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# THE EFFECT OF THE PROPORTION OF SORGUM FLOUR *(Sorghum bicolor)* AND JACKFRUIT SEED FLOUR *(Artocarpus heterophyllus)* ON THE PHYSICOCHEMICAL AND ORGANOLEPTIC PROPERTIES OF *CRISPY GLUTEN FREE BROWNIES*

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**Abstract**

Crispy brownies are a popular bakery product innovation due to their crispy texture and distinctive taste. With the increasing interest in gluten-free foods, the use of local non-wheat raw materials such as sorghum flour *(Sorghum bicolor)* and jackfruit seed flour *(Artocarpus heterophyllus)* is important to develop as an alternative to wheat flour. Both ingredients have the potential to support the physicochemical and organoleptic quality of the product. This study aims to examine the effect of variations in the proportion of the two flours and determine the optimal formulation of gluten-free *crispy brownies* . The study used an experimental method with a completely randomized design (CRD) with one factor , namely the difference in the concentration of the combination of sorghum flour and jackfruit seed flour. The treatment consisted of 5 levels, namely P1 (90 %: 10%), P2 (80%: 20%), P3 (70%: 30%), P4 (60%: 40%), and P5 (50%: 50%), each treatment was repeated 3 times. The parameters tested included water content, protein content, breaking strength test, and organoleptic tests (color, aroma, taste , texture). Data were analyzed using parametric statistics through Analysis of Variance (ANOVA) with the help of SPSS 24 software. If there were significant differences between treatments, the analysis was continued using the Tuckey test . Organoleptic data with the hedonic test method based on the panelists' level of preference were tested with Kruskal Wallis. The results showed that variations in the proportion of the two flours did not have a significant effect ($p>0.05$) on all parameters tested, including water content, protein content, breaking strength, and organoleptic attributes (color, aroma, taste, and texture). All treatments had organoleptic characteristics in the "Neutral" category with an average score ranging from 3.44 to 3.98. Based on the effectiveness test, treatment P1 (90% sorghum flour: 10% jackfruit seed flour) was determined as the best formulation with the highest Yield Value (NH) of 0.738, which had a water content of 2.41%, a protein content of 7.38%, a breaking strength of 441.73 gf, and organoleptic scores of color 3.86, taste 3.84, aroma 3.78, and texture 3.98.

**Keywords: *crispy brownies, gluten- free* , jackfruit seed flour, sorghum flour.**

## INTRODUCTION

Food security and public health issues have become major global concerns, as awareness of the importance of special diets and healthy lifestyles grows (Rahmawati & Wahyani, 2021). One growing dietary trend is the consumption of *gluten-free products* , stemming from the rise in cases of *Celiac Disease* , non- *celiac gluten sensitivity* , and individual choices to limit consumption of *the gluten protein* found in wheat. In Indonesia, dependence on wheat flour as the primary ingredient for bakery products remains very high, while the potential of local gluten-free food sources *such* as *sorghum* ( *Sorghum bicolor* ) and jackfruit seeds ( *Artocarpus heterophyllus* ) has not been optimally utilized (Hanifah *et al* ., 2022; An-Najjah *et al.*, 2021). This presents both challenges and opportunities for the development of local food products with high economic value and supports food diversification. *Sorghum* flour has been shown to have a relatively high protein content, around 10–11%, slightly lower than wheat (12%) but higher than milled rice (6–7%) (Winiastri, 2021). Furthermore, *sorghum flour* exhibits beneficial physiological effects, such as reducing fasting blood glucose in diabetic animal models (Dewi *et al* .,

2020), and significantly impacting the texture and moisture content of bakery products (Seveline *et al* ., 2022; Rahayu *et al* ., *2021). However, its development and utilization in Indonesia are still limited, creating an urgent need to maximize the potential of this local cereal as an alternative gluten-free* food ingredient . On the other hand, jackfruit seed flour has promising nutritional content, including 12.19 g of protein, 56.21 g of carbohydrates, and 1.12 g of fat per 100 g of dry matter (Andyarini & Hidayati, 2017). Previous research has shown that substituting jackfruit seed flour in cakes increases protein content while reducing water content, and produces a crispy texture *that* is acceptable to panelists (Restu *et al* ., 2015; Nabilah & Kisnawaty, 2023). Although jackfruit seeds are abundantly available, their utilization remains low due to limited public knowledge and limited processing innovation (An-Najjah *et al* ., 2021).

