomannan quickly absorbs water. The water absorption capacity of noodles can be utilized to foresee the quality of cooked noodles since the less water is absorbed, the stronger the texture and the more elastic the noodles. Flour rich in glucomannan has high solubility properties in hot and cold water (Charoenrein *et al*., 2011). Adding hydrocolloids to make noodles can increase viscosity and water absorption (Kaur et al., 2015). The more porang flour is added, the more water is needed, so the water increases because porang flour absorbs water to expand. Glucomannan has several unique properties, including being equal to the arrangement of a thick solution in water, being equal to expansion with great swelling power, and being able to make a gel (Zhang *et al*., 2005).

3.1.3. Swelling Index

The statistical results using ANOVA at a 95% confidence level present that the use of glucomannan flour, the ratio of mocaf flour to soybean flour, and the interaction between the utilization of the mocaf and soybean flour ratio with the addition of glucomannan flour have no significant effect on the swelling index of the gluten-free wet noodles. The maximum swelling index was achieved with the A3B3 treatment at 344%. The minimum swelling index was found in the A2B1 treatment at 271%. Compared to the control, wheat flour noodles had a swelling index of 255.45%. Compared to the control, the swelling index of wheat flour noodles was 255.45%. The swelling index of gluten-free wet noodles from mocaf, soybeans, and glucomannan can be seen in Table 3.

Table 3. Swelling Index of Gluten-Free Wet Noodles from Mocaf, Soybeans, and Glucomannan

Ratio Mocaf Flour: Soybean Flour (%)	Glucomannan Flour (%)			
	2 (B1)	5 (B2)	8 (B3)	Mean
80:20 (A1)	292,00	315,00	307,00	304,67 a
75:25 (A2)	271,00	300,00	340,00	303,67 a
70:30 (A3)	298,00	273,00	344,00	305,00 a
Mean	287,00 a	296,00 a	330,33 a	(-)

Description: numbers followed by the same letter in the same column or row are not significantly different according to the α 5% Tukey test. (+): there is an interaction between factors

This swelling index analysis determined how much expansion occurs when the noodles are cooked. The proportion of noodle extension is impacted by the noodles' capacity to retain water. Glucomannan flour is a thickener agent and has a solid water-binding ability. According to Harmayani *et al*. (2014), one gram of glucomannan from Konjac can absorb 200 ml of water. Glucomannan from porang flour has a water-holding capacity of 34.5 grams of water/gram of glucomannan. The water-holding capacity of glucomannan is be relevant to its function as a thickening agent and a binder for essential ingredients (Handayani *et al*., 2023). Soy protein content also can bind water in noodles (Sholichah *et al*., 2021).

3.1.4. Cooking Loss

The statistical results using ANOVA at a 95% confidence level present that the use of glucomannan flour, the ratio of mocaf flour to soybean flour, and the interaction between the use of the mocaf and soybean flour ratio with the addition of glucomannan flour have no significant effect on on the cooking loss of the gluten-free wet noodles produced. The maximum cooking loss was achieved with the A3B3 treatment at 23.8%. In comparison, the minimum cooking loss was found in the A3B2 treatment at 6.19%. Compared to the control, wheat flour noodles had a swelling index of 3.19%. The cooking loss of gluten-free wet noodles from mocaf, soybeans, and glucomannan can be seen in Table 4.

Table 4. Cooking Loss of Gluten-Free Wet Noodles from Mocaf, Soybeans, and Glucomannan

Ratio Mocaf Flour: Soybean Flour (%)	Glucomannan Flour (%)			
	2 (B1)	5 (B2)	8 (B3)	Mean
80:20 (A1)	9,47	6,23	9,59	8,43 a
75:25 (A2)	8,78	8,35	22,90	13,34 a
70:30 (A3)	8,11	6,19	23,80	12,70 a
Mean	8,79 a	6,92 a	18,76 a	(-)

Description: numbers followed by the same letter in the same column or row are not significantly different according to the α 5% Tukey test. (+): there is an interaction between factors

Cooking loss shows the loss of material while cooking noodles in water. Cooking loss occurs because some starch is released from the noodle strands during cooking. The released starch is suspended in the cooking water, causes turbidity, and causes the noodle soup to become thick. Good quality noodles or pasta have less than 10% cooking loss (Sholichah *et al*., 2021). This can be seen from the control treatment, gluten-free noodles have higher cooking loss than those made from wheat flour. High cooking loss can cause the texture of the noodles to become stronger and more slippery. High cooking loss is caused by insufficient binding of gelatinized starch to ungelatinized starch (Mulyadi *et al*., 2014). Cooking loss occurs due to an imbalance in the amount of water and flour used, disrupting the protein-starch matrix in the noodle dough (Faridah & Widjanarko, 2014).

