Effect of Liquid Smoke on the Characteristics of Sensory Quality of Chicken Nugget

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(receive 12-03-2025; revised 05-06-2025; accepted 08-07-2025)

ABSTRAK

Hafid H, Herniati S, Nasiu F, Pancar FM, Ananda SH. 2025. Pengaruk asam cair terhadap karakteristik kualitas sensori nuget ayam. JITV 30 (2):126-132. DOI:http://dx.doi.org/10.14334/jitv.v30i2.3514.

Berbagai bahan digunakan untuk meningkatkan kualitas makanan olahan termasuk nugget ayam yang merupakan salah satu produk olahan daging unggas yang banyak dikonsumsi masyarakat. Salah satu bahan yang digunakan diindustri pangan adalah penggunaan asap cair yang dapat berfungsi sebagai bahan antioksidan dan antimikroba. Penelitian ini bertujuan untuk mengetahui pengaruh penggunaan asap cair terhadap pH dan kualitas sensoris nugget ayam broiler. Penelitian ini dilaksanakan di Laboratorium Teknologi Pengolahan Hasil Ternak, Fakultas Peternakan Universitas Halu Oleo, Kendari. Perlakuan dalam penelitian ini terdiri dari empat kelompok yaitu nugget ayam tanpa asap cair 0% (P0), nugget ayam dengan asap cair 2% (P1), nugget ayam dengan asap cair 4% (P2), dan nugget ayam dengan asap cair 6% (P3). Penelitian ini dirancang dengan menggunakan Rancangan Acak Lengkap (RAL) dengan 4 perlakuan dan 4 kali ulangan. Data yang diperoleh dianalisis menggunakan analisis sidik ragam (ANOVA) dan jika terdapat pengaruh yang signifikan maka dilanjutkan dengan uji Duncan multiple range tests (DMRT) untuk mengetahui perbedaan antar perlakuan. Hasil penelitian menunjukkan bahwa penambahan asap cair pada pembuatan nugget ayam tidak memberikan pengaruh nyata terhadap warna, aroma, tekstur, dan keempukan nugget ayam, tetapi berpengaruh nyata terhadap penurunan nilai rasa nugget yang dihasilkan. Hal ini menunjukkan bahwa asap cair berpotensi digunakan sebagai salah satu bahan dalam proses pembuatan nugget ayam, meskipun perlu dilakukan perbaikan formula untuk meningkatkan cita rasa produk akhir.

Kata Kunci : Nugget Ayam, Asap Cair, Kualitas Sensori

ABSTRACT

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Various ingredients are used to enhance the quality of processed foods, including chicken nuggets, one of the widely consumed processed poultry meat products. One of the ingredients used in the food industry is liquid smoke, which can serve as an antioxidant and antimicrobial agent, providing a color effect and a distinctive smoke flavor to the product. This study aims to determine the Effect of using liquid smoke on pH and the sensory quality of broiler chicken nuggets. This research was conducted at the Laboratory of Animal Product Processing Technology, Faculty of Animal Husbandry, Halu Oleo University, Kendari. The treatments in this study consisted of four groups: chicken nuggets without 0% liquid smoke (P0), chicken nuggets with 2% liquid smoke (P1), chicken nuggets with 4% liquid smoke (P2), and chicken nuggets with 6% liquid smoke (P3). This study employed a completely randomized design (CRD) with four treatments and four replications. The data obtained were analyzed using analysis of variance (ANOVA). If a significant effect was found, it was followed up with Duncan's multiple range tests (DMRT) to determine differences between treatments. The results showed that the addition of liquid smoke in making chicken nuggets had no significant effect on the color, aroma, texture, or tenderness of the chicken nuggets, but significantly reduced the taste value of the chicken nuggets. This suggests that liquid smoke can improve the sensory quality of chicken nuggets.

Key Words: Chicken Nugget, Liquid Smoke, Sensory Quality

INTRODUCTION

It has been realized that the culinary industry in Indonesia, particularly in Kendari City, is progressing. This situation requires the guarantee of culinary quality to meet the needs of both the market and consumers, ensuring that the product is safe for consumption. One of the raw materials in the culinary industry that should be guaranteed to maintain its quality is chicken meat. Chicken meat is a protein food source that can be easily found in a traditional market, is cheaper, and easily processed, digested, and has a delicious taste that makes

it desirable (Hafid et al. 2017a; Hafid et al. 2017b; Mir et al. 2017; Ismail & Joo 2017). However, this product is easily spoiled due to the existence of endogenous cathepsin enzyme and bacterial contamination (Patriani et al. 2020; Saenz-García et al. 2020). Therefore, meat spoiling should be prevented by either processing or preservation action (Patriani et al. 2020). Processing will have a positive effect on the formation of product diversity, increase the storage period, and enhance the economic value of the product. One alternative to chicken meat processing is making nuggets, a type of fast food made from livestock products that Indonesians love to consume and is widely available in society (Tasse et al. 2015).

