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VARIATION OF THE PROPORTIONS OF TOFU FLOUR AND CHICKEN MEAT *(Gallus domesticus)* ON THE CHEMICAL AND ORGANOLEPTIC QUALITY OF CORNED BEEF

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Abstract

Corned beef is a processed meat product that is widely consumed because it is practical, has a distinctive taste, and has a relatively long shelf life. The use of chicken meat (*Gallus domesticus*) as an alternative raw material for corned beef has the potential to reduce production costs, but requires fillers to improve product characteristics, one of which is tofu dregs flour. Tofu dregs flour as a by-product of the tofu industry contains protein and dietary fiber that has the potential to improve nutritional quality while supporting the utilization of agro-industrial waste. This study aims to determine the effect of variations in the proportion of chicken meat and tofu dregs flour on the chemical and organoleptic quality of corned beef, and to determine the best formulation. The study was conducted experimentally using a one-factor Completely Randomized Design with four levels of treatment of the proportion of tofu dregs flour: chicken meat, namely P1 = 10%:90%; P2 = 20%; 80%; P3 = 30%:70% and P4 = 40%:60%, each level was repeated three times. The research variables included chemical quality parameters (protein, fat, and crude fiber content) and organoleptic tests (color, aroma, and taste) using hedonic tests. The parametric data obtained were analyzed using ANOVA, if the results showed a very significant/significant difference, further tests were carried out. The nonparametric data obtained were further tested using the Kruskal–Wallis method, while the best treatment was determined by an effectiveness test. The results showed that variations in the proportion of tofu dregs flour and chicken meat (*Gallus domesticus*) had a very significant effect on the chemical quality (protein, fat, and crude fiber content) and organoleptic (taste and aroma color) of corned beef. The best treatment was treatment P4 with the parameter criteria of protein content 6.22%, fat content 6.27%, fiber content 4.70%, color 4.4 (like), taste 4 (like) and aroma 4.18 (like).

Keywords: corned chicken, tofu dregs flour, chemical quality, organoleptic, filler

INTRODUCTION

Corned beef is a processed meat product widely consumed due to its convenience, distinctive flavor, and relatively long shelf life. This product is commonly used as a ready-to-eat side dish or as an additional ingredient in various food preparations. Conventionally, corned beef is made from beef, but high prices and limited supply have encouraged the use of alternative, more economical raw materials without compromising product quality (Sembor & Tinangon, 2022). Chicken (*Gallus domesticus*) was chosen as an alternative due to its affordability, high protein content, relatively low fat content, and consumer acceptance. Furthermore, its softer texture and bright color have the potential to produce corned beef with good physical and sensory characteristics. However, its use requires a combination of fillers to improve texture, increase water holding capacity, and reduce production costs, one of which is tofu dregs flour (Rahayu, 2020).

Tofu dregs flour is a byproduct of the tofu industry that is still rich in nutrients, with a protein content of around 25–30% and total dietary fiber of ±40–60% on a dry basis, as well as minerals such as calcium, phosphorus, potassium, iron, zinc, and magnesium. Its use as a substitute in meat products can increase fiber content, support food diversification, and reduce agro-industrial waste, while improving texture and reducing fat content in corned beef without significantly reducing sensory acceptability (Siregar et al., 2023). Previous research has shown that substituting plant-based fillers in processed meat products impacts chemical and organoleptic quality. Adding tofu dregs flour at 10–30% has been reported to increase protein and fiber levels, but excessive use can reduce texture and flavor preferences (Deglas, 2017). Variations in the proportions of meat and fillers in corned chicken have also been shown to affect protein and fat levels, as well as sensory attributes such as color, aroma, flavor, and texture (Andini, 2024).

Based on this, further research is needed regarding the variation in the proportion of chicken meat (*Gallus domesticus*) and tofu dregs flour in making corned beef to obtain an optimal formulation with the best chemical and organoleptic quality.