3.2. Chemical Analysis

3.2.1. Water Content

The statistical results using ANOVA at a 95% confidence level showed that the use of glucomannan flour and the interaction between the ratios of mocaf and soybean flour, along with glucomannan flour, significantly affected the gluten-free wet noodles' water content. However, the ratio of mocaf and soybean flour did not significantly affect the water content of gluten-free noodles. The highest water content was achieved with the A3B3 treatment at 42.1%. In comparison, the lowest water content was achieved with the A2B1 treatment at 36.8%. Compared to the control, wheat flour noodles had a water content of 33.2%. The water content of gluten-free wet noodles from mocaf, soybeans, and glucomannan can be seen in Table 5.

Table 5 shows that adding glucomannan flour tends to increase the water content. This increase in water content is due to glucomannan flour having properties as a fiber that can absorb water and function as a gel former and water binder in making noodles (Rahmawati *et al.*, 2023). Glucomannan flour is a type of water-soluble polysaccharide, the use of glucomannan can increament the water absorption capacity of the product. Thus, adding of glucomannan can increase the water absorption capacity of the noodles. This water absorption capacity is correlated with water content, where the higher the capability of the noodles to soak up the water, the higher the water content of the wet noodles (Faridah & Widjanarko, 2014). Compared to the standard of wet noodles, where the maximum water content is 65%, gluten-free wet noodles from mocaf, soybeans, and glucomannan have met the set standards (Badan Standarisasi Nasional, 2015).

Table 5. Water Content of Gluten-Free Wet Noodles from Mocaf, Soybeans, and Glucomannan

Ratio Mocaf Flour: Soybean Flour (%)	Glucomannan Flour (%)			
	2 (B1)	5 (B2)	8 (B3)	Mean
80:20 (A1)	38,30 abc	40,20 abc	40,60 abc	39,70 a
75:25 (A2)	36,80 c	40,30 abc	41,60 ab	39,57 a
70:30 (A3)	39,50 abc	38,20 bc	42,10 a	39,83 a
Mean	38,20 a	39,57 b	41,43 b	(+)

Description: numbers followed by the same letter in the same column or row are not significantly different according to the α 5% Tukey test. (+): there is an interaction between factors

3.2.2 Protein Content

The statistical results using ANOVA at a 95% confidence level showed that the ratio of mocaf flour to soybean flour and the interaction between the use of the mocaf and soybean flour ratio with the addition of glucomannan flour significantly affect the protein content of the gluten-free wet noodles. However, adding glucomannan did not significantly affect the protein content of gluten-free wet noodles. The highest protein content was achieved with the A3B3 treatment at 9.75%. In comparison, the lowest protein content was achieved with the A1B2 treatment at 6.01%. Compared to the control, wheat flour noodles have a protein content of 10.49%. The protein that plays an important role in making noodles is gluten, which is formed by glutenin and gliadin. So, when compared, gluten-free noodles have less protein than wheat noodles. The protein content in all research treatments is beneath the control noodle. The protein content of gluten-free wet noodles from mocaf, soybeans, and glucomannan can be seen in Table 6.

Table 6. Protein Content of Gluten-Free Wet Noodles from Mocaf, Soybeans, and Glucomannan

Ratio Mocaf Flour: Soybean Flour (%)	Glucomannan Flour (%)			
	2 (B1)	5 (B2)	8 (B3)	Mean
80:20 (A1)	6,63 bc	6,01 c	7,13 bc	6,59 b
75:25 (A2)	6,44 bc	7,26 bc	6,66 bc	6,79 b
70:30 (A3)	8,26 ab	8,48 ab	9,75 a	8,50 a
Mean	7,11 a	7,25 a	7,85 a	(+)

Description: numbers followed by the same letter in the same column or row are not significantly different according to the α 5% Tukey test. (+): there is an interaction between factors

