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The Effect of Seaweed Addition on the Organoleptic Properties of Tempeh Sausages

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ABSTRACT

Background: *Food production today not only caters to consumer preferences but also must consider nutritional and health aspects. Sausages available on the market are typically made from meat, which is low in fiber and high in cholesterol, posing risks for atherosclerosis and other degenerative diseases. Tempeh and seaweed are local food ingredients rich in nutrients that can serve as alternative materials for innovating healthy sausage products.*

Research Methods: *This study employed a complete randomized design (CRD) experimental method with one factor: seaweed substitution at three levels—5%, 10%, and 15% of the weight of tempeh. A sensory evaluation was conducted using the hedonic method, and the data were analyzed with one-way ANOVA.*

Research Result: *The evaluation of color, texture, and aroma showed scores ranging from 1.80 to 2.10 on a neutral scale. The taste evaluation resulted in scores ranging from 1.80 to 2.00 on the neutral scale, with statistical analysis revealing a significant effect of seaweed addition on the taste of tempeh sausages ($p<0.05$).*

Conclusion: *Indicates that the addition of seaweed does not significantly affect the color, aroma, and texture of tempeh sausages ($p>0.05$) but has a significant impact on taste ($p<0.05$). The sensory evaluation results showed that the color scores for tempeh sausages ranged from 1.90 to 2.10 (neutral), the aroma scores ranged from 1.63 to 1.97 (neutral), the taste scores ranged from 1.80 to 2.00 (neutral), and the texture scores ranged from 1.83 to 2.00 (neutral).*

BACKGROUND

An increase in degenerative diseases accompanies the rapid growth of the culinary industry. Thus, food products must consider nutritional and health aspects. The innovation of processed food products has increased demand for convenient items such as sausages. Sausages are processed meat products made by grinding, seasoning, and encasing the meat. In Indonesia, sausage consumption increased from 2.9 grams per capita per day in 1995 to 53.3 grams per capita per day in 2000 (Prayitno et al., 2009). Market-available sausages are primarily made from chicken or beef, which are low in fiber and contain high cholesterol (42-80 mg/100 grams), posing risks for atherosclerosis and other degenerative diseases (Purbowati et al., 2020). Atherosclerosis affects over 200 million people worldwide, contributing to increased morbidity and mortality from cardiovascular diseases (Conte & Vale, 2018).

Tempeh is a local food product derived from fermented soybeans using Rhizopus spp., which enhances its digestibility and nutritional value compared to raw soybeans. Tempeh contains 20.8 grams of protein and 2.89 grams of fat per 100 grams, with a high proportion of unsaturated fatty acids (Romulo & Surya, 2021). Tempeh can produce vegetarian sausages as a nutritious alternative, catering to consumers who avoid meat and fish.

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Dietary fiber plays a vital role in gastrointestinal function and reducing the risk of degenerative diseases. Although fiber supplements are available, natural sources from fruits, vegetables, and legumes are recommended (Slavin, 2013). Seaweed, particularly Eucheuma cottonii, is a marine-derived fiber source with significant potential. It produces carrageenan, a gelling and stabilizing agent beneficial in sausage production. Carrageenan resists degradation and enhances the texture of processed food products. Prior studies have shown that 3% carrageenan improves the functional properties of chicken sausages (Ismanto, 2013), and up to 50 grams of seaweed flour significantly enhances the sensory attributes of catfish nuggets (Lutfhiana, 2017). Additionally, a 2.5% seaweed addition improved the emulsion stability of mackerel sausages by up to 96% (Ramasari, Ma'ruf & Riyadi, 2012).

Considering these factors, this study aims to investigate the effect of seaweed addition on the organoleptic properties of tempeh sausages.

RESEARCH METHODS

This laboratory-based experimental study used a Completely Randomized Design (CRD) with one factor: seaweed substitution at three levels (5%, 10%, and 15% of tempeh weight). Table 1 shows the formulation used in the production of tempeh sausages.

Sensory evaluation was conducted using the hedonic method (Rahayu, 1998) with a three-point scale: 1 = dislike, 2 = neutral, and 3 = like. Data were analyzed using one-way ANOVA.

Table 1. Formulation of Tempeh Sausage with Seaweed Addition

No	Ingredient	Treatment			
		to	t1	t2	t3
1	Tempeh (g)	100	100	100	100
2	Seaweed (*) (%)	0	5	10	15
3	Shallots (g)	15	15	15	15
4	Garlic (g)	10	10	10	10
5	Egg white (g)	20	20	20	20
6	Black pepper (g)	0,5	0,5	0,5	0,5
7	Salt (g)	3	3	3	3
8	Cooking oil (ml)	10	10	10	10

Note: (*) The amount of seaweed added is based on the tempeh weight.

