

## The effect of replacing filler with sweet potato flour on the hedonic test of spent quail meat sausages among child panelists

### *Pengaruh substitusi filler tepung ubi jalar terhadap uji hedonik sosis daging puyuh afkir pada panelis anak-anak*

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**Abstract.** Sweet potato flour is a source of fiber with potential to be used as a filler in meat products, such as sausages. This study aimed to determine the effect of substituting sweet potato flour as a filler on the hedonic evaluation of spent quail meat sausages by child panelists. The materials used in this research included spent quail meat, tapioca, soy protein isolate, oil, monosodium glutamate, sodium tripolyphosphate, pepper, carrageenan, salt, garlic, shallots, ice, egg white, onions, coriander, frankfurter, nutmeg, sugar, white sweet potato flour, yellow sweet potato flour, purple sweet potato flour, and collagen casings. The filler substitution treatments were as follows: P1 (no substitution), P2 (20% white sweet potato flour), P3 (20% yellow sweet potato flour), P4 (20% purple sweet potato flour), and P5 (a 20% combination of white, yellow, and purple sweet potato flours in a 1:1:1 ratio), based on the total amount of tapioca filler. Sensory tests were conducted with 40 child panelists aged 6-12 years. The hedonic parameters evaluated included color, flavor, taste, texture, chewiness, and overall acceptability, measured using a 5-point Likert scale. The data were analyzed using non-parametric methods, specifically the Kruskal-Wallis test, followed by Duncan's New Multiple Range Test for further analysis when significant differences were found. The results indicated that sweet potato flour substitution significantly affected the chewiness score of the sausages but did not influence the scores for color, flavor, taste, or texture. It was concluded that substituting sweet potato flour as a filler can improve the chewiness of spent quail meat sausages and can be used up to 20% of the total filler in sausage production.

**Keywords:** spent quail meat, dietary fiber, sausage, sweet potato.

**Abstrak.** Tepung ubi jalar merupakan sumber serat yang berpotensi digunakan sebagai bahan pengisi pada produk olahan daging, seperti sosis. Tujuan penelitian ini untuk mengetahui pengaruh substitusi *filler* tepung ubi jalar terhadap uji hedonik sosis daging puyuh afkir pada panelis anak-anak. Materi penelitian terdiri atas daging puyuh afkir, tapioka, isolat protein kedelai, minyak, mononatrium glutamat, natrium tripolifosfat, lada, karagenan, garam, bawang putih, bawang merah, es, putih telur, bawang bombay,

ketumbar, *frankfurter*, pala, gula, tepung ubi jalar putih, tepung ubi jalar kuning, tepung ubi jalar ungu, dan selongsong kolagen. Perlakuan substitusi *filler* tapioka yaitu P1 (tanpa substitusi), P2 (tepung ubi jalar putih 20%), P3 (tepung ubi jalar kuning 20%), P4 (tepung ubi jalar ungu 20%), dan P5 (kombinasi ubi jalar putih, ungu, dan kuning 20% dengan perbandingan 1:1:1) dihitung dari total *filler* tapioka. Uji sensori dilakukan oleh 40 panelis anak-anak usia 6-12 tahun. Paramater yang diamati pada uji hedonik yaitu warna, aroma, rasa, tekstur, kekenyalan, dan daya terima. Skala hedonik dengan skala *likert* yaitu berkisar antara 1 sampai 5. Data hasil uji hedonik dianalisis dengan analisis non parametrik melalui uji *Hedonic Kruskal Wallis* dan apabila terdapat perbedaan diuji lanjut dengan uji *Duncan's New Multiple Range Test*. Hasil penelitian menunjukkan bahwa substitusi *filler* ubi jalar dapat mempengaruhi skor kekenyalan sosis, tetapi tidak mempengaruhi skor warna, aroma, rasa, dan tekstur sosis. Kesimpulan penelitian bahwa substitusi *filler* ubi jalar dapat meningkatkan nilai skor dari kekenyalan sosis daging puyuh afkir. Tepung ubi jalar dapat digunakan sebagai substitusi *filler* sampai 20% dari total *filler* pada pengolahan sosis daging puyuh afkir.

**Kata kunci:** daging puyuh, *dietary fiber*, sosis, ubi jalar.

## INTRODUCTION

Childhood is a critical phase for physical, mental, and cognitive growth and development. Optimal nutritional intake, including dietary fiber and antioxidants, is essential to support these processes. Dietary fiber aids digestion, helps regulate blood sugar levels, and promotes a feeling of fullness (Yolanda, Dewi, & Wijanarka, 2018). Antioxidants protect the body from damage caused by free radicals, which are known to contribute to various chronic diseases (Andarina & Djauhari, 2017). However, many Indonesian children do not receive sufficient dietary fiber and antioxidants from their daily food intake. This is often due to unbalanced eating patterns, such as low consumption of vegetables and fruits. A deficiency in dietary fiber and antioxidants may increase the risk of various health problems in children..

