Linker (The Journal of Emerging Research in Agriculture, Fisheries, and Forestry)
Volume 6, Issue 1
ISSN (Print): 3082-3625 ISSN (Online): 2815-2018
DOI: https://doi.org/10.65141/jeraff.v6i1.n6

Consumer Acceptability and Sensory Evaluation of Pork Patties with Glutinous Rice Flour as Binder

Mary Grace T. Hista[1], Romeo Jay B. Sollestre[2], Joshua C. Filiminiano[3], Jade S. Sabongan[4]
College of Agriculture and Related Sciences, Monkayo College of Arts, Sciences, and Technology, Monkayo, Davao de Oro, 8805, Philippines[1,2,3,4]
histamarygrace2516@gmail.com; rjsollesre.moncast@gmail.com

RESEARCH ARTICLE INFORMATION	ABSTRACT

Received: November 14, 2025
Reviewed: May 21, 2026
Accepted: June 23, 2026
Published: June 30, 2026

Consumer demand for ready-to-eat pork products in the Philippines has increased the need for affordable and functional binders in processed meats. However, limited research has examined the use of glutinous rice flour (GRF), a locally available amylopectin-rich starch, as a binder for pork patties. This preliminary sensory evaluation assessed the sensory qualities and consumer acceptability of pork patties formulated with varying levels of GRF. A Completely Randomized Design (CRD) with four treatments (T1: breadcrumbs, T2: 2% GRF, T3: 3% GRF, and T4: 5% GRF) and three replications was employed. Ten untrained panelists evaluated odor, juiciness, tenderness, flavor, and overall acceptability using a 5-point Hedonic Scale. Data were analyzed using one-way ANOVA and Duncan's Multiple Range Test at a 5% significance level. Significant differences were observed in odor, juiciness, and flavor ($p < 0.05$). T3 recorded the highest odor and flavor ratings, while T4 obtained the highest juiciness rating. In contrast, T2 received the lowest odor and juiciness scores, whereas T1 had the lowest flavor rating. Tenderness and overall acceptability did not differ significantly among treatments, although T3 and T4 obtained the highest overall acceptability rating. The results suggest that GRF at 3–5% may be a promising and low-cost binder for pork patties. However, the findings should be interpreted cautiously because they are based on a small panel of 10 untrained consumers. Future studies should include larger consumer panels, nutritional profiling, cooking loss and moisture analyses, shelf-life evaluation, and economic feasibility assessments.

Keywords: *glutinous rice flour, pork patty, sensory evaluation, consumer acceptability, binder*

Introduction

The pork industry in the Philippines comprises two main sectors: commercial and backyard. Most pigs (~70%) are raised on small-scale backyard farms, with commercial farms contributing the remaining ~30% (Department of Agriculture, 2022). Pork is one of the most widely consumed meat proteins worldwide and provides many essential nutrients (protein, vitamins, minerals) (Jung et al., 2024). In the Philippines, pork remains a staple meat, and its consumption is projected to grow with population and economic expansion (Global Ag Media, 2024). As a result, convenient pork products (e.g., pork patties and burgers) are increasingly popular for their taste and texture. To maintain quality in such processed meats, food formulators often use non-meat binders and fillers to improve juiciness and cohesiveness (Van Buren et al., 2023). However, many commonly used binders, such as breadcrumbs, are either imported, costly, or inconsistent in quality, making the search for a locally available and affordable binder timely and relevant.

Basically, pork is also widely used in processed products like sausages, hams, and patties, which often include added binders to improve quality. Functional binders (e.g., starches, cereal flours, and other fibers) are commonly incorporated to boost water-holding, emulsification, and yield (Ciobanu et al., 2025). Starch-based binders gelatinize and swell, entrapping water in a gel matrix that contributes to perceived juiciness and tenderness during consumption (Colle & Bass, 2020). Previous studies have demonstrated that glutinous rice flour improves the functional and sensory properties of sausages, beef patties, and chicken meat burgers. However, evidence regarding its application as a binder in pork patties, particularly among Filipino consumers with distinct culinary preferences and familiarity with glutinous rice, remains limited. Addressing this gap is important to determine whether GRF can serve as an affordable, locally available alternative to commercial binders while maintaining desirable sensory quality.