The protein content of gluten-free wet noodles is correlated with the addition of the concentration of soybean flour used. Soybean flour contains 37.38% protein (Violalita *et al.*, 2020). Therefore, increasing the use of soybean flour results in a higher protein content in the noodles. Furthermore, due to their nutritional value, soybeans contain certain phytochemicals that improve health and are a resource of dietary fiber, phospholipids, isoflavones, phenolic acids, saponins, and phytic acid (Kim *et al*., 2021). Compared to the standard of wet noodles, where the minimum protein content is 6% (Badan Standarisasi Nasional, 2015). Gluten-free wet noodles from mocaf, soybeans, and glucomannan have met the set standards

3.2.3 Ash Content

The statistical results using ANOVA at a 95% confidence level showed that the use of glucomannan flour, the ratio of mocaf flour to soybean flour, and the interaction between the use of the mocaf and soybean flour ratio with the use of glucomannan flour significantly affect the ash content of the resulting gluten-free wet noodles. The maximum ash content was achieved with the A3B3 treatment at 3.29%. In comparison, the minimum ash content was achieved with the A1B1 treatment at 1.72%. Compared to the control, wheat flour noodles have an ash content of 1.11%. The ash content of gluten-free wet noodles from mocaf, soybeans, and glucomannan can be seen in Table 7.

Table 7. Ash Content of Gluten-Free Wet Noodles from Mocaf, Soybeans, and Glucomannan

Ratio Mocaf Flour: Soybean Flour (%)	Glucomannan Flour (%)			
	2 (B1)	5 (B2)	8 (B3)	Mean
80:20 (A1)	1,72 c	2,36 b	2,97 a	2,35 b
75:25 (A2)	1,89 c	2,38 b	3,03 a	2,43 b
70:30 (A3)	1,98 c	2,53 b	3,29 a	2,60 a
Mean	1,86 c	2,42 b	3,10 a	(+)

Description: numbers followed by the same letter in the same column or row are not significantly different according to the α 5% Tukey test. (+): there is an interaction between factors

Based on Table 7, it is clear that the ash content increases along the addition of soybean flour and glucomannan flour. Ash content is one factor that determines a material's quality. Ash content signifies the amount of minerals in a nourishment; the more mineral substances contained in food, the higher the ash content. Ash is an inorganic residue obtained after burning materials at high temperatures (Kardina & Eka, 2018).

Table 8. Fat Content of Gluten-Free Wet Noodles from Mocaf, Soybeans, and Glucoman

Ratio Mocaf Flour: Soybean Flour (%)	Glucomannan Flour (%)			
	2 (B1)	5 (B2)	8 (B3)	Mean
80:20 (A1)	1,56 ab	1,42 ab	1,68 a	1,55 b
75:25 (A2)	0,74 b	1,26 ab	1,32 ab	1,11 c
70:30 (A3)	1,85 a	1,92 a	2,07 a	1,95 a
Mean	1,38 a	1,53 a	1,69 a	(+)

Description: numbers followed by the same letter in the same column or row are not significantly different according to the α 5% Tukey test. (+): there is an interaction between factors

3.2.4 Fat Content

Based on the statistical results using ANOVA at a 95% confidence level, it shows that the ratio of mocaf flour to soybean flour and the interaction between the use of the ratio of mocaf flour and soybeans with the use of glucomannan flour has a significant effect on the fat content of the gluten-free wet noodles. However, adding glucomannan did not significantly affect the fat content of gluten-free wet noodles. The maximum fat content was achieved with the A3B3 treatment at 2.07%. In comparison, the minimum fat content was achieved with the A2B1 treatment at 0.74%. Compared to the control, wheat flour noodles have a fat content of o,47%. The protein content obtained in all research treatments shows that the fat content of the noodles produced is higher than that of the control. The fat content of gluten-free wet noodles from mocaf, soybeans, and glucomannan can be seen in Table 8.

The fat content of gluten-free wet noodles is correlated with the expansion of the concentration of soybean flour utilized. Soybean flour contains 20.8% fat (Violalita *et al*., 2020). Therefore, the more soybean flour is utilized, the more the fat content of the noodles will tend to be. Soybean flour consists of stearic, palmitic, oleic, and linoleic acids. The polyunsaturated fatty acid linolenic acid is rated essential for human nutrition (Prabakaran *et al*., 2018).