Nuggets are one of the meat-processed products made from ground meat, formed into a rectangular shape, and coated with seasoned flour (Sumina et al. 2018). Nugget is defined as a chicken processed product that is formed, cooked, and made from a mixing of ground chicken meat added with coating ingredients, with or without the addition of other ingredients and other allowed ingredients (BSN 2002). Moreover, the nutritional content per 100 g of chicken nuggets was as follows: moisture 60 g, protein 12 g, fat 20 g, carbohydrate 25 g, calcium 30 mg, and energy 1364 kilojoules or 326 kcal.

In making chicken nuggets, liquid smoke, which can be produced from coconut shell smoke, is an important ingredient (Kailaku et al. 2017; Rizal et al. 2020). Liquid smoke from coconut shells is obtained by condensing the smoke from coconut shells through a pyrolysis process at a temperature of 400°C. This liquid smoke contains various chemical compounds, including phenol, ketone, organic acid, alcohol, and ester (Budaraga et al. 2016a; Budaraga et al. 2016b). Those chemical compounds can serve as antioxidants and antimicrobials, imparting a color effect and a special smoke flavor in agricultural products (Sorour et al. 2022; Suryani et al. 2022; Wibowo et al. 2023; Abustam et al. 2018). Nowadays, liquid smoke is generally used in fish preservation. It can be hypothesized that liquid smoke can bind water in meat, thereby enhancing the sensory quality of chicken nuggets.

MATERIALS AND METHODS

This study was conducted in the Laboratory of Processing Technology of Animal Products, Faculty of Animal Science, University of Halu Oleo, Kendari, Indonesia. Ingredients used were chicken meat, liquid smoke, ice cube, tapioca flour, sea salt, seasonings, bread flour, fried oil, egg, and aquadest. In contrast, the tools used were a blender, plastic washbowl, plate, grounding machine, binder, knife, analytical balance, cutting board, frying pan, stove, and pH meter.

Chicken nugget-making procedures

There are many processes in making chicken nuggets. The first step is to clean the broiler chicken meat separately and then balance all the ingredients, including broiler chicken meat, garlic, pepper, tapioca flour, ice cube, sea salt, and liquid smoke, according to the determined formula. The next step is to grind the meat in a grinding machine for six minutes. Then, add an ice cube to the grinding container to prevent the container from becoming too hot and to prevent the meat protein from decaying. Additionally, mix all the ingredients according to a predetermined formula. All the ingredients, including a grounded protein source, filler, garlic, pepper, sea salt, and liquid smoke, are then mixed in the batter. All the treatment ingredients are then stirred into the plate of each treatment using a spoon to produce a homogeneous mixture of ingredients and liquid smoke.

A further step is to form the chicken nugget batter on the cutting board, which has been previously oiled with frying oil to prevent the batter from sticking when the nuggets are cooked. Nugget batter is formed as thick as possible and then steamed for 20 minutes to make it cooked solid and easy to cut. The cutting process is used to produce uniform chicken nuggets that are easy to fry and cook. There will be two further steps to produce fried chicken nuggets. First of all, the chicken nugget batter is then coated with egg yolk for a better taste and increased nutritional content, and then coated with bread flour to coat the outer part of the nugget. Additionally, bread flour is used to achieve the golden yellow color after the frying process. The final step is to fry the nuggets for one minute, which strengthens the taste of the cooked nuggets and enhances their flavor, creating a crunchy texture and making them ready to be served.

Nugget formula

The formula of ingredients in the nugget-making process was modified to analyze the sensory quality characteristics of nuggets, using chicken meat with the addition of liquid smoke, as presented in Table 1.

pH measurement

pH was measured according to Soeparno (2015) by weighing 10 g of the ground sample and mixing it with 10 mL of aquadest, then stirring to form a homogeneous mixture. A clean pH meter was then put into a pH 7 buffer to calibrate the pH. The next step was to measure the pH of each homogeneous mixture solution three times, and the results were then averaged to obtain the average pH value.