LITERATURE REVIEW

Corned Beef and Quality Requirements

Corned chicken is a ready-to-eat processed product made from finely chopped boneless chicken, then mixed with spices, fillers, and permitted food additives. The mixture is then placed in airtight (hermetic) packaging and processed through thermal sterilization until it reaches commercially sterile conditions. This process allows the product to be stored at room temperature for extended periods without microbiological deterioration. In Indonesia, the quality of corned chicken is regulated by SNI 3775:2024, which covers requirements for raw materials, nutritional composition such as a minimum protein content of approximately 12%, limits on the use of additives, heavy metal contamination, and microbiological safety (BSN, 2024).

In addition to meeting composition standards, corned beef must also meet sensory quality and food safety requirements. Organoleptically, the product must have a normal color, odor, and taste typical of corned beef, without any deviations such as rancid odor or abnormal color. From a chemical aspect, the protein, fat, and water content must be within the standard range, while from a microbiological safety aspect, the product must be free from pathogenic bacteria, especially *Salmonella* , which can be eliminated through a proper commercial sterilization process (BPOM, 2025).

Ingredients for Making Corned Beef

The main ingredient in making corned beef is meat as a source of animal protein, while additional ingredients include fillers, spices, fat, and other supporting ingredients that function to improve texture, increase water-holding capacity, and form the product's distinctive flavor (Paulini, 2025). The combination of these ingredients determines the final characteristics of corned beef, both chemically and sensorially.

Chicken meat is generally used in fillet form because it is boneless, has a soft texture, and is easy to grind and mix with other ingredients. Furthermore, chicken meat contains high levels of protein, around 31 g per 100 g, with a relatively lower fat content than red meat. Fresh meat quality is characterized by a bright pink color, no off-odor, and is free from bruising or mucus, indicating that the raw material is still suitable for processing (BSN, 2024; Datta et al., 2023).

Tofu dregs flour has the potential to be used as a substitute or filler because it still contains relatively high nutritional content, particularly 20–27% protein and 15–25% crude fiber. Its use not only improves texture and increases the fiber content of the product but also supports the utilization of agro-industrial waste, making it more environmentally friendly. Thus, tofu dregs flour can increase product added value while reducing production costs (Fera & Solikhin, 2021; Ernawati et al., 2024).

Eggs are added as a natural binder because their protein and fat content helps form a stable emulsion structure. Furthermore, eggs contribute to the savory flavor and color of the product, thus enhancing the sensory acceptability of corned beef (Wulandari & Arief, 2022; Thohari, 2018).

Vegetable oil increases the moisture content of the product, improves the texture so it doesn't become too dry, and helps form an emulsion between fat and water. It also acts as a heat conductor during the cooking process, ensuring more even cooking (Khafiza et al., 2025; Ayustaningwarno et al., 2021).

Garlic and onions are used as natural flavorings, imparting a distinctive aroma to corned beef. Both ingredients contain volatile sulfur compounds and other bioactive components that can enhance sensory quality while also providing mild antimicrobial effects (Islam et al., 2023; Enejiyon et al., 2020).

Chicken stock powder, sugar, and pepper are added to enhance the flavor and create a sensory balance between savory, sweet, and slightly spicy notes. This spice combination is crucial for creating the desired corned beef flavor (Malichati & Adi, 2018; Maryani et al., 2021; Yanto, 2015).

Soy sauce and fish sauce act as sources of umami flavor because they contain amino acids produced by protein fermentation. The addition of these two ingredients can enhance the deliciousness and complexity of the product's flavor (Widiantara, 2018; Rushariandi et al., 2017).

Red yeast rice powder is used as a natural dye, imparting a distinctive red color to processed meat products. In addition to its aesthetic value, red yeast rice also contains bioactive compounds produced by mold fermentation, which have the potential to provide additional health benefits (Putra et al., 2018; Susilo et al., 2024).

Corned Beef Making Process

The corned beef production process begins with selecting high-quality raw materials, followed by washing to remove surface dirt and microorganisms. The meat is then ground until smooth to facilitate mixing with the other ingredients. Afterward, spices, fillers, and additional ingredients are mixed until a homogeneous mixture is obtained. The mixture is sealed in a retort and sterilized at high temperatures to kill microorganisms and heat-resistant spores. After the sterilization process is complete, the product is gradually cooled and stored at room temperature. This series of processes aims to produce a product that is safe, stable during storage, and has good sensory quality (Ilyas, 2024).