Developing bakery products based on a combination of *sorghum flour* and jackfruit seeds is an important strategy to increase the economic value of local food ingredients while providing a safe *gluten-free alternative for individuals with gluten intolerance* . Brownies are a suitable product choice because they have a large market in Indonesia. However, conventional brownies are generally semi-moist with a limited shelf life, making them less practical for daily consumption. Modifying the texture to create *Crispy Brownies* allows for a longer shelf life, ease of consumption, and continued consumer appeal (Faridhotululla, 2024). Although several studies have examined *sorghum flour* and jackfruit seed flour separately, studies on the combination of the two in *Crispy Gluten-Free* Brownies are still very limited. Based on this, this study was conducted to determine the effect of the proportion of sorghum flour and jackfruit seed flour on the physicochemical and organoleptic properties of Crispy Gluten-Free Brownies and to determine the best formulation from the treatments tested. This research is expected to serve as a reference in the development of sustainable local food innovations, while also emphasizing the urgency of utilizing food resources that have been underutilized.

## LITERATURE REVIEW

### *Sorghum* Flour ( *Sorghum bicolor* )

*Sorghum* ( *Sorghum bicolor* ) is a cereal that has high adaptability to dry conditions and marginal soils, so it has the potential as a local carbohydrate source. *Sorghum flour* is gluten-free, making it safe for individuals with gluten intolerance or *celiac disease* . The chemical composition of *sorghum flour* consists of ±82.5% starch, 10–12% protein, 1–2% fat, 70–75% carbohydrate, and 2% fiber (Suarni & Firmansyah, 2005; Setiarto et al., 2017). The high protein and fiber content allows *sorghum flour* to contribute to the nutritional value and texture of *bakery products* . *sorghum* flour production process includes grain sorting, washing, polishing to reduce tannins, drying to optimal moisture content, and milling into a fine flour (Durinep et al., 2024; Marissa, 2012). This flour can be processed through soaking, fermentation, or heating to improve functional properties, such as water-binding capacity, starch gelatinization, and digestibility (Kinanti et al., 2014). In gluten-free *bakery products* , *sorghum flour* serves as a starch source and also influences the product's texture, color, and stability.

### Jackfruit Seed Flour ( *Artocarpus heterophyllus* )

Jackfruit seeds ( *Artocarpus heterophyllus* ) are rich in starch, protein, and fiber, making them a potential substitute for wheat flour. The chemical composition of jackfruit seeds includes 40–50% starch, 6–7% protein, 1–2% fat, and 1–3% fiber (Ocloo et al., 2010; Paramitha, 2022). Transforming the seeds into flour improves physical stability, shelf life, and functional properties such as water absorption and gelatinization, which are important in *bakery product formulations* . The use of jackfruit seed flour as a partial substitute can increase crispiness and nutritional value without significantly reducing *organoleptic acceptability up to a certain proportion (Sofian et al., 2023; Zarima, 2024). In gluten-free crispy brownies* , jackfruit seed flour contributes to the crispy texture, structural stability, and nutrient balance.

### *Crispy Gluten-Free Brownies*

*Crispy brownies* are a *bakery product* with a crunchy texture and low water content, thus having a longer shelf life than conventional *brownies* . *Substitution of sorghum flour* and jackfruit seeds can affect physicochemical properties such as water content, protein, fat, carbohydrates, and fiber, as well as *organoleptic parameters* including aroma, taste, color, and crispness (Haziman et al., 2024; Walgiyanti et al., 2022). Optimal use of these two gluten-free flours is expected to produce *brownies* that are gluten-free, nutritionally balanced, and have a texture acceptable to consumers.

**Chemical Analysis**

**Water content**

Moisture content is an important parameter that determines the crispiness *of gluten-free brownies* . The lower the moisture content, the higher the crispiness because water acts as *a plasticizer* that softens the food matrix structure (Tunick, 2013). A crispy structure is formed when the moisture content is low enough for the pores to become brittle. Increasing moisture content during storage can reduce crispness due to surface rehydration (Arimi, 2010; Jakubczyk et al., 2008). Substitution of certain seed or fruit flours can increase water absorption, so controlling moisture content during baking and storage is crucial (Mendis et al., 2025).

