

# Sensory Characteristics of Meat Sausage Products with Modified Cassava Flour as Filler

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**Abstract:** The use of modified cassava starch and flour in this study aims to obtain the optimal concentration of modified cassava starch and flour ratio in meat sausage emulsion type products and characterize organoleptic properties in meat sausage emulsion type products using modified cassava starch and flour as fillers. The ingredients used are modified cassava starch and flour, beef obtained from the Son Haji Sonny Bandar Lampung slaughterhouse, chicken meat from PT. Ciomas Adisatwa Lampung, sausage sleeves, and seasonings used in making beef sausages. The treatment given is a ratio of starch:modified cassava flour with a ratio of 90:10; 80:20; 70:30; and 60:40. The sensory test results showed that the most preferred sensory characteristics of sausages were sausages with a modified 80:20 starch:cassava flour ratio treatment for the sensory characteristics of sausage taste and texture. As for color sensory characteristics at a ratio of 60:40; and for aroma sensory characteristics at a ratio of 70:30. From the sensory characteristics that are closer to the quality characteristics of sausages are texture and taste, it can be concluded that the most preferred sausage is sausage with the addition of starch and modified cassava flour in a ratio of 80: 20.

**Keywords:** Filler; Modified cassava flour; Sausage; Sensory characteristics.

## Introduction

One of the important non-meat mixtures in emulsion-type product formulations is filler and binder which is usually a material with a high starch content. The addition of fillers to meat products can increase stability, taste, water holding capacity, product slice characteristics, and can reduce costs meat product formulation (Santhi et al., 2017; Sembor et al., 2023; Sofyan, 2018). The use of modified cassava starch and flour as fillers and binders serves to absorb water that will be removed from meat protein when the product is heated. A good filling and binder must have the ability to hold product water during the cooking, cooling, and storage processes of the product (Jin et al., 2019; Weerasinghe et al., 2021). Fillers function to increase water trapping power, but have little effect on the emulsion, adding to the weight of the product by substituting some meat so that costs can be reduced, plays a role in the formation of structure and texture in compact sausages (Anggraeni et al., 2014). The addition of various types of flour and starch as fillers will affect the physico-chemical properties and organoleptic

properties of food products (Sembor et al., 2023).

The formation of emulsions in meat occurs when fat globules are dispersed in a matrix of dissolved proteins, water, and additives. The stability of the stem emulsion in meat batter is influenced by the amount of myofibril protein that functions as an emulsifier. Meat batter or oil-in-water emulsion consists of protein-coated fat globules dispersed in a myofibrillar protein gel (Dickinson, 2012). Myofibril proteins will be released from the meat muscle at the *chopping* / reduction stage which will then interact with fat particles. As a result, dissolved protein and water in the meat batter mixture will form a matrix that envelops the fat globules resulting in an emulsion that will be stable after heating (Lonergan et al., 2019).

Cassava starch and modified cassava flour (or often called *Fermented Cassava Flour*) have been widely used in various food products including meatballs, wet noodles, cookies, and biscuits (Gusriani et al., 2021). The results of the study of Surfiana et al (2023), showed that in addition to having superior physicochemical characteristics compared to conventionally produced cassava starch and flour, modified cassava starch and flour produced by integrated fermentation techniques

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have an *amylograph* pasting profile which is better so that it has better functional properties if used as a filler and binder in products that require emulsion properties in the processing process.

The properties of starch and modified cassava flour are the basis for application to processed animal products, namely as fillers and fat binders so that the ability of meat to bind water (WHC) remains high (Wang et al., 2022). The use of modified cassava starch as a filler and binder contributes economically to lower production costs because it reduces *cooking loss* and increases product yield (Totosaus, 2009).