Chemical Properties

The chemical parameters observed in corned beef include crude fiber, fat content, and protein content because these three determine the nutritional value and quality of the product according to poultry corned beef standards (BPOM, 2025).

Crude fiber was analyzed using a gravimetric method to determine the insoluble fiber fraction derived from plant-based fillers such as tofu dregs flour. While this method does not reflect the overall total dietary fiber, the results are still important in illustrating the contribution of structural fiber to the product (Mauer & Bradley, 2017).

Fat content plays a major role in determining the flavor, tenderness, and stability of a product during storage. Too much fat can result in a soft texture and the potential for rancidity due to oxidation, so it needs to be controlled to maintain quality (Ikhsan, 2025).

Protein content is a key indicator of corned beef's nutritional quality and reflects the proportion of meat ingredients in the formulation. Poultry corned beef products generally must meet a minimum protein content of approximately 12% or more to meet applicable quality standards (BPOM, 2025).

Organoleptic Test and Effectiveness Test

Organoleptic testing is conducted to assess panelists' preference for a product's color, aroma, taste, texture, and overall acceptability. This testing is crucial because the success of a formulation innovation is determined not only by nutritional value but also by consumer acceptance of the product's sensory characteristics (Waluyo et al., 2021).

To determine the best treatment from several tested formulations, an effectiveness test method was used. This method calculates an index based on a combination of chemical parameter values and hedonic test results, allowing for the selection of the most optimal formulation overall, both in terms of nutritional quality and consumer acceptance (De Garmo & Sullivan, 1984; Sigit, 2020).

RESEARCH METHODS

The research was conducted for one month in November 2025, with chemical quality analysis conducted at the Chemistry Laboratory of Trunojoyo University, Madura, and organoleptic tests at the Tristar Institute, Surabaya. The tools used include processing equipment such as choppers, digital scales, stoves, basins, cloth filters, knives, spatulas, Teflon, and baking pans, as well as laboratory equipment for crude fiber analysis, fat using the Soxhlet method, and protein using the Kjeldahl method. The main ingredients of the research were chicken meat and tofu dregs flour, with supporting ingredients in the form of egg white, vegetable oil, garlic, onions, powdered chicken stock, sugar, pepper, soy sauce, fish sauce, and powdered red yeast rice. Chemicals for analysis included H_2SO_4, NaOH, distilled water, 95% alcohol, n-hexane, Kjeldahl catalyst, boric acid, indicators, and standard titration solutions.

This study used a mixed method, namely an experimental approach to test the effect of variations in the addition of tofu dregs flour on the quality of corned chicken, as well as a qualitative descriptive approach to interpret the results of panelist assessments (Setiawan, 2025). The research design used was a one-factor Completely Randomized Design (CRD) with four treatment levels, namely the proportion of tofu dregs flour to chicken meat: P1 (10%:90%), P2 (20%:80%), P3 (30%:70%), and P4 (40%:60%). Each treatment was repeated three times to obtain 12 experimental units, which have met the minimum replication requirements in the RAL for analysis of variance (Lusiana & Mahmudi, 2021). The parameters observed included crude fiber content, fat content, protein content, and organoleptic properties including color, aroma, and taste.

The research procedure consisted of making tofu dregs flour and making chicken corned beef. Tofu dregs flour was made through the stages of squeezing to reduce water content, steaming as a sterilization process, cooling, drying, refining, and sieving to obtain 80 mesh flour (Yustina & Abadi, 2012). The manufacture of chicken corned beef refers to the modification of the processed meat product process, starting from trimming and washing the meat,

grinding, weighing the ingredients according to the formulation, mixing using a chopper until homogeneous, molding in a baking pan, steaming until cooked, cooling, and then conducting chemical and organoleptic testing (Heinz & Hautzinger, 2007).

The research variables included crude fiber analyzed by gravimetric method, fat content by Soxhlet method, and protein content by Kjeldahl method referring to SNI 01-2891-1992. Organoleptic test was conducted using hedonic test according to SNI 2346:2015 and corned beef sensory criteria in SNI 01-3775-2006 with a scale of 1–5 (very dislike to very like). Chemical data were analyzed parametrically using ANOVA with the help of SPSS version 25, and if there were significant differences, continued with BNT, BNJ, or Duncan test based on the coefficient of variation value (Paiman, 2015). Organoleptic data were analyzed using Kruskal–Wallis test (Ayustaningwarno, 2014), while the determination of the best treatment was done by effectiveness test (De Garmo & Sullivan, 1984).