**Protein Content**

Protein is a macromolecule that influences the nutritional value and functional properties of a product. In plant-based ingredients, protein is often bound to cell walls, making it less digestible than animal protein. Protein analysis generally uses the *Kjeldahl method* , which calculates total nitrogen and converts it to a protein value (Probosari, 2019). Protein content affects the texture, stability, and nutritional quality *of gluten-free brownies* .

**Fracture Strength Test**

Breaking strength indicates the pressure or force required to break a product and is an indicator of structural strength and crispness. Measurements are performed using *a Texture Analyzer* , with controlled pressure applied until the sample breaks. Breaking strength is strongly influenced by moisture content; the lower the moisture content, the harder and crispier the *brownie texture* . This test is important for assessing product stability during storage and distribution.

***Organoleptic* Test**

*Organoleptic* testing assesses the sensory characteristics *of brownies* based on human sensory perception, including color, aroma, taste, and texture (Mehran, 2015). Panelists are classified according to their level of expertise, ranging from limited panels to consumer panels, with varying numbers of panelists. Assessments generally use a five-level *Likert scale* , from very like to very dislike. *Organoleptic test results* form the basis for consumer acceptance of *gluten-free crispy brownies* .

**Effectiveness Test**

Effectiveness testing is used to assess the success of a *brownie formulation* based on chemical and sensory analysis results (Fadhilah, 2019). This test helps determine the extent to which a particular treatment or flour combination has the desired impact on physical, chemical, and sensory qualities. Furthermore, effectiveness testing can validate the success of a *brownie formulation* in terms of consumer acceptance, texture, and nutritional value.

**RESEARCH METHODS**

This research was conducted at the Chemistry and Food Technology Laboratory, Faculty of Food Technology and Fisheries, Dr. Soetomo University Surabaya, from October to December 2025. The main ingredients used were Sorghum flour ( *Sorghum bicolor* ) and Jackfruit seed flour ( *Artocarpus heterophyllus* ) obtained online through the Shopee platform from the “Serba Serbu Production” store, in the form of fine powder with their respective distinctive colors. Other supporting ingredients include eggs, sugar, Dark Cooking Chocolate (DCC), butter, cocoa powder, salt, xanthan gum, and baking powder obtained from “Tobaku” at Jalan Dukuh Kupang No. 57A, Surabaya. The tools used in making brownies include standard kitchen equipment such as mixers, digital scales, spatulas, ovens, as well as equipment for chemical analysis such as analytical balances, Kjeldahl apparatus, burettes, pipettes, volumetric flasks, and thermometers.

The research method applied was a quantitative laboratory experiment, aimed at observing the effect of the proportion of sorghum flour and jackfruit seed flour on the physical, chemical, and organoleptic characteristics of gluten-free crispy brownies. The experimental design used a one-factor Completely Randomized Design (CRD), namely the comparison of the proportion of sorghum flour and jackfruit seeds with five different treatments, each repeated three times, so that a total of 15 experimental units were obtained. The procedure for making brownies is carried out by heating the oven to a temperature of 150–160°C, melting DCC, butter, and salt using a double boiler or microwave, and preparing the egg and sugar mixture until dissolved. Sorghum flour, jackfruit seed flour, cocoa powder, xanthan gum, and baking powder are sifted, then mixed with the chocolate and butter mixture until evenly distributed. The mixture is poured into a baking pan lined with baking paper and baked for 25 minutes, then cooled

on a cooling rack until dry to maintain crispness. The observed variables included water content (gravimetric method), protein content (Kjeldahl method), breaking strength using Texture Analyzer, and organoleptic tests on color, aroma, taste, and texture with 30 panelists using a preference scale. Data were analyzed using parametric statistics through ANOVA with the help of SPSS version 24, and further tests were carried out using the Tuckey test. Non-parametric data in the form of organoleptic test results were analyzed using the Kruskal-Wallis test.

## RESULTS AND DISCUSSION

### Fracture Strength Test

The ANOVA results of the breaking strength test of gluten-free crispy brownies with different concentrations of sorghum flour *(Sorghum bicolor)* and jackfruit seed flour *(Artocarpus heterophyllus)* did not have a significant effect on the breaking strength test of crispy brownies. The average breaking strength test *of crispy brownies* is presented in Table 1.