Several previous studies have shown that the use of modified cassava starch resulted in softer chicken sausage characteristics compared to controls (Mahdi & Hosnaini, 2017). Some research results show that the substitution of 50% composite flour in the processing of chicken sausages with cassava starch produces the most preferred sensory properties of chicken sausages. Several previous studies showed that using modified cassava starch resulted in softer chicken sausage characteristics compared to the control (Mahdi & Hosnaini, 2017). The research results of Weerasinghe et al (2021), showed that substituting 50% composite flour in chicken sausage processing with cassava starch resulted in chicken sausage's most favorable sensory properties. In general, modified starch, especially acid-modified starch, can improve the quality attributes of chicken sausages, which produces better products.

Based on the above, the research aims to obtain the optimal concentration of modified cassava starch in beef sausage emulsion type products and characterize the physicochemical properties of beef sausage emulsion type products using modified cassava starch as *filler* and *binder*.

**Method**

*Material*

The main ingredients used are starch and modified cassava flour from the research of (Surfiana et al., 2023). beef obtained from Son Haji Sonny Bandar Lampung slaughterhouse and chicken meat from PT. Ciomas Adisatwa. Other ingredients are sausage sleeves and seasonings. The equipment used includes meat grinders, sausage stuffers, boilers, packers, as well as other equipment for testing the sensory characteristics of sausages.

*Method*

The research was carried out at the Agricultural Product Technology Laboratory of Lampung State Polytechnic. The research was carried out for 6 months from April to September 2023. The study used the Langkang Random Design (RAL) method of one factor,

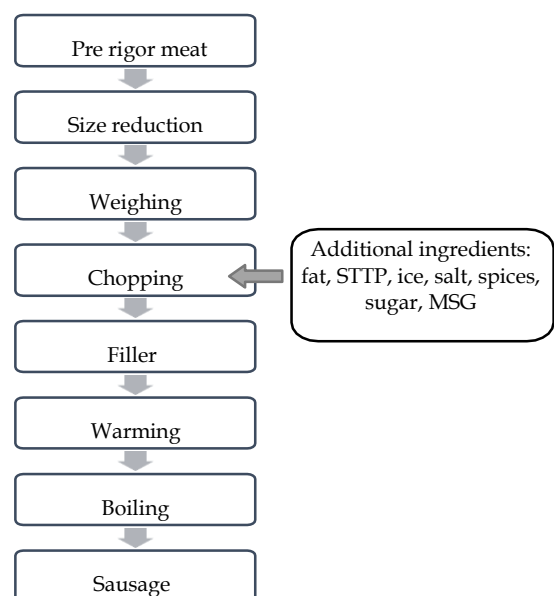
namely the comparison of composite flour t (starch / tapioka: modified cassava flour from the research of (Surfiana et al., 2023) namely P 1 (90:10), P2 (8 0:20), P 3 (70:30), and P 4 (60:40). Each treatment was repeated 4 times. The data obtained were tested for homogeneity of variety with the *Bartlett's* test, followed by variety analysis at the level of 5% to determine the effect of the treatment given. After the assumptions are met and if the real effect is continued with the Honest Real Difference test at the level of 5%. For data on sensory test results, a descriptive test is used from the average value generated from each test against sensory characteristics. The formulation of making sausages is presented in Table 1.

**Table 1.** Sausage Formulation with the Addition of Starch Composite Flour and Modified Cassava Flour (Mocaf)

Material	Amount (%)
Meat	58.4
Fat	20
Composite flour	12
Ice	5
STTP	0.6
Salt	1.6
Sugar	0.6
MSG	0.8
Spices	1

*Sausage Processing*

Prerigor meat is reduced in size. Next weighed. and crushing is carried out while being given additional ingredients in the form of fat, STTP, ice cubes, salt, spices, sugar, and salt. The mixture that has been evenly distributed is put in the sleeve. Thencooking is done to produce ready-to-eat sausages (Figure 1).