Testing of sensory quality characteristics of nugget

A sensory quality test is a test of ingredients or products based on the level of fondness (Hedonic test)

Table 1. Chicken nugget batter ingredients per unit sample

Ingredients	Treatments			
	P0	P1	P2	P3
Broiler chicken meat (grams)	100	100	100	100
Liquid smoke (%)	0	2	4	6
Tapioca flour (%)	10	10	10	10
Garlic (%)	2	2	2	2
Pepper (%)	2	2	2	2
Sea salt (%)	1	1	1	1
Ice cube (%)	1	1	1	1
Egg yolk (%)	1	1	1	1

P0 = liquid smoke 0 % per 100 g of broiler chicken meat, P1 = liquid smoke 2 % per 100 g of broiler chicken meat, P2 = liquid smoke 4 % per 100 g of broiler chicken meat, P3 = liquid smoke 6 % per 100 g of broiler chicken meat

Table 2. Hedonic scale for sensory quality test

Parameters	Hedonic Scale	Criteria
Color	1	Dark brown
	2	Brown
	3	Yellow-brown
	4	Golden yellow
	5	Yellow
Aroma	1	Very dislike
	2	Dislike
	3	Like enough
	4	Like
	5	Very like
Texture	1	Very rough
	2	Rough
	3	Medium
	4	Soft
	5	Very soft
Tenderness	1	Very not tender
	2	Not tender
	3	Tender enough
	4	Tender
	5	Very tender
Flavor	1	Very dislike
	2	Dislike
	3	Dislike enough
	4	Like
	5	Very like

(Julianto et al. 2021). Testing is conducted by using the panelist' responses to describe the level of their fondness for the result of the experiment. The number of panelists is twenty-five students, categorized as untrained panelists. The hedonic scale includes color, aroma, texture, tenderness, and flavor. The hedonic scale is presented in Table 2 (Sari et al. 2023).

Research design

The design used was a completely randomized design consisting of 4 treatments and 25 untrained panelists as replication. The model of the experiments was categorized as P0= liquid smoke 0 % per 100 g of broiler chicken meat, P1= liquid smoke 2 % per 100 g of broiler chicken meat, P2= liquid smoke 4 % per 100 g of broiler chicken meat, P3= liquid smoke 6 % per 100 g of broiler chicken meat. The observation value of treatment at-i on replication at-j (Y_{ij}) calculated used formula as follow:

$$Y_{ij} = \mu + \alpha i + \varepsilon ij$$

where μ is middle value; α_i is effect of treatment at-i; ε_{ij} is trial error of treatment at-i on replication of-j; i is treatment of 0,1,2,3, and so on and j is replication at 1,2,3, and so on.

Data analysis

The data were analyzed using analysis of variance (ANOVA). If the result of the ANOVA shows a significant effect, it will be further analyzed using the Duncan Multiple Range Test (Paiman, 2015).

RESULTS AND DISCUSSION

pH and sensory quality characteristics of chicken nuggets, consisting of color, texture, flavor, and tenderness, are presented in Table 3.

pH

pH value can affect the texture and juiciness of the nugget since pH affects the interaction between protein, water, and fat, whereas at the low pH, protein electricity becomes neutral, and protein clamps and solidifies, creating a harder and drier texture (Torun et al. 2023; Cornet et al. 2021; Barbut 2024). Since the liquid smoke contains organic acids, it was assumed that a higher level of liquid smoke may decrease the pH. However, there was no significant effect of liquid smoke on pH in this study, indicating that the use of liquid smoke up to a level of 6% has an insufficient organic acid content to decrease the pH.

Color

An interesting color will increase the acceptance of processed chicken nuggets with liquid smoke. Color is also a quality characteristic that becomes a consumer consideration because of the first sight of the consumer on a product in color. Based on the ANOVA result in Table 3, it shows that using liquid smoke in the making process of chicken nuggets has no significant effect (P>0.05) on nugget color. The measurement score is 3.88-3.90, indicating that the color of the chicken nuggets is yellow-brown to yellow. Treatment of liquid smoke at levels up to 6% could not significantly affect the color because liquid smoke does not affect the concentration of the myoglobin pigment in meat. The color of meat is mainly affected by myoglobin pigment concentration in meat (Soeparno 2005; Han et al. 2024; Gupta et al. 2018; Bekhit et al. 2019; Yu et al. 2017; Tushar et al. 2023).

Aroma

Aroma is one of the key indicators used to determine the level of consumer acceptance of a product. The addition of liquid smoke to the chicken nugget-making process has no significant effect (P>0.05) on the aroma of the chicken nuggets. Measurement scores ranged from 3.82 to 3.96, indicating that the aroma of chicken nuggets with liquid smoke was generally liked and liked enough. The highest score for aroma was achieved by the treatment without liquid smoke addition, at 3.96, indicating that the aroma of chicken nuggets without liquid smoke is more appealing. In many ways, food deliciousness is determined by the aroma and smell of that dish because aroma, which can stimulate the appetite, will be a suitable parameter for consumers to choose the product (de Araújo et al. 2022; Berčík et al. 2021; Flores 2018; Sherina et al. 2023).