Sweet potatoes are known to be a rich source of dietary fiber and antioxidants, yet their use in meat-based products, particularly sausages, has not been extensively explored. Sweet potatoes are high in beta-carotene, anthocyanins, and vitamin C, all of which act as powerful antioxidants. They also contain significant amounts of dietary fiber, including pectin, cellulose, and hemicellulose, which support digestive health (Ernayanti, Sukardi, & Damat, 2021). Sweet potatoes can be utilized as a filler in sausage production. By incorporating sweet potatoes as a natural source of dietary fiber and antioxidants into sausages, it is expected that the resulting meat product will not only be nutritionally beneficial but also help protect children's health from the harmful effects of free radicals.

Sausages are commonly made from beef, but other potential meat sources, such as quail meat, can also be used. Quail meat is a high-quality source of protein and contains less fat compared to beef or chicken. It is also rich in essential vitamins and minerals, including iron, zinc, and vitamin B12 (Kartikayudha, Isroli, & Suprapti, 2014). Developing sausage products made from quail meat and sweet potatoes could be a strategic solution to enhance the intake of dietary fiber and antioxidants in children's diets. Sausages are widely favored by children and are easy to prepare. The addition of sweet potato as a filler in sausages may improve the nutritional value and create a more appealing product that is likely to be accepted by children.

Research on the application of sweet potatoes as a source of natural dietary fiber and antioxidants in quail meat-based sausages also holds economic potential. Sweet potatoes are a widely available agricultural commodity in Indonesia, yet their use remains limited to a few processed products. Exploring the use of sweet potatoes as a filler in sausage products not only adds value to quail meat products but also contributes to the diversification of functional food products. This study is expected to support the development of healthier food options for children by utilizing sweet potatoes as a natural source of dietary fiber and

antioxidants. Therefore, this research is necessary to investigate the effect of sweet potato filler substitution on the hedonic evaluation of sausages made from spent quail meat.

## MATERIALS AND METHODS

### Tools and Materials

The equipment used in this study included a meat grinder, spoon, containers, gas stove, pot, knife, cutting board, digital scale, tissue, sausage stuffer, and meat processor. The materials consisted of spent quail meat, tapioca starch, onions, coriander, pepper, carrageenan, nutmeg, sugar, salt, garlic, shallots, soy protein isolate (SPI), palm oil, sodium tripolyphosphate (STPP), ice, egg white, monosodium glutamate (MSG), frankfurter, white sweet potato flour, yellow sweet potato flour, purple sweet potato flour, and collagen casings.

### Research Method

The experimental design involved five treatments of tapioca filler substitution as follows: P1 (no substitution), P2 (20% white sweet potato flour), P3 (20% yellow sweet potato flour), P4 (20% purple sweet potato flour), and P5 (a 20% combination of white, yellow, and purple sweet potato flours in a 1:1:1 ratio), calculated based on the total amount of tapioca filler used.

### Research Method

The formulation of spent quail meat sausages used in this study followed the procedure described by Prasetyo & Prayitno (2021). The specific formulation for each filler substitution treatment is presented in Table 1.

Table 1. Formulation of spent quail meat sausages

No.	Ingredients	Treatments				
		P1	P2	P3	P4	P5
1.	Spent quail meat	45	45	45	45	45
2.	Filler					
	- Tapioca	4	3.2	3.2	3.2	3.2
	- Purple sweet potato	0	0.8	0	0	0
	- White sweet potato	0	0	0.8	0	0
	- Yellow sweet potato	0	0	0	0.8	0
	- Mixed sweet potato (1:1:1 ratio)	0	0	0	0	0.8
3.	Egg white	20	20	20	20	20
4.	SPI	4	4	4	4	4
5.	Palm oil	6	6	6	6	6
6.	Salt	1	1	1	1	1
7.	Garlic	1.3	1.3	1.3	1.3	1.3
8.	Shallots	2	2	2	2	2
9.	Onion	2	2	2	2	2
10.	STPP	0.5	0.5	0.5	0.5	0.5
11.	MSG	0.7	0.7	0.7	0.7	0.7
12.	Coriander	0.2	0.2	0.2	0.2	0.2
13.	Nutmeg	0.2	0.2	0.2	0.2	0.2
14.	Sugar	0.5	0.5	0.5	0.5	0.5
15.	Frankfurter	1	1	1	1	1
16.	Pepper	0.3	0.3	0.3	0.3	0.3
17.	Carrageenan	0.9	0.9	0.9	0.9	0.9
18.	Ice	10.4	10.4	10.4	10.4	10.4
	Total	100	100	100	100	100