**Figure 1.** Sausage Processing Process Flow Diagram

*Observation*

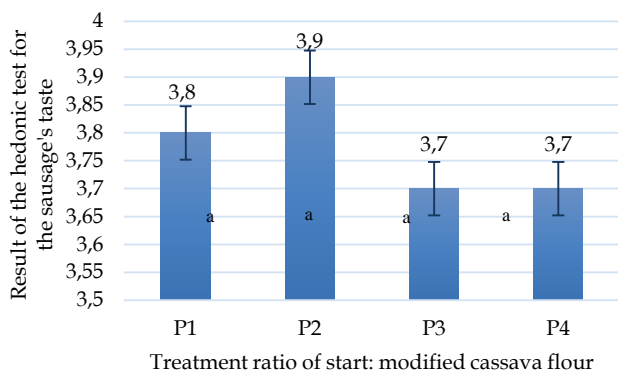
The observation made is a sensory test of sausages using hedonic / preferential tests on the characteristics of the resulting sausages including taste, texture, aroma, and color of sausages.

**Result and Discussion**

*Sensory Characteristics of the Resulting Sausage Taste*

The results of the variety analysis test and the middle value showed that the modified starch:cassava flour comparison treatment had a significant effect on the sensory characteristics of the resulting sausage taste preference. However, the results of further tests showed that between treatments did not show a noticeable difference at the real level of 5% and 10% (shown with the same letter in Figure 2).

Taste is a chemical reaction from the combination of various food ingredients and creates a new taste that is felt by the tongue (Sharifi et al., 2023; Tepper & Barbarossa, 2020). Many taste attributes are determined by the formulation used and not by the processing process carried out (Mouritsen, 2015; Winarno, 2008). The treatment given did not show a noticeable difference in the sensory characteristics of the resulting sausage taste. The formulation of flavoring ingredients and fillers for making sausages has an influence on the taste of the product produced (Zurriyati, 2011). The taste of a food ingredient can come from the food ingredient itself and other ingredients in the product that are added (Battacchi et al., 2020; Prayitno et al., 2012; Yang & Lee, 2020).

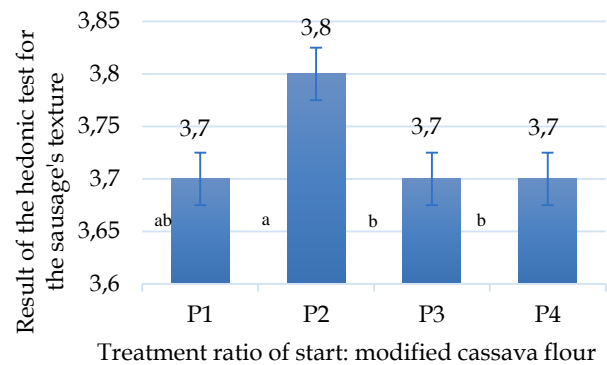


**Figure 2.** Results of Favorability Testing for Sausage Taste Produced on Various Ratios of Starch and Modified Cassava Flour

*Sensory Characteristics of the Resulting Sausage Texture*

The results of the analysis of variety and middle values on the sensory characteristics of sausage texture preferences showed that the comparative treatment of starch and cassava flour used had a significant effect on the sensory characteristics of the desired sausage texture

produced, while the repetition as a group did not differ markedly. The results of further tests showed that the P3 and P4 treatments showed the same results, but different from the P1 and P2 treatments, and P2 was different from P3 and P4. The mean favorability value showed that the P2 treatment had the highest favorability value (3.76) (Figure 3).



**Figure 3.** Results of Favorability Testing for Sausage Texture Produced on Various Ratios of Starch and Modified Cassava Flour

Texture is one of the determining factors in the acceptance of a food product. Texture will provide information about the softness of the food, the shape of the surface on the food, and the state of the food (dry, wet, and moist) (Day & Golding, 2016). The texture of a sausage is determined by its constituent ingredients, the conditions during homogenization, and the processing process (Ismanto et al., 2020; Prastini & Widjanarko, 2015; Ruiz-Capillas et al., 2012).