Glutinous (sticky) rice flour (GRF), made from waxy or malagkit rice, contains nearly 100% amylopectin, allowing it to form a viscous, gelatinous paste when heated (Ohbayashi, 2024). In meat batters, such sticky starch gels bind water and fat tightly. In fact, meat processors commonly use cereal starches (from rice, tapioca, potato, etc.) to boost yield and juiciness. Upon cooking, the starch granules gelatinize and swell, entrapping water in a gel matrix that reduces shrinkage and fat drip (Pereira et al., 2019; Owusu-Ansah, 2022). Because sticky rice is a traditional staple in the Philippines, GRF remains inexpensive and accessible. Nevertheless, previous studies showed that GRF improves texture and moisture retention in sausages and beef patties (Yi et al., 2012; Gao et al., 2014), particularly among Filipino consumers, whose preferences and familiarity with glutinous rice may influence sensory perception and product acceptability. This underscores the need to investigate whether substituting breadcrumbs with GRF can maintain or improve sensory traits such as tenderness, juiciness, and flavor.

More broadly, plant-based extenders are now widely used to reformulate meat products without significantly compromising desirable sensory attributes. Reviews indicate that replacing part of the meat with cereals, tubers, or pulses generally improves product yield while only slightly altering taste or texture (Pintado & Delgado-Pando, 2020). Similarly, Peetitungwong et al. (2020) reported that incorporating 5% rice bran into pork patties did not reduce consumer acceptability. Similarly, Monica et al. (2024) found that incorporating 3-5% white GRF, together with varying chitosan levels, improved moisture-binding capacity. Likewise, Yi et al. (2012) demonstrated that incorporating 1–3% GRF significantly reduced hardness and chewiness, increased juiciness and fat/moisture retention ($p < 0.05$), improved tenderness, and reduced cooking loss through enhanced water and fat binding. However, excessive GRF inclusion may produce an overly soft or pasty texture because of extensive starch gelatinization and water binding, potentially reducing the firm, meat-like bite expected in processed pork products (Gao et al., 2014; Pereira et al., 2020). Therefore, the present study selected 2%, 3%, and 5% GRF as low, intermediate, and relatively high inclusion levels based on previously reported improvements in water-binding capacity, texture, and consumer acceptability, allowing evaluation of the dose-dependent effects of GRF on the sensory quality of pork patties.

Previous studies have demonstrated the potential of locally available agricultural resources in developing acceptable value-added food products through sensory evaluation (San Antonio et al., 2024). However, limited studies have investigated glutinous rice flour as a binder in pork patties under local consumer conditions. Therefore, this study aimed to address this research gap by evaluating the sensory qualities and consumer acceptability of pork patties formulated with varying levels of glutinous rice flour. The study determined whether GRF could serve as an effective and locally available alternative binder to breadcrumbs. By examining its influence on aroma, tenderness, juiciness, flavor, and overall acceptability, this research can contribute to the growing body of knowledge on the use of locally sourced ingredients in processed meat products within the Philippine context.

Methods

Research Design

This study employed a Completely Randomized Design (CRD) consisting of four treatments with three independent replications. Each replication represented a separate batch of pork patty formulation prepared independently using the same ingredients, formulation procedure, and cooking conditions. Thus, a total of 12 experimental batches (4 treatments × 3 replications) were produced. Each batch served as the experimental unit for sensory evaluation.

Locale of the Study

The study was conducted at two locations. The preparation and formulation of pork patties were carried out in the kitchen of one of the authors, located in Purok 3, Poblacion, Monkayo, Davao de Oro. The sensory evaluation and data gathering took place within the Monkayo College of Arts, Sciences, and Technology (MonCAST) campus. All activities related to treatment preparation, cooking, serving, and sensory scoring were conducted from November 28 to 30, 2025.

Figure 1. *Location of the Study*

Participants

The sensory evaluation was conducted using a panel of untrained consumer judges. These individuals were selected based on their willingness to participate and their familiarity with pork products. A total of 10 judges participated in the evaluation. The judges were not given any background information about the treatments to avoid bias, and the coded samples were served in randomized order. This study was designed as a preliminary sensory evaluation; therefore, a small panel of 10 untrained consumer judges was considered appropriate for obtaining initial consumer acceptability data.