### Sausage Processing

Sausage processing was carried out according to the method described by (Prasetyo & Prayitno, 2021). The process began by separating the meat from the bones and connective tissues, followed by fine grinding. The ground meat was then mixed with oil using a meat processor. Next, STPP, salt, the respective filler substitution treatments, and part of the ice were added. All spices were mixed separately and combined with the remaining oil. SPI, egg white, tapioca, and the remaining half of the ice were then added and mixed until the mixture reached a smooth, elastic consistency. The sausage batter was filled into collagen casings using a stuffer, with each sausage tied off with string at both ends, forming sausages approximately 10 cm in length. Finally, the raw sausages were steamed at a temperature of 60°C to 75°C for 60 minutes.

### Sensory Evaluation

The sensory evaluation of the spent quail meat sausages was conducted through a hedonic test following the method of Sujarwanta, Jamhari, Suryanto, Yuliatmo, & Prayitno (2019). The sensory test involved 40 child panelists aged 6-12 years. The hedonic parameters assessed included color, flavor, taste, texture, chewiness, and overall acceptability. A 5-point Likert scale was used, ranging from 1 (extremely dislike) to 5 (extremely like).

### Sensory Evaluation

The hedonic test data were analyzed using non-parametric statistical methods, specifically the Kruskal-Wallis test. If significant differences were found, further analysis was conducted using Duncan's New Multiple Range Test (Zhang, He, Kang, & Li, 2018).

## RESULTS AND DISCUSSION

The results of the hedonic test for spent quail meat sausages with sweet potato filler substitution, as evaluated by children, are presented in Table 2.

Table 2. Hedonic test results of spent quail meat sausages among children

Variables	Treatments				
	P1	P2	P3	P4	P5
Color <sup>ns</sup>	4.13	4.23	4.30	4.23	4.28
Flavor <sup>ns</sup>	4.45	4.50	4.43	4.45	4.43
Taste <sup>ns</sup>	4.63	4.73	4.70	4.70	4.65
Texture <sup>ns</sup>	4.33	4.48	4.35	4.23	4.25
Chewiness	4.15 <sup>a</sup>	4.55 <sup>b</sup>	4.48 <sup>b</sup>	4.48 <sup>b</sup>	4.65 <sup>b</sup>
Overall acceptability <sup>ns</sup>	4.45	4.70	4.73	4.50	4.53

P1 (no substitution), P2 (purple sweet potato flour), P3 (white sweet potato flour), P4 (yellow sweet potato flour), and P5 (combination of sweet potato flours).

<sup>ns</sup>not significantly different (P>0.05)

<sup>ab</sup>different superscripts indicate a significant difference (P<0.05)

### Color

The results showed that substituting different types of sweet potato flour (purple, white, yellow, and mixed) had no significant effect (P>0.05) on the color scores of spent quail meat sausages in the hedonic test, as evaluated by child panelists aged 6-12 years. The color scores ranged from 4.13 to 4.30, indicating a preference level between "like" and "extremely like." This may be due to the dominant color of quail meat and other ingredients, which typically produce a characteristic reddish or pale brown sausage color (Islamiati, Alfina Baharuddin, & Fairus Prihatin Idris, 2023) that remains consistent even with limited amounts of sweet potato flour substitution. Additionally, the heating process during sausage production may degrade natural pigments such as anthocyanins in purple sweet potatoes and carotenoids in yellow sweet potatoes (Suzanna, Wijaya, & Fadilah, 2019), reducing their

visual contribution to the final product. The neutral tones of white and yellow sweet potatoes tend to blend with the sausage batter, resulting in no striking contrast between treatments. Children's visual perception is likely influenced by the overall appearance of the sausage, which they perceive as normal or appealing, making subtle color differences insufficient to significantly affect their evaluation.

### **Flavor**

The substitution of different sweet potato flour types as fillers also had no significant effect ( $P > 0.05$ ) on the aroma scores in the hedonic evaluation. Aroma scores ranged from 4.43 to 4.50, indicating a general preference between "like" and "extremely like." This is likely due to the neutral aroma profile of sweet potato flour, which lacks strong or dominant scents (Utomo & Octasari, 2023), especially after steaming a process that tends to evaporate volatile aromatic compounds characteristic of sweet potatoes (Li et al., 2025). Moreover, the distinctive aroma of seasoned and processed quail meat tends to dominate, potentially masking any minor aroma differences introduced by the added fillers. Additionally, children may have different olfactory sensitivities than adults and are more likely to focus on familiar and pleasant overall aromas (Putri, Yuwono, & Nisa, 2024), making them less responsive to subtle variations arising from different sweet potato varieties.