The properties of starch and modified cassava flour become the basis for application to processed animal products, namely as fillers and fat binders, so that meat's ability to bind water (WHC) remains high. According to Zebua et al (2015), sausage emulsion is greatly influenced by the amount of fat and amount of water added, where the formation of a sturdy sausage emulsion will produce a solid texture and compact, if fibrous, then the composition of the sausage becomes unstable. Amylopectin plays a role in stickiness, while amylose plays a role in product hardness (Ambarwati et al., 2014). The higher the content of amylose, the starch's ability to absorb water and expand to become more prominent because amylose can form more outstanding hydrogen bonds than amylopectin. The use of modified cassava starch and flour as fillers and binders contributes economically to lower production costs because it reduces *cooking loss* and increases product yield (Totosa, 2009).

The results of the study of (Surfiana et al., 2023) showed that in addition to having superior

physicochemical characteristics compared to conventionally produced cassava starch and flour, modified cassava starch and flour produced by integrated fermentation techniques have an amylograph pasting profile which is better so that it has better functional properties if used as a filler and binder in products that require emulsion properties in the processing process. Some previous studies have shown that the use of modified cassava starch resulted in softer chicken sausage characteristics compared to controls (Mahdi & Hosnaini, 2017). The formation of elasticity is the potential for the formation of strong stickiness from the high levels of amylopectin (Faturahman et al., 2018).

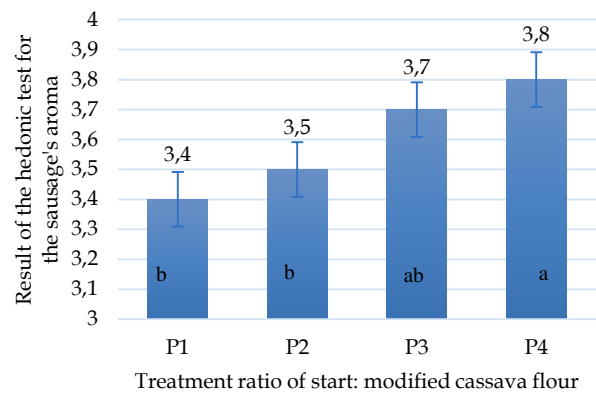
*Sensory Characteristics of the Aroma of Sausages Produced*

Meat sausage is defined as a product made from meat that is mashed with or without the addition of other foods and permitted foodstuffs and put into the sausage sleeve with or without the cooking process (Badan Standarsasi Nasional, 2015). The raw materials used to make sausages consist of the main ingredients, namely meat and additional ingredients such as fillers, binders, seasonings, flavoring ingredients, and other permitted food ingredients. The filler is a non-meat fraction that is added in the manufacture of gels. The filler serves as an emulsion stabilizer, increasing water binding, minimizing shrinkage, and reducing costs. Sensory testing or testing with the senses or known as organoleptic testing is used to determine the acceptability and assess the quality of a product (Khan & Rahman, 2021).

The results of the variety analysis test and the middle value showed that the comparative treatment of starch and modified cassava flour had a significant effect on the sensory characteristics of the favorite sausage aroma produced, while the group did not differ markedly. Further test results showed that P1 and P2 treatments produced the same sensory characteristics of sausage aroma liking, The difference in preference for sausage aroma began at P3 treatment, which was a ratio of 70:30 (Figure 4).

One of the factors that affect the aroma of processed meat products is the ingredients added during product manufacturing. The aroma caused by sausages comes from volatile compounds found in beef and the mixing of additives, and seasonings. Spices can provide flavor and can increase the aroma of sausages (Zurriyati, 2011). The aroma of processed meat products can be influenced by the ingredients added during the manufacture and cooking of processed meat products (Rauf et al., 2015). In addition, the addition of flour showed an increase in the value of panelists' liking for the aroma of the resulting sausage. Sensory characteristics of sausage

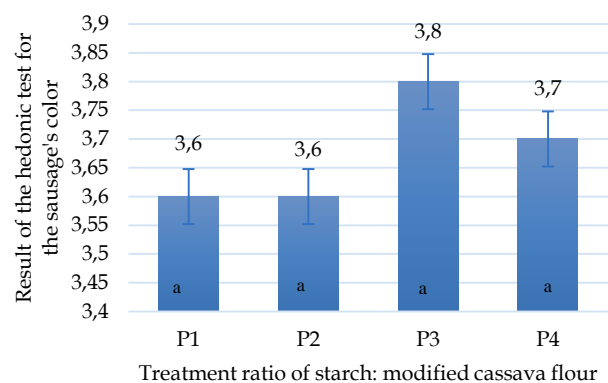
aroma were most preferred in 4 treatment (modified starch:cassava flour ratio = 60:40).