Treatments and Formulation

The study consisted of four treatment formulations that differed only in the type or level of binder used, while all other ingredients and preparation procedures were kept constant.

- T1 – Control: Pork patty with 7g (5%) breadcrumbs
- T2 – 2.8 g (2%) GRF per 140g pork each replication
- T3 – 4.2 g (3%) GRF per 140g pork each replication
- T4 – 7 g (5%) GRF per 140g pork each replication

Ingredients were weighed accurately, mixed thoroughly by hand until homogenous, and shaped into 22-gram patties (1 cm thick). The patties were refrigerated briefly to allow binder hydration and mixture firming.

Cooking Procedure

The refrigerated patties were cooked individually in a lightly oiled frying pan over medium heat under uniform cooking conditions. Each patty was cooked until fully done and evenly browned on both sides, turning only once during cooking to ensure uniform heat distribution. After cooking, the patties were placed on absorbent paper towels for approximately one minute to remove excess surface oil before sensory evaluation. All treatments were prepared and cooked following identical procedures to minimize experimental variation.

Sensory Evaluation

Sensory evaluation was conducted immediately after cooking. Each sample was assigned a randomly generated three-digit code to conceal treatment identity and was presented warm to the panelists in randomized order to minimize serving bias. Drinking water was provided to the panelists between samples to reduce carry-over effects during evaluation. Each panelist independently evaluated the samples based on sensory attributes, such as odor, juiciness, tenderness, flavor, and overall acceptability. The attributes were rated using a 5-point Hedonic Scale, where 5 = Like Extremely and 1 = Dislike Extremely.

Data Collection and Variables Measured

The study collected sensory evaluation scores for five response variables, such as odor or the aroma perceived immediately before tasting the pork patty; juiciness or the amount of moisture perceived during chewing; tenderness or the ease of chewing and softness of the cooked patty; flavor or the overall taste impression resulting from the combination of meat, seasonings, and binder; and the overall acceptability or the general preference of the panelists considering all sensory attributes. Individual scores from each panelist were recorded, and mean values for each treatment and replication were computed prior to statistical analysis.

Statistical Analysis

The sensory evaluation data were analyzed using one-way Analysis of Variance (ANOVA) under a Completely Randomized Design (CRD) to determine significant differences among treatment means. Whenever significant treatment effects were detected, Duncan's Multiple Range Test (DMRT) was performed for mean separation. Statistical analyses were conducted using the Statistical Tool for Agricultural Research (STAR) Version 2.0.1. Statistical significance was declared at $\alpha = 0.05$.

Ethical Considerations

The study adhered to ethical standards for research involving human participants. All panelists were informed of the purpose of the study and their role in the sensory evaluation before participation. Verbal informed consent was obtained from each participant, and all responses were treated confidentially through the use of coded data. Participation was entirely voluntary, and panelists were free to withdraw from the study at any time without consequence. No minors or vulnerable individuals were involved in the evaluation. The pork patties were prepared following proper food hygiene and safety practices to minimize health risks. The researchers declare that no conflicts of interest influenced the conduct, analysis, or reporting of this study.

Results and Discussion

Table 1 presents the mean sensory scores of pork patties formulated with different levels of glutinous rice flour (GRF). Significant differences among treatments were observed for odor ($p = 0.0135$), juiciness ($p = 0.0466$), and flavor ($p = 0.0178$), whereas tenderness ($p = 0.0661$) and overall acceptability ($p = 0.0810$) did not differ significantly. Treatments containing 3% and 5% GRF generally obtained the highest mean scores across most sensory attributes.

Treatments T3 (3% GRF) and T4 (5% GRF) consistently received the highest scores across most sensory attributes, indicating improved sensory performance compared to the control (T1). The enhanced ratings for T3 and T4 support existing literature demonstrating that glutinous rice flour increases water retention, cohesiveness, and overall palatability of meat products due to its high amylopectin content, which forms a viscous gel during cooking (Pereira et al., 2019; Gao et al., 2014). In contrast, T2 (2% GRF) displayed slightly lower ratings in odor and tenderness, suggesting that the binder level may have been insufficient to exert its full functional capacity.