3.2.5 Carbohydrate Content

The statistical results indicate that both the ratio of mocaf flour to soybean flour and the interaction between these ratios along with the addition of glucomannan flour significantly affect the carbohydrate content of the gluten-free wet noodles produced. However, adding glucomannan did not significantly affect the carbohydrate content of gluten-free wet noodles. The highest carbohydrate content, measured at 51.2%, was found in the A2B3 treatment, while the lowest, at 45.9%, occurred in the A3B3 treatment. In comparison, the control group of wheat flour noodles had a carbohydrate content of 54.7%. Table 9 illustrates the carbohydrate content of gluten-free wet noodles made from mocaf, soybeans, and glucomannan.

Table 9. Carbohydrate Content of Gluten-Free Wet Noodles with Mocaf, Soybeans, and Glucomannan

Ratio Mocaf Flour: Soybean Flour (%)	Glucomannan Flour (%)			
	2 (B1)	5 (B2)	8 (B3)	Mean
80:20 (A1)	49,70 abcd	51,00 ab	50,10 abc	50,27 a
75:25 (A2)	50,40 abc	47,00 cde	51,20 a	49,53 a
70:30 (A3)	46,30 de	47,40 bcde	45,9 e	46,53 b
Mean	48,8 a	48,47 a	49,07 a	(+)

Description: numbers followed by the same letter in the same column or row are not significantly different according to the α 5% Tukey test. (+): there is an interaction between factors

The use of soybean flour influences the carbohydrate content of gluten-free wet noodles. Increasing the concentration of soybean flour or reducing the amount of mocaf flour used will decrease the carbohydrate content in the resulting noodles. Soybean flour contains 30.39%

carbohydrates (Violalita *et al*., 2020), while mocaf flour has a high starch content, ranging from 85% to 87% (Lala *et al*., 2013).

3.3. Sensory Analysis

The sensory analysis of gluten-free wet noodles made from mocaf, soybeans, and glucomannan evaluated several parameters: appearance, color, aroma, texture, and taste. This analysis was conducted using the hedonic method with 25 slightly trained panelists. The sensory evaluation results for the gluten-free wet noodles, which include mocaf, soybeans, and glucomannan, are presented in Figure 2.

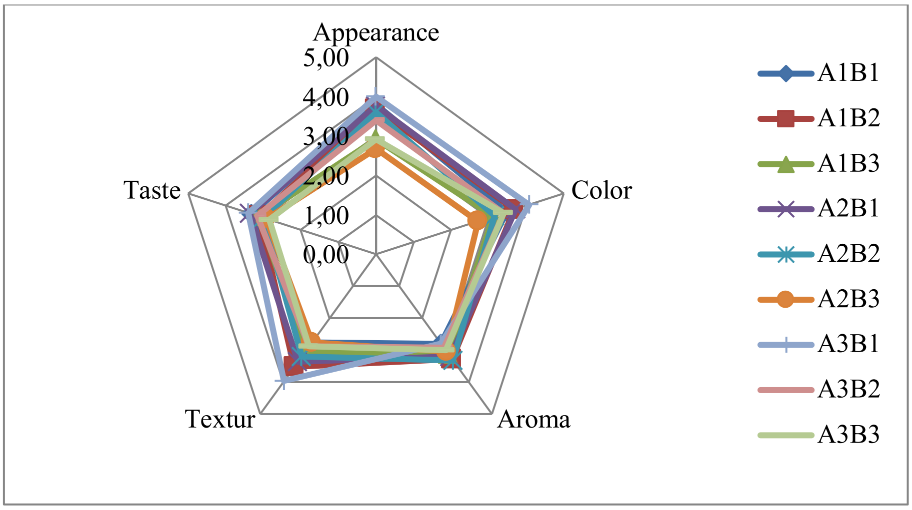

Figure 2. Sensory Analysis of Gluten-Free Wet Noodles from Mocaf, Soybeans, and Glucomannan

3.3.1 Appearance

A sensory test was conducted to evaluate the impact of glucomannan flour and the interaction between different ratios of mocaf and soybean flour on the appearance of gluten-free wet noodles. The panelists rated treatment A3B1 the highest, giving it an average score of 4 (somewhat like). In contrast, treatment A2B3 received the lowest score, with an average value of 2.68 (neutral).