**Figure 4.** Results of Favorability Testing of Sausage Aroma Produced on Various Ratios of Starch and Modified Cassava Flour

*Sensory Characteristics of the Resulting Sausage Color*

The results of the variety analysis and middle value analysis showed that the comparative treatment of modified cassava starch and flour had a significant effect on the sensory characteristics of the sausage aroma produced, while the group did not differ markedly. Further test results showed that all treatments produced the same sausage aroma preference characteristics (Figure 5).



**Figure 5.** Results of Favorability Testing of Sausage Color Produced on Various Ratios of Starch and Modified Cassava Flour

The modified cassava used is white with a whiteness degree value of > 90 so that it does not cause color differences in the resulting sausages. Overall treatment showed almost the same level of liking (> 3.5 with a neutral rating scale towards liking). Panelists judged that the color produced by sausages was light brown, so the color of the modified cassava flour used did not affect the color of the sausage products. The color of



sausages is influenced by the myoglobin content of meat. Myoglobin is a pigment in meat muscles composed of protein. Myoglobin can be oxidized at a temperature of 80-85°C to form metmyoglobin which causes a brown color (Totosaus, 2009). The red color of sausages is caused by the heme pigment in the meat.

## Conclusion

The 80:20 modified cassava starch and flour ratio treatment had the most preferred sensory characteristics by panelists on the sensory characteristics of taste and texture. As for color sensory characteristics, panelists liked sausages with a starch:cassava flour ratio treatment of 70:30, and for aroma characteristics panelists liked sausages with the addition of starch:modified cassava flour 60:40.

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## Author Contributions

SF: Developing ideas, analyzing, writing, reviewing, responding to reviewers' comments; CUW, HR, DEN: analyzing data, overseeing data collection, reviewing scripts, and writing.

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## Conflicts of Interest

The authors declare no conflict of interest.