**Table 1. Average breaking strength test of crispy gluten-free brownies**

| Treatment (Sorghum Flour : Jackfruit Seed Flour) | Mean ± sd |
|---|---|
| P1 (90 % : 10%) | 441.73 ± 39.86[a] |
| P2 (80 % : 20%) | 333.81 ± 20.74[a] |
| P3 (70 % : 30%) | 331.97 ± 37.62[a] |
| P4 (60 % : 40%) | 458.89 ± 19.92[a] |
| P5 (50 % : 50%) | 328.87 ± 23.61[a] |

Description: The same letters behind the mean figure indicate no significant difference between treatments using the Tuckey test at 5% level.

The results of the study showed that variations in the proportions of sorghum flour and jackfruit seed flour did not significantly affect the breaking strength of crispy brownies. This is due to the relatively similar starch content of sorghum flour and jackfruit seed flour , so their ability to form a crispy structure tends to be similar. Jackfruit seed flour contains 65.97% starch (Ulyarti and Capriola, 2022), while the starch content of sorghum flour is 51.32–66.39% depending on the variety (Avif and Oktaviana, 2020). Any difference in concentration of the two ingredients used will not affect the breaking strength because the starch content is relatively the same. The addition of sorghum flour or jackfruit seed flour can individually affect the breaking strength of cookies. Cicilia et al. (2021) reported that the higher the substitution of wheat flour with modified jackfruit seed flour, the higher the breaking strength of cookies, the highest breaking strength occurred at 75% substitution of jackfruit seed flour. Sarofa et al. (2023) reported that the lower the proportion of modified sorghum flour and the higher the proportion of tapioca flour, the lower the flake breaking strength. The best breaking strength was obtained with a ratio of 80:20 of modified sorghum flour and tapioca flour.

### Water Content Test

The results of the study showed that variations in the proportions of sorghum flour and jackfruit seed flour did not significantly affect the water content of *crispy gluten-free brownies* . This was due to Both types of flour have relatively the same starch content, as discussed in the previous section, thus showing similar water binding and release mechanisms during the heating process. The difference in the concentration of sorghum flour and jackfruit seed flour in the formulation did not cause significant changes in water content. The results of the ANOVA test of the water content of gluten-free crispy brownies with different concentrations of sorghum flour *(Sorghum bicolor)* and jackfruit seed flour *(Artocarpus heterophyllus* ) did not have a significant effect on the water content test of crispy brownies. The average water content test *of crispy brownies* is presented in Table 2.

**Table 2. Average water content of crispy gluten-free brownies**

| Treatment (Sorghum Flour : Jackfruit Seed Flour) | Mean ± sd |
|---|---|
| P1 (90 % : 10%) | 2.41 ± 0.29[a] |
| P2 (80 % : 20%) | 2.14 ± 0.12[a] |
| P3 (70 % : 30%) | 2.35 ± 0.14[a] |
| P4 (60 % : 40%) | 2.28 ± 0.07[a] |
| P5 (50 % : 50%) | 2.79 ± 0.43[a] |

Description: The same letters behind the mean figure indicate no significant difference between treatments using the Tuckey test at 5% level.

Rahayu et al. (2019) stated that the increase in water absorption capacity is related to the increase in hydroxyl groups in starch, where the higher the starch content in the material, the faster the starch gelatinization

process, thereby increasing the starch's ability to absorb water. Jackfruit seed flour is known to have functional properties related to water, especially its relatively high water absorption capacity, which is influenced by its starch content and the presence of hydroxyl groups in starch granules (Tulyathan *et al* ., 2002; Teo, 2024). On the other hand, sorghum flour also shows quite good water absorption capacity as reflected in the water absorption index (WAI) value, thus playing a role in forming the physical characteristics of starch-based processed products (Frederick *et al.,* 2009).

**Protein Level Test**

The results of the ANOVA on protein content in gluten-free crispy brownies with different proportions of sorghum flour ( *Sorghum bicolor* ) and jackfruit seed flour ( *Artocarpus heterophyllus* ) showed that it did not have a significant effect on the protein content of the product. The average protein content test *for crispy brownies* is presented in Table 3.

**Table 3. Average protein content of *crispy gluten-free brownies***

| Treatment (Sorghum Flour : Jackfruit Seed Flour) | Mean ± sd |
|---|---|
| P1 (90 % : 10%) | 7.38 ± 0.75[a] |
| P2 (80 % : 20%) | 7.31 ± 0.74[a] |
| P3 (70 % : 30%) | 7.85 ± 0.68[a] |
| P4 (60 % : 40%) | 7.87 ± 0.23[a] |
| P5 (50 % : 50%) | 7.18 ± 0.29[a] |

Description: The same letters behind the mean figure indicate no significant difference between treatments using the Tuckey test at 5% level.