Texture

Texture is a primary characteristic of food quality, as each food product has distinct characteristics and a unique structure. Based on Table 3, it was shown that the addition of liquid smoke in the chicken nugget-making process has no significant effect (P>0.05) on the texture of the product. Measurement scores ranged from 3.67 to 3.87, indicating that the chicken nugget texture was middle soft to soft. The addition of liquid smoke up to a level of 6% had no significant effect on the improvement of the water-binding capacity of nugget protein; therefore, it cannot significantly affect the texture. The factor affecting the density, compactness, and elasticity of meat-processed products is the water-binding capacity of meat protein (Xu et al. 2024; Bao & Ertbjerg 2019; Zhang et al. 2020; Shen et al. 2020).

Table 3. pH, score of color, aroma, texture, flavor, and tenderness of broiler meat chicken nuggets with liquid smoke.

Parameters	Treatment of liquid smoke addition			
	P0(0% of LS)	P1 (2% of LS)	P2 (4 % of LS)	P3 (6 % of LS)
pH	6.01±0.06	5.97±0.11	6.58±0.32	5.84±0.45
Color	3.85±0.15	3.88±0.18	3.69±0.10	3.90±0.20
Aroma	3,97±0.08	3.92±0.08	3.92±0.14	3.82±0.01
Texture	3.87±0.09	3.80±0.05	3.69±0.15	3.67±0.09
Flavor	4.05±0.06[a]	3.80±0.14[b]	3.78±0.13[b]	3.69±0.08[b]
Tenderness	3.78±0.035	3.95±0.06	3.85±0.015	3.77±0.06

P0 = liquid smoke 0 % per 100 g of broiler chicken meat, P1 = liquid smoke 2 % per 100 g of broiler chicken meat, P2 = liquid smoke 4 % per 100 g of broiler chicken meat, P3 = liquid smoke 6 % per 100 g of broiler chicken meat

Flavor

Flavor is the most affecting factor in determining the level of consumer fondness. The flavor of the nugget is directly proportional to panelist fondness (Dashdorj et al. 2015; Fiorentini et al. 2020; Lee et al. 2018; Miyaki et al. 2016). The more delicious the nugget product served, the higher the fondness level of the panelist for the nugget product served. Flavor also affects the acceptance of consumers of the agricultural product. In flavor measurement, the sense of taste is more commonly used, which is divided into several factors, including salty, sour, sweet, and bitter (Taylor et al. 2024).

The addition of liquid smoke in the chicken nugget-making process has a very real effect ($P<0.01$) on nugget flavor. The highest measurement score is achieved without liquid smoke treatment, reaching a value of 4.05, indicating that chicken nuggets without liquid smoke are more appealing. It is likely because the liquid smoke produces a flavor that is less appealing to panelists. The flavor of chicken nuggets is influenced by the addition of seasonings during the manufacturing process, which includes sea salt, garlic, pepper, and tapioca flour. Those seasonings play a primary role in giving taste to chicken nuggets (Hafid et al. 2017b), while the flavor of the product is more significantly affected by the addition of seasonings (Feng et al. 2018; Oktafa et al. 2022; Neves et al. 2021). Moreover, the flavor of the product can be enhanced by the addition of seasonings that are appealing to consumers. The addition of seasonings and flavoring ingredients is primarily intended to enhance or intensify the flavor.

Tenderness

Tenderness is the sensation of the ease with which the meat or food can be cut into smaller pieces by teeth. Meat is considered tender if it can be cut easily with incisors and is easy to chew and swallow after being chewed by molars. Meat could be considered not tender enough if it should be bitten with a canine tooth, and it is hard if bitten with molars (Patriani et al. 2020). Results of ANOVA indicated that the addition of liquid smoke in the chicken nugget-making process has no real effect ($P>0.05$) on nugget tenderness. The measurement score ranged from 3.77 to 3.95, indicating that it was tender enough. It was expected that the addition of liquid smoke could elevate the water binding capacity of the nugget because the smoke's ability to bind the free half water to and free half water, and water is free to fill the space between cells, causing an increase in water binding capacity, which automatically will decrease the shearing force of meat. Moreover, the lower the shearing force of meat, the higher its tenderness (Choe et al. 2015).

CONCLUSION

The addition of liquid smoke, up to 6% of the batter, in making chicken nuggets does not affect the color, aroma, texture, and tenderness parameters. However, it significantly decreases the flavor score of the nugget. The use of liquid smoke to enhance the flavor of the nuggets may not be effective for chicken meat.

CONFLICT OF INTEREST

Statement declaring that there is no conflict of interest with any party related to the materials discussed in the paper.

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