The results generally align with past studies where GRF improved the sensory quality of beef or pork patties (Yi et al., 2012; Gao et al., 2014). The high consumer preference for T3 and T4 indicates that GRF can serve as a viable alternative to commercial breadcrumbs, especially in settings where affordability and local availability are important considerations. These findings imply potential applications in small-scale meat processing, household cooking, and community-level livelihood projects.

Table 1. Mean Sensory Scores of Pork Patties Formulated with Different Levels of Glutinous Rice Flour (GRF) as Binder

Treatment	Attributes				
	Odor	Juiciness	Tenderness	Flavor	Overall Acceptability
T1 – 7 g/5% Bread Crumbs	4.12^{a}	3.83^{ab}	3.73	3.70^{c}	3.81
T2 – 2.8 g/2% GRF	3.53^{b}	3.67^{b}	3.60	3.83^{bc}	3.96
T3 – 4.2 g/3% GRF	4.50^{a}	4.30^{a}	4.33	4.60^{a}	4.53
T4 – 7 g/5% GRF	4.23^{a}	4.33^{a}	4.47	4.33^{ab}	4.53
CV%	6.60	7.01	9.76	7.15	8.70
PR (>F)	0.0135	0.0466	0.0661	0.0178	0.0810

Note: The values are means of the three replications; the significance level was set at 5%; Aroma of the pork patty with the different types of treatment. Means within the same row sharing the same superscript letter are not significantly different at the 5% level according to Duncan's Multiple Range Test (DMRT).

Odor

Odor ratings ranged from 3.53 to 4.50, with significant differences (p = 0.0135). T3 recorded the highest numerical odor score, but it did not differ significantly from the control (T1) or T4. The improved aroma of GRF-based patties may be attributed to the binder's ability to retain fats and moisture during cooking, which intensifies meat volatiles responsible for a pleasant aroma. Pereira et al. (2019) explained that starches enhance meat emulsification and reduce fat loss, resulting in richer aromatic profiles. Meanwhile, the lowest rating (T2) suggests that too little GRF does not substantially improve volatile retention. These findings support Gao et al. (2014), who found enhanced aroma in pork patties containing GRF due to reduced cooking loss. Generally, the data demonstrate that moderate-to-high GRF levels can elevate the desirable aroma of pork patties.

Juiciness

Juiciness scores ranged from 3.67 to 4.33, with significant differences (p = 0.0466). Treatment 4 (5% GRF) recorded the highest juiciness score (4.33), closely followed by T3 (4.30). The numerically higher juiciness of GRF-enhanced patties aligns with established mechanisms. This observation is consistent with previous reports suggesting that amylopectin forms a gel network that traps water and fat within the meat matrix (Colle & Bass, 2020; Van Buren et al., 2023). This prevents excessive moisture loss during frying, resulting in a juicier bite.

On the other hand, the control (T1) produced moderately juicy patties but performed lower than T3 and T4, reflecting the typical behavior of breadcrumbs, which hold less moisture than glutinous rice starch. The observed juiciness improvement coincides with the research findings of Yi et al. (2012), who reported greater moisture retention in beef patties containing GRF.

Tenderness

Tenderness scores ranged from 3.60 to 4.47, but differences were not statistically significant (p = 0.0661). Although tenderness scores were numerically higher for T3 and T4, the differences were not statistically significant (p = 0.0661). The increased tenderness is likely due to starch gelatinization, which softens the patty structure while enhancing cohesiveness (Pereira et al., 2019). Treatment 2 (2% GRF) showed the lowest tenderness score, indicating that insufficient starch may not adequately support moisture entrapment and structural softening. Despite the statistical outcome, the sensory trend suggests that GRF improves textural quality at moderate-to-high inclusion levels. This supports Ciobanu et al. (2025), who emphasized that starch-based dietary fibers enhance texture in processed meat systems.

Flavor

Flavor ratings varied from 3.70 to 4.60, with significant differences (p = 0.0178). Treatment 3 achieved the highest flavor score (4.60), indicating that 3% GRF may represent the optimal level for enhancing taste without overpowering the meat’s natural flavors. GRF does not contribute strong flavors; instead, it improves flavor perception by retaining juices, fats, and seasonings within the patty (Owusu-Ansah et al., 2022).

On the other side, the control treatment had the lowest flavor score (3.70), possibly due to greater moisture and fat loss during frying. Enhanced flavor in GRF-based patties is consistent with the research findings of Peetitungwong et al. (2020), who reported that cereal-derived binders boost seasoning retention and improve mouthfeel.