The results of the analysis of variance showed that the protein content of *gluten-free crispy brownies* formulated with various proportions of sorghum flour *(Sorghum bicolor* ) and jackfruit seed flour *(Artocarpus heterophyllus* ) was in the range of 7.18–7.87%. This insignificant difference is due to the relatively similar protein content of both types of flour . *et al.* (2023) stated that jackfruit seed flour contains 16.37 g of protein per 100 g, indicating a significant contribution of jackfruit seed flour protein to a flour-based food system. Winiastri (2021) stated that sorghum protein content is in the range of 10–11%. Thus, varying the proportions of sorghum flour and jackfruit seed flour in the formulation does not significantly affect the protein content of brownies, but maintains a stable protein content.

**Organoleptic Evaluation Results**

Presenting the results of organoleptic tests of gluten-free crispy brownies made from sorghum flour *(Sorghum Bicolor)* and jackfruit seed flour *(Artocarpus heterophyllus)* with each different treatment did not have a significant effect on the organoleptic test of crispy brownies. The median value of the hedonic test of *crispy brownies* is presented in Table 4.

**Table 4. Median value of the hedonic test of *crispy gluten-free brownies***

| Treatment | Parameter | | | |
|---|---|---|---|---|
| | **Color** | **Flavor** | **Aroma** | **Texture** |
| P1 | 3.86[a] | 3.84[a] | 3.78[a] | 3.98[a] |
| P2 | 3.61[a] | 3.53[a] | 3.44[a] | 3.72[a] |
| P3 | 3.83[a] | 3.51[a] | 3.60[a] | 3.81[a] |
| P4 | 3.63[a] | 3.56[a] | 3.61[a] | 3.79[a] |
| P5 | 3.69[a] | 3.76[a] | 3.66[a] | 3.74[a] |

Description: The median value in the column followed by the same letter indicates no significantly different in the Mann-Whitney test.

**Color**

The results of the organoleptic color test analyzed nonparametrically using the Kruskal–Wallis test as presented in Table 4 show that variations in the proportion of sorghum flour and jackfruit seed flour in making crispy gluten-free brownies do not have a significant effect on color attributes . The median value of the panelists' preference for the color of brownies in each treatment was 3.86 in P1; 3.61 in P2; 3.83 in P3; 3.63 in P4; and 3.69 in P5 , all of which were in the neutral category . The results of the Kruskal–Wallis test produced a significance value of 0.633 ($p > 0.05$ ) , so it can be concluded that there was no significant difference between treatments.

The lack of significant differences in color attributes is thought to be due to the dominant use of cocoa powder in the brownie formulation, which masks the natural color differences between sorghum flour and jackfruit seed flour. Furthermore , the baking process triggers the Maillard reaction and caramelization, resulting in the characteristic dark brown color of brownies, so variations in flour type and proportion do not have a striking visual impact. The resulting color uniformity led panelists to give relatively similar ratings to all treatments. These results align with research by Rahmawati et al. (2021) , which reported that substitution of various types of non-wheat flour in chocolate brownie products did not significantly affect color due to the strong influence of cocoa pigments and browning reactions during baking.

**Aroma**

The results of the organoleptic test on aroma attributes based on the Kruskal–Wallis nonparametric analysis as presented in Table 4 show that variations in the proportion of sorghum flour and jackfruit seed flour did not have a significant effect on the level of panelists' preference ($p > 0.05$). The median value of aroma preference in each treatment was in the range of 3.44–3.78 , namely 3.78 (P1), 3.44 (P2), 3.60 (P3), 3.61 (P4), and 3.66 (P5), with all included in the neutral category and having the same letter notation. This indicates that the difference in formulation does not produce a significant difference in aroma sensory. This condition is thought to be because the distinctive aroma of brownies is dominated by the use of cocoa powder and margarine and the formation of a roasted aroma during the baking process, so that the distinctive aroma of sorghum flour and jackfruit seed flour is relatively masked. This result is in line with Falesta's (2024) research which states that in plant-based food products, the final aroma is more influenced by the dominant aroma-giving ingredients and the heating process than by variations in the basic flour ingredients.