RESULTS

The Influence of Seaweed Addition on the Organoleptic Properties of Tempe Sausages: Average Values and Significance of Organoleptic Test Results for Tempe Sausages with Seaweed Addition are presented in Table 2

Table 2. Average Values and Significance of the Effect of Seaweed Addition on the Organoleptic Properties of Tempe Sausages

Fish Meat Addition	Organoleptic Test Parameters			
	Color	Aroma	Taste	Texture
T0	2,03	2,10	2,23	1,73
t1 (5%)	1,97	1,87	2,00	2,00
t2 (10%)	2,10	1,97	1,93	1,93
t3 (15%)	1,80	1,63	1,80	1,83
Probability	0,66	0,56	0,001	0,37
Notation	NS	NS	S	NS

Note: S = Significant, NS = Not Significant

DISCUSSION

Color of Tempe Sausage

Color is the initial impression observed by panelists before perceiving other sensory stimuli. Food color plays a significant role in attracting consumers to try a product. Additionally, color can indicate

chemical changes in food, serving as a consideration for food safety and quality before consumption. Bright and appealing food colors can give the impression that the food is fresh and nutritious (Harefa, 2024).

The assessment of the color of tempe sausage under various seaweed addition treatments showed preference scores ranging from 1.80 to 2.10, rounded to 2, which falls within the neutral value scale.

The tempe sausage produced in this study was bright brown, similar to the typical color of sausages. The color of the tempe sausage is influenced by the soybean raw material used. The addition of seaweed did not affect the tempe sausage's color, as the seaweed's color is as bright as the tempe itself, resulting in no significant differences in color among the treatments.

The aroma of Tempe Sausage

The aroma of food is related to the olfactory sense and serves as a determining factor for the perceived deliciousness of food. Generally, the scent received by the nose and brain combines four primary smells: fragrant, sour, rancid, and burnt. A fragrant smell can create the impression that the food is fresh and nutritious (Ni et al., 2022).

The aroma evaluation of tempe sausage under various seaweed addition treatments showed neutral values with scores ranging from 1.63 to 1.97, rounded to 2, which is classified within the neutral value scale.

The aroma of the sausage produced in this study was the characteristic tempe scent, complemented by seasonings such as chicken broth, shallots, garlic, and spices during sausage cooking. The typical off-flavor of tempe caused by the lipoxygenase enzyme activity was not dominant due to the steaming process before sausage dough preparation. Furthermore, the fishy aroma from the seaweed addition was absent, as the seaweed was soaked for three days with water changes every 12 hours, then boiled at 100°C for 15 minutes until it expanded 5-6 times its dry weight. Adding spices was intended to provide flavor and aroma to enhance appetite (Fachruddin, 2007).

Taste of Tempe Sausage

The taste of a food ingredient results from interactions between the food and the taste senses when it enters the mouth, reflecting the overall characteristics of the ingredient (Muchtar, 2022). In this study, the savory taste of the Tempe sausage was achieved by adding seasonings such as chicken broth, salt, and spices.

The addition of seaweed in several tempe sausage treatments resulted in a neutral evaluation from panelists, with scores ranging from 1.80 to 2.00, rounded to 2, classified as neutral. Statistical analysis revealed that adding seaweed significantly affected the taste of the Tempe sausage ($p < 0.05$). Treatment T1 showed a significant difference from treatments T2 and T3, where T1 was preferred, with the highest score of 2.00 (neutral). This was due to the influence of seaweed on the absorption of spices despite the exact amount and type of spices used in each treatment. Adding seaweed without adjusting the amount of spices affected the balance of ingredients and seasonings, impacting the tempe sausage's taste.

Texture of Tempe Sausage

The texture of food is related to the flow and deformation properties of the product, as well as how the structural components are arranged into micro and macro structures (I. et al., 2019). Therefore, food producers must consider texture during production to meet consumer preferences.

The texture of the tempe sausage in this study was soft and fibrous, similar to that of typical beef or chicken sausages, which was achieved by adding egg whites that enhanced emulsification in the tempe sausage. The addition of seaweed in various treatments resulted in neutral evaluations from panelists, with scores ranging from 1.83 to 2.00, rounded to 2, which falls within the neutral value scale. Based on panelist assessments, treatment T1 was preferred over treatments T2 and T3, with the highest score of 2.00 (neutral). Texture, which refers to the sensory pressure observed through the mouth or touch, is an important factor in product acceptance by consumers, influenced by the components in the product (Ridayanti et al., 2006). The texture of the Tempe sausage in this study did not show significant differences between treatments, as the addition of seaweed and egg whites helped improve the soft texture across all treatments.

CONCLUSIONS

The addition of seaweed to tempeh sausages does not significantly affect color, aroma, or texture ($p>0.05$), but it has a significant impact on taste ($p<0.05$). The recommended formulation is 5% seaweed substitution, which yields the most favorable organoleptic properties. Indicates that the addition of seaweed does not significantly affect the color, aroma, and texture of tempeh sausages ($p>0.05$) but has a significant impact on taste ($p<0.05$). The sensory evaluation results showed that the color scores for tempeh sausages ranged from 1.90 to 2.10 (neutral), the aroma scores ranged from 1.63 to 1.97 (neutral), the taste scores ranged from 1.80 to 2.00 (neutral), and the texture scores ranged from 1.83 to 2.00 (neutral).

RECOMMENDATION

Based on the research findings, the recommended addition of seaweed is in treatment T1, which involves incorporating 5% seaweed by weight of the tempe, as it demonstrates organoleptic properties that the panelists generally favor.

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