Although both treatments received high flavor ratings, the slightly higher score at 3% GRF may indicate that moderate GRF inclusion enhanced texture and moisture perception without excessively diluting the characteristic pork flavor. Increasing GRF to 5% may have slightly altered the meat-to-binder ratio, resulting in a marginally lower flavor score, although the difference was not statistically significant.

Overall Acceptability

Overall acceptability ranged from 3.81 to 4.53, with T3 and T4 tied for the numerically higher rating (4.53). Although overall acceptability was numerically higher for T3 and T4, these differences were not statistically significant (p = 0.0810). Consumers tended to prefer treatments with greater juiciness and tenderness, which are closely linked to acceptability (Pintado & Delgado-Pando, 2020). These results indicate that GRF at 3%–5% can equal or surpass traditional breadcrumbs in consumer preference. Considering the affordability and abundance of glutinous rice in the Philippines, using GRF as a binder can support local livelihoods while reducing dependence on commercial extenders.

Figure 3. *Pork Patties with Various Treatment Levels Applied*

Conclusion and Future Works

This study provides preliminary evidence that glutinous rice flour (GRF) has potential as a locally available binder for pork patties and may serve as a feasible alternative to conventional breadcrumbs without adversely affecting consumer sensory acceptability. While the observed sensory responses suggest promising applications for GRF in processed meat products, these conclusions should be interpreted cautiously because they are based on a preliminary sensory evaluation using a small panel of untrained consumer judges and were not supported by instrumental physicochemical analyses. Future studies involving larger consumer panels and comprehensive quality assessments are recommended to further validate the functional and sensory performance of GRF before broader recommendations for commercial application can be made.

In order to strengthen the evidence supporting the use of glutinous rice flour as a meat binder, future research may focus on instrumental quality analyses, such as texture profile analysis, color measurement, cooking yield, and moisture loss. Nutritional profiling may also be conducted to determine how GRF affects the fat, protein, carbohydrate, and caloric content of pork patties. Othe researchers may also take into account shelf-life and microbial studies to assess product stability during storage, and/ or cost-benefit analysis to evaluate the economic feasibility of GRF substitution at different production scales. Furthermore, consumer testing with a larger and more diverse panel to strengthen generalizability and the application of GRF to other processed meat products, such as sausages, meatballs, embutido, or plant-based patties, are likewise recommended.

By and large, this preliminary study suggests that glutinous rice flour has potential as a sustainable, functional, and culturally acceptable binder for pork patties. Nevertheless, further validation through larger-scale sensory and physicochemical studies is recommended before its wider application in the Philippine food industry.

References

[1] Ciobanu, M. M., Manoliu, D. R., Ciobotaru, M. C., Flocea, E. I., & Boișteanu, P. C. (2025). Dietary fibres in processed meat: A review on nutritional enhancement, technological effects, sensory implications and consumer perception. *Foods, 14*(9), 1–31. https://doi.org/10.3390/foods14091459

[2] Colle, M., & Bass, P. (2020, November 4). *Meat and potato … starch. The National Provisioner.* Retrieved from https://www.provisioneronline.com/articles/110155-meat-and-potato-starch.

[3] Department of Agriculture. (2022). *Philippine hog industry roadmap 2022-2026.* Department of Agriculture–Bureau of Agricultural Research. https://www.da.gov.ph/wp-content/uploads/2023/05/Philippine-Hog-Industry-Roadmap.pdf.

[4] Gao, X., Zhang, W., & Zhou, G. (2014). Effects of glutinous rice flour on the physiochemical and sensory qualities of ground pork patties. *LWT-Food Science and Technology, 58*(1), 135–141. https://doi.org/10.1016/j.lwt.2014.02.044.

[5] Global Ag Media. (2024, September 3). *Philippine pork consumption to rise 2% in 2024. The Pig Site.* https://www.thepigsite.com/news/2024/09/philippine-pork-consumption-to-rise-2-in-2024.

[6] Jung, A. J., Sharma, A., Chung, M., Wallace, T. C., & Lee, H. J. (2024). The Relationship of Pork Meat Consumption with Nutrient Intakes, Diet Quality, and Biomarkers of Health Status in Korean Older Adults. *Nutrients, 16*(23), 4188. https://doi.org/10.3390/nu16234188.