The use of glucomannan flour also influences the appearance of gluten-free wet noodles. The optimum appearance can be seen in using 2% glucomannan flour. When the concentration of glucomannan is increased, the noodles produced become softer because they absorb more water. The criteria for the best appearance chosen by the panelists for noodles were prioritized: the noodle strands did not break easily and had a homogeneous shape (Effendi *et al*., 2016).

3.3.2 Color

The addition of glucomannan, the ratio of mocaf flour to soybean flour, and the interaction between the use of the ratio of mocaf flour and soybean flour with the addition of glucomannan flour had a significant effect on the color of the gluten-free wet noodles produced. The panelists gave the highest score to treatment A3B1 with an average value of 4.08 (somewhat like). In comparison, the lowest assessment was found in treatment A2B3 with an average value of 2.72 (neutral).

The use of soybean flour and glucomannan flour influences the color of these gluten-free wet noodles. The amount of soy flour used affects the color of the noodles: the more soy flour added, the yellower the noodles will be. However, if more glucomannan flour is included in the mixture, the noodle dough will turn gray. As a result, increasing both soy and glucomannan flour will lead to duller yellow noodles. Soybeans contain 16.34 mcg of carotene per 100 grams, which contributes to the yellow color of the final product (Ratnawati *et al*., 2019).

3.3.3 Aroma

Adjusting the ratio of mocaf flour and soybean flour, along with the addition of glucomannan flour, did not significantly affect the aroma of the gluten-free wet noodles. The panelists gave the highest score for treatment A2B2, with an average value of 3.32 (neutral). In comparison, the lowest assessment was found in treatment A2B3, with an average value of 2.80 (neutral). Aroma is the quality of sensation felt through the olfactory organs from certain volatile compounds. Smell has a significant role in taste perception in food and beverages (Tournier *et al*., 2007).

3.3.4 Texture

The addition of glucomannan flour and the use of the ratio of mocaf flour and soybean flour with the addition of glucomannan flour significantly affected the texture of the resulting gluten-free wet noodles. The panelists gave the highest score for treatment A3B1, with an average score of 3.96 (rather like it). In comparison, the lowest assessment was found in treatment A2B3, with an average value of 2.76 (neutral).

The inclusion of glucomannan flour affects the texture of these gluten-free wet noodles. Glucomannan flour acts as a thickener and expander, binding water and trapping water molecules in the gel structure formed when it is mixed. However, panelists gave lower scores when the addition of glucomannan flour was increased. This occurs because of an imbalance between the amount of water and the added glucomannan flour, which disrupts the protein-starch matrix (Faridah & Widjanarko, 2014).

3.3.5 Taste

The interaction between the ratios of mocaf flour and soybean flour, along with the addition of glucomannan flour, did not significantly affect the taste of gluten-free wet noodles. The panelists rated treatment A3B1 the highest, giving it an average score of 3.40 (neutral), while treatment A2B3 received the lowest score with an average value of 2.84 (neutral). Taste is a gustatory perception (sweet, salty, sour, and bitter) caused by compounds that dissolve in the oral cavity. The taste-sensing process involves detecting certain compounds that are soluble in water, oil, or saliva from the taster's nipples, which are found mainly on the tongue's surface and the mucosa of the palate in the throat area (Tournier *et al*., 2007).

4. Conclusion

From the results of this study, it can be concluded that the ratio of mocaf and soybean flour significantly affects gluten-free noodles' elasticity, protein, ash, fat, carbohydrates, and color. The addition of glucomannan significantly affects elasticity, water absorption, water content, ash, texture, color, and appearance of gluten-free noodles. The interaction between the treatment of the ratio of mocaf flour to soybean flour and the addition of glucomannan flour significantly affects elasticity, water absorption, water content, protein, ash content, fat, carbohydrates, appearance, color, and texture. Based on physical, chemical, and sensory analysis, noodles with the treatment A2B1 is the best treatment with elasticity 73.3%, water absorption, 89.3%, swelling index 271%, cooking loss 8.78%, water content 36,8%, protein 6.44%, ash content 1.89%, fat 0.74%, carbohydrate 50.4%, sensory test results appearance 3.76 (somewhat like), color 3.72 (rather like), aroma 3.2 (neutral), texture 3.36 (neutral), and taste 3.36 (neutral).

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