## References

- Ambarwati, H., Suryaningsih, L., & Rachmawan, O. (2014). Pengaruh Penggunaan Tepung Aren Terhadap Sifat Fisik dan Akseptabilitas Rolade Daging Itik. *J. Rekayasa Pangan Dan Pert.*, 2(4), 92-102. Retrieved from <https://jurnal.unpad.ac.id/ejournal/article/view/633>
- Anggraeni, D. A., Widjanarko, S. B., & Ningtyas, D. W. (2014). Proporsi tepung porang (*amorphophallus muelleri* blume): tepung maizena terhadap karakteristik sosis ayam. *Jurnal Pangan Dan Agroindustri*, 2(3), 214-223. Retrieved from <https://jpa.ub.ac.id/index.php/jpa/article/view/70>
- Badan Standarsasi Nasional. (2015). SNI No. 3820:2015 tentang sosis daging. *Standar Nasional Indonesia*, 39.
- Battacchi, D., Verkerk, R., Pellegrini, N., Fogliano, V., & Steenbekkers, B. (2020). The state of the art of food ingredients' naturalness evaluation: A review of proposed approaches and their relation with consumer trends. *Trends in Food Science and Technology*, 106(July), 434-444. <https://doi.org/10.1016/j.tifs.2020.10.013>
- Day, L., & Golding, M. (2016). *Food Structure, Rheology, and Texture* (L. Melton, F. Shahidi, & P. B. T.-E. of F. C. Varelis (eds.); pp. 125-129). Academic Press. <https://doi.org/https://doi.org/10.1016/B978-0-08-100596-5.03412-0>
- Dickinson, E. (2012). Emulsion gels: The structuring of soft solids with protein-stabilized oil droplets. *Food Hydrocolloids*, 28(1), 224-241. <https://doi.org/10.1016/j.foodhyd.2011.12.017>
- Faturohman, T., Susilo, A., & Mustakim. (2018). Pengaruh Penggunaan Tepung yang Berbeda terhadap Tekstur, Kadar Protein, Kadar Lemak, dan Organoleptik pada Bakso Daging Kelinci. *MaduRanch: Jurnal Ilmu-Ilmu Peternakan*, 3(1), 29-34. <http://dx.doi.org/10.53712/maduranch.v3i1.344>
- Gusriani, I., Koto, H., & Dany, Y. (2021). Aplikasi Pemanfaatan Tepung Mocaf (Modified Cassava Flour) Pada Beberapa Produk Pangan Di Madrasah Aliyah Mambaul Ulum Kabupaten Bengkulu Tengah. *Jurnal Inovasi Pengabdian Masyarakat Pendidikan*, 2(1), 57-73. <https://doi.org/10.33369/jurnalinovasi.v2i1.19142>
- Ismanto, A., Lestyanto, D. P., Haris, M. I., & Erwanto, Y. (2020). Komposisi Kimia, Karakteristik Fisik, dan Organoleptik Sosis Ayam dengan Penambahan Karagenan dan Enzim Transglutaminase. *Sains Peternakan*, 18(1), 73. <https://doi.org/10.20961/sainspet.v18i1.27974>
- Jin, S. keun, Kim, S. H., Choi, J. S., & Yim, D. G. (2019). Effect of diverse binder materials and their addition levels on physico-chemical characteristics of sausages. *Journal of Food Measurement and Characterization*, 13(2), 1558-1565. <https://doi.org/10.1007/s11694-019-00071-1>
- Khan, M. S., & Rahman, M. S. (2021). Techniques to measure food safety and quality: Microbial, chemical, and sensory. In *Techniques to Measure Food Safety and Quality: Microbial, Chemical, and Sensory* (Issue September 2021). <https://doi.org/10.1007/978-3-030-68636-9>
- Lonergan, S. M., Topel author., D. G., & Marple, D. N. author. (2019). *The science of animal growth and meat technology* (Second edi). <http://lib.ugent.be/catalog/ebk01:4100000007101096>
- Mahdi, A., & Hosnaini, R. H. (2017). Aplikasi Modified Cassava Flour (Mocaf) Sebagai Bahan Pengisi Pada Sosis Ayam. *Jurnal Kejaora (Kesehatan Jasmani Dan Olahraga)*, 2(2), 136-140. <https://doi.org/10.36526/kejaora.v2i2.130>