**Flavor**

The results of organoleptic tests on taste attributes showed that variations in the proportion of sorghum flour and jackfruit seed flour did not significantly affect the level of panelists' preference ($p > 0.05$ ) . The median taste preference values for each treatment were 3.84 ( P1), 3.53 (P2), 3.51 (P3), 3.56 (P4), and 3.76 (P5), all of which were in the neutral category. The absence of significant differences between treatments indicates that the taste characteristics of the brownies were relatively uniform. This is thought to be due to the dominance of the chocolate flavor and the addition of sugar which produces a consistent sweet-bitter flavor profile across all treatments, so that variations in the proportion of flour do not provide a contrasting sensory effect. Furthermore, the use of jackfruit seed flour did not produce any disturbing *off-flavors* . This finding aligns with research by Sari et al. (2022), which reported that in gluten-free bakery products, flavor acceptance was more influenced by the primary flavoring ingredient than the type of substitute flour used.

**Texture**

The results of organoleptic tests on texture attributes showed that variations in the proportion of sorghum flour and jackfruit seed flour did not significantly affect the level of panelist preference ($p > 0.05$ ) . The median values of texture preference for each treatment were 3.98 ( P1), 3.72 (P2), 3.81 (P3), 3.79 (P4), and 3.74 (P5), all of which were included in the neutral category and had the same letter notation. This indicates that differences in formulation did not produce significant differences in texture. The uniformity of texture is thought to be related to the role of starch content in both types of flour, which contributes to the formation of product structure during baking, resulting in relatively uniform characteristics of crispy gluten-free brownies. These results align with research by Putri and Wahyuni (2021), which states that substituting non-wheat flour in bakery products does not always significantly affect texture if the processing and basic formulation are relatively similar .

**Determination of Best Treatment (Effectiveness Test)**

Effectiveness testing was used to determine the best and most preferred treatment. Based on the effectiveness test results for all research parameters, including chemical and organoleptic tests, the best treatment achieved the highest yield (NH) value. The calculation of the *crispy* brownie effectiveness test is presented in Table 5.

**Table 5. Effectiveness Test Calculation**

| Parameter | Yield Value (NH) of Treatment | | | |
|---|---|---|---|---|
| | P1 | P2 | P3 | P4 |
| Water content | 0.071 | 0.143 | 0.090 | 0.109 |
| Protein Content | 0.061 | 0.046 | 0.111 | 0.143 |
| Breaking Strength | 0.043 | 0.121 | 0.126 | 0,000 |
| Color | 0.143 | 0,000 | 0.121 | 0.009 |
| Aroma | 0.143 | 0,000 | 0.069 | 0.079 |
| Flavor | 0.143 | 0.014 | 0,000 | 0.024 |
| Texture | 0.143 | 0.069 | 0.106 | 0.100 |
| **Total** | 0.89* | 0.44 | 0.76 | 0.61 |

Description * = best treatment

Based on the analysis of the effectiveness test of all research parameters, crispy brownies with formulation P1 (90% sorghum flour: 10% jackfruit seed flour) showed the best performance with the highest yield value of 0.738. This treatment has a protein content of 7.38%, a water content of 2.41%, a breaking strength of 441.73, and organoleptic scores including color 3.86, taste 3.84, aroma 3.78, and texture 3.98. These results indicate that the combination of the proportions of sorghum flour and jackfruit seed flour in P1 produces chemical, physical, and sensory qualities, so this formulation is determined as the best choice for making *gluten-free crispy brownies* based on sorghum flour and jackfruit seed flour.

## CONCLUSION

Based on the research results, it can be concluded that variations in the proportion of sorghum flour and jackfruit seed flour do not have a significant effect on the chemical properties (water and protein content), physical properties (breakability), or organoleptic properties (color, taste, aroma, and texture) of gluten-free crispy brownies. This indicates that the use of jackfruit seed flour up to a proportion of 50% is still able to maintain quality characteristics equivalent to a lower proportion. Based on the effectiveness test for all parameters, treatment P1 (90% sorghum flour: 10% jackfruit seed flour) is the best formulation with a Yield Value (NH) of 0.738. This formulation produces a product with a water content of 2.41%, a protein content of 7.38%, a breakability of 441.73 gf, and the most optimal level of panelist preference for all sensory attributes (score 3.78–3.98). This product has the potential as an alternative local gluten-free food that has good nutritional value and consumer acceptance.

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