[7] Monica, M., Fitriani, A., & Setyaji, H. (2024). Use of chitosan and white glutinous rice flour on the quality of chicken meat burger. *International Journal of Advanced Scientific Research, 2*(5), 507–516. https://doi.org/10.59890/ijasr.v2i5.1926

[8] Ohbayashi, K., Sugiyama, Y., Nohmi, T., Nishimura, K., Nakazaki, T., Sato, Y. I., … & Iwasaki, Y. (2024). Anekomochi glutinous rice provides low postprandial glycemic response by enhanced insulin action via GLP-1 release and vagal afferents activation. *The Journal of Physiological Sciences, 74*(1), 1–12. https://jps.biomedcentral.com/articles/10.1186/s12576-024-00940-5.

[9] Owusu-Ansah, P., Besiwah, E. K., Bonah, E., & Amagloh, F. K. (2022). Non-meat ingredients in meat products: A scoping review. *Applied Food Research*, *2*(1). https://doi.org/10.1016/j.afres.2022.100044.

[10] Peetitungwong, S., Chonmanawat, M., Santiwattana, P., Sirisukpornchai, T., Kaewsaad, T., & Theprugsa, P. (2020). The usage of rice bran flour and pea protein in pork patties and pork meatballs. *International Journal of Agricultural Technology, 16*(2), 329–338. https://www.thaiscience.info/Journals/Article/IJAT/10992808.pdf.

[11] Pereira, J., Hu, H., Xing, L., Zhang, W., & Zhou, G. (2019). Influence of rice flour, glutinous rice flour, and tapioca starch on the functional properties and quality of an emulsion-type cooked sausage. *Foods, 9*(1), 1–12. https://doi.org/10.3390/foods9010009.

[12] Pintado, T., & Delgado-Pando, G. (2020). Towards more sustainable meat products: Extenders as a way of reducing meat content. *Foods, 9*(8), 1–19. https://doi.org/10.3390/foods9081044.

[13] San Antonio, M. J., Asprec, M. J., Angeles Jr, I., & Castro, M. (2024). Microbiological, Nutrient Analysis and Sensory Acceptability of Bottled Rice Eel (Monopterus Albus) In Spanish Oil Style with Different Fruit Flavorings. *Linker (The Journal of Emerging Research in Agriculture, Fisheries and Forestry)*, *4*(2), 16–34. https://doi.org/10.65141/jeraff.v4i2.n2

[14] Van Buren, J. B., Puga, K. J., Hoffman, K. C., Nasados, J. A., Bass, P. D., & Colle, M. J. (2023). Water binders in beef patties increase yield and extend shelf life. *Translational Animal Science, 7*(1), 1–7. https://doi.org/10.1093/tas/txad091.

[15] Yi, H. C., Cho, H., Hong, J. J., Ryu, R. K., Hwang, K. T., & Regenstein, J. M. (2012). Physicochemical and organoleptic characteristics of seasoned beef patties with added glutinous rice flour. *Meat science, 92*(4), 464-468. https://doi.org/10.1016/j.meatsci.2012.05.012.

Acknowledgment

The researchers extend their sincere gratitude to the Monkayo College of Arts, Sciences, and Technology (MonCAST) for allowing the conduct of this study and for providing the necessary support during the sensory evaluation procedures. Special thanks are also given to the consumer panelists who willingly participated in the evaluation sessions. Their time and honest feedback greatly contributed to the successful completion of this research.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the conduct of this research and the publication of this paper. No external funding, financial support, or institutional influence affected the study's design, data collection, analysis, or interpretation.

Artificial Intelligence (AI) Declaration Statement

The authors acknowledge the use of artificial intelligence (AI) tools, specifically ChatGPT, developed by OpenAI, in the preparation and refinement of certain sections of this manuscript, such as language refinement, grammar correction, formatting, and editorial enhancement of selected sections of the manuscript. The AI tool was used solely to improve clarity, coherence, formatting, and grammar. All ideas, data interpretations, and results presented in the manuscript remain the authors' own. The authors thoroughly reviewed, verified, and edited all AI-assisted content to ensure accuracy, integrity, and alignment with the study's objectives before inclusion in the final manuscript.