### **Taste**

There was no significant effect ( $P > 0.05$ ) of sweet potato flour substitution on the taste scores of spent quail meat sausages. Taste scores ranged from 4.63 to 4.73, indicating a general preference between "like" and "extremely like." This suggests that substituting purple, white, yellow, or mixed sweet potato flour as a filler did not significantly alter flavor perception among the child panelists. Sweet potatoes typically have a mild to slightly sweet flavor (Tsai et al., 2021), and when used in limited quantities as fillers in sausage formulations, their impact on overall taste is minimal. Furthermore, the use of spices such as salt, pepper, garlic, onion, and flavor enhancers tends to produce stronger flavor profiles that overshadow the subtle taste differences of the sweet potato varieties. Since children generally prefer savory and mildly sweet tastes, their evaluations were likely influenced more by seasoning balance and meat flavor than by filler characteristics. This is consistent with findings from Hoffman, Salgado, Dresler, Faller, & Bartlett (2016) indicating that children focus more on familiar and pleasant flavors than on subtle differences between ingredients.

### **Texture**

The substitution of sweet potato flour had no significant effect ( $P > 0.05$ ) on texture scores. Scores ranged from 4.23 to 4.48, indicating that the panelists generally "liked" the sausage texture. This may be attributed to the similar physical properties of different sweet potato flour varieties in terms of their gel-forming abilities and contribution to tenderness in processed meat products (Verma, Chatli, Kumar, Kumar, & Mehta, 2015). Sweet potato flour generally contains starches with comparable amylose and amylopectin content (Anwar, Irhami, & Kemalawaty, 2019), which contribute similarly to the elasticity and softness of the sausage. Additionally, standardized mixing and processing methods likely homogenized the final texture, making it difficult for child panelists to distinguish between treatments. Children tend to be more sensitive to coarse or hard textures but less so to subtle differences in softness. Ayandipe et al. (2022) also noted that sausage texture is more influenced by meat-to-water ratios and thermal processing than by filler type alone.

### **Chewiness**

Unlike the other attributes, the substitution of sweet potato flour significantly affected ( $P < 0.05$ ) the chewiness scores of spent quail meat sausages. Chewiness scores ranged from 4.15 to 4.65, corresponding to “like” to “extremely like.” The lowest score was recorded in the control treatment (P1, no filler substitution), while the highest chewiness score was found in the mixed filler treatment (P5), which used a combination of purple, white, and yellow sweet potato flours. This indicates that the composition and interaction of different sweet potato varieties created a synergistic effect that improved the sausage’s elasticity. Differences in amylose content and crude fiber among the sweet potato varieties may influence gel structure during heating, with the combination forming a more stable and elastic starch-protein network (Salama, Mu, & Sun, 2021). Purple sweet potatoes contain anthocyanins and soluble fiber that enhance water retention and improve structure (Gionte, Limonu, & Liputo, 2022), while yellow and white varieties typically contain higher starch levels, contributing to increased chewiness (Yuliansar, Ridwan, & Hermawati, 2020). Optimal chewiness creates a pleasant mouthfeel, which children can easily notice, given their sensitivity to chewing texture. Jeltema, Beckley, & Vahalik (2016) reported that children can clearly distinguish ideal chewiness levels and prefer products with moderate elasticity.

### Overall Acceptability

Different types of sweet potato flour substitution had no significant effect ( $P > 0.05$ ) on overall acceptability scores of the sausages. Scores ranged from 4.45 to 4.73, indicating high acceptance (“like” to “extremely like”) across all treatments. This suggests that sausages made with various sweet potato flour fillers were equally well-received by the child panelists. Overall acceptability reflects the integration of all major sensory attributes color, aroma, taste, texture, and chewiness (Fiorentini, Kinchla, & Nolden, 2020). The average scores suggest no single treatment was strongly preferred or disliked. This indicates that inclusion of various sweet potato flours did not negatively affect the overall perception of the product. Children often base their assessments on general enjoyment and previous food experiences. According to Sick, Højjer, & Olsen (2019), children’s acceptance of processed meat products is largely influenced by ease of consumption, savory taste, attractive color, and uniform texture.

### CONCLUSION

The results of this study showed that substituting sweet potato flour as a filler significantly affected the chewiness of the sausages but did not impact their color, flavor, taste, or texture. It can be concluded that sweet potato flour substitution improves the chewiness of sausages made from spent quail meat. Sweet potato flour can be used as a filler substitute at levels of up to 20% of the total filler content in the production of spent quail meat sausages

### ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to Politeknik Negeri Jember and the Directorate General of Vocational Education, Ministry of Education, Culture, Research, and Technology, for funding this research through the Vocational Student Creativity Program (PKM Vokasi).

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