- Mouritsen, O. G. (2015). The science of taste. *Flavour*, 4(1), 10–11. <https://doi.org/10.1186/s13411-014-0028-3>
- Prastini, A. I., & Widjanarko, S. B. (2015). Pembuatan sosis ayam menggunakan gel porang (*Amorphophallus muelleri* Blue) sebagai bahan pengikat terhadap karakteristik sosis. *Jurnal Pangan Dan Agroindustri*, 3(4), 1503–1511. Retrieved from <https://jpa.ub.ac.id/index.php/jpa/article/view/274>
- Prayitno, A. H., Miskiyah, F., Rachmawati, A. V., Baghaskoro, T. M., Gunawan, B. P., & (Soeparno), S. (2012). Karakteristik Sosis dengan Fortifikasi  $\beta$ -Caroten dari Labu Kuning (*Cucurbita moschata*) (Sausage Characteristics as Affected by  $\beta$ -Caroten Fortification of Pumpkin (*Cucurbita moschata*)). *Buletin Peternakan*, 33(2), 111. <https://doi.org/10.21059/buletinpeternak.v33i2.124>
- Ruiz-Capillas, C., Triki, M., Herrero, A. M., Rodriguez-Salas, L., & Jiménez-Colmenero, F. (2012). Konjac gel as pork backfat replacer in dry fermented sausages: Processing and quality characteristics. *Meat Science*, 92(2), 144–150. <https://doi.org/https://doi.org/10.1016/j.meatsci.2012.04.028>
- Santhi, D., Kalaikannan, A., & Sureshkumar, S. (2017). Factors influencing meat emulsion properties and product texture: A review. *Critical Reviews in Food Science and Nutrition*, 57(10), 2021–2027. <https://doi.org/10.1080/10408398.2013.858027>
- Sembor, S. M., Liwe, H., & Lontaan, N. N. (2023). *The Effect of Various Types of Flour as Filler Materials on Physical, Chemical and Organoleptic Characteristics of Salami Culled Laying Hens*. LXIX(2), 144–154. Retrieved from <https://veterinarymedicinejournal.usamv.ro/index.php/scientific-papers/current?id=1867>
- Sharifi, E., Fang, L., & Amin, S. H. (2023). A novel two-stage multi-objective optimization model for sustainable soybean supply chain design under uncertainty. *Sustainable Production and Consumption*, 40, 297–317. <https://doi.org/10.1016/j.spc.2023.07.006>
- Sofyan, I. (2018). Pengaruh Konsentrasi Bahan Pengisi dan Sodium Tripolyphosphate ( $\text{Na}_5\text{P}_3\text{O}_{10}$ ) terhadap Karakteristik Sosis Jamur Tiram Putih (*Pleurotus ostreatus*). *Pasundan Food Technology Journal*, 5(1), 25. <https://doi.org/10.23969/pftj.v5i1.807>
- Surfiana, Hasanudin, U., Nurdjanah, S., & Utomo, T. P. (2023). Physicochemical Characteristics and Pasting Properties of Modified Cassava Starch and Flour by Integrated Processing Technology. *Food Science and Technology (United States)*, 11(1), 7–18. <https://doi.org/10.13189/fst.2023.110102>
- Tepper, B. J., & Barbarossa, I. T. (2020). *Taste, Nutrition, and Health*. 1–5.
- Totosaus, A. (2009). *The Use of Potato Starch in Meat Products*. Retrieved from <https://api.semanticscholar.org/CorpusID:202690737>
- Wang, Z., Mhaske, P., Farahnaky, A., Kasapis, S., & Majzoobi, M. (2022). Cassava starch: Chemical modification and its impact on functional properties and digestibility, a review. *Food Hydrocolloids*. Retrieved from <https://api.semanticscholar.org/CorpusID:246357853>
- Weerasinghe, R. K. L., Wickramasinghe, I., & Somendrika, M. A. D. (2021). Determining The Effect Of Replacing Composite Flour Mixture With Cassava Starch On Nutritional And Physical Properties Of Chicken Sausages. *Potravinarstvo Slovak Journal of Food Sciences*, 15(September), 792–798. <https://doi.org/10.5219/1611>
- Winarno, F. G. (2008). *Kimia Pangan dan Gizi*. In *Gramedia Pustaka Utama*. Retrieved from <http://library.um.ac.id/free-contents/index.php/buku/detail/kimia-pangan-dan-gizi-f-g-winarno-14159.html>
- Yang, J. E., & Lee, J. (2020). Consumer perception and liking, and sensory characteristics of blended teas. *Food Science and Biotechnology*, 29(1), 63–74. <https://doi.org/10.1007/s10068-019-00643-3>
- Zebua, E. A., Rusmarilin, H., & Limbong, L. N. (2015). Pengaruh Perbandingan Kacang Merah dan Jamur Tiram dengan Penambahan Tapioka dan Tepung Talas Terhadap Mutu Sosis. *Jurnal Hasil Riset*. 2(4), 92–101.
- Zurriyati, Y. (2011). Palatabilitas Bakso Dan Sosis Sapi Asal Daging. *Jurnal Peternakan*, 8(2), 49–57. <http://dx.doi.org/10.24014/jupet.v8i2.198>