RESULTS AND DISCUSSION

1. Chemical Test

Protein Content

The results of determining the protein content in corned chicken using tofu dregs can be seen in Table 1 below.

Table 1. Average protein content of corned beef and tofu dregs

Treatment Code	Test			Average (%)
	1	2	3	
P1	9.53	10.17	10.72	10.14 [a]
P2	7.97	8.10	7.49	7.85 [b]
P3	8.32	8.19	8.58	8.36 [b]
P4	5.89	5.78	6.99	6.22 [c]
KK = 5.97% (BNJ ≥ 5%)				

results showed that variations in the proportion of chicken meat and tofu dregs flour had a very significant effect on the protein content of corned beef, as indicated by differences in letter notation in the mean values between treatments. The treatment with the highest proportion of chicken meat produced the highest protein content, while increasing the concentration of tofu dregs flour caused a decrease in protein content. The results of the further Honestly Significant Difference test with a coefficient of variation value of five point nine seven percent confirmed the significant effect of the treatment on the protein content of corned beef.

The decrease in protein content occurs because chicken meat has a higher protein content than tofu dregs flour. Chicken meat has a protein content ranging from eighteen to twenty-three percent, making it the primary protein source in corned beef (Defri et al., 2021), while tofu dregs flour has a relatively lower protein content due to the tofu processing process (Deglas, 2017). The results of this study align with the findings of Afrila and Rinanti (2026), who reported that increasing the substitution of plant-based ingredients in processed meat products leads to a decrease in protein content. Therefore, a higher proportion of chicken meat results in a more optimal protein content in corned beef.

Fat Content

The results of determining the fat content in corned chicken using tofu dregs are shown in Table 2 below

Table 2. Average fat content of corned beef and tofu dregs

Treatment Code	Test			Average (%)
	1	2	3	
P1	2.96	2.05	2.11	2.37 [a]
P2	4.29	4.10	3.24	3.88 [b]
P3	5.73	5.94	4.89	5.52 [c]
P4	6.03	6.28	6.50	6.27 [c]
KK = 10.72% (Duncan α= 5%)				

Table 2 shows the fat content of corned chicken with variations in the proportion of chicken meat and tofu dregs flour ranging from 2.37% to 6.27%, with the lowest value at P1 (2.37%) and the highest at P4 (6.27%). The results of the analysis of variance showed a significant effect between treatments, so it was continued with the

Duncan test (KK = 10.72%). The difference in letter notation indicates that P1, P2, and P3 are significantly different from each other, while P3 and P4 are not significantly different.

Fat content tended to increase as the proportion of tofu dregs flour increased and the proportion of chicken decreased. Treatment P1, with the highest chicken content (90%), produced the lowest fat content, while P4, with the highest tofu dregs flour (40%), produced the highest fat content. This indicates that differences in ingredient composition affect the product's ability to retain fat during processing.

The increase in fat content can also be influenced by the composition of additional ingredients in the formulation, such as vegetable oil used in equal amounts in each treatment (Fauziyah et al., 2017). However, differences in the proportions of chicken meat and tofu dregs flour result in different fat-binding capacities. Tofu dregs flour has a relatively high fiber content that can increase fat retention in processed meat products (Annisa et al., 2020). Therefore, the higher the addition of tofu dregs flour, the fat content of corned chicken tends to increase, as supported by the results of the analysis of variance which showed a significant effect of treatment on the fat content of corned chicken.

Crude Fiber Content

The results of determining the crude fiber content in corned chicken using tofu dregs are shown in Table 3 below. The analysis results show that variations in the proportion of chicken meat and tofu dregs flour have a very significant effect on the crude fiber content of corned chicken, as indicated by the difference in letter notation in the average value between all treatments (Table 3).

Table 3. Average crude fiber content of corned chicken and tofu dregs

Treatment Code	Test			Average (%)
	1	2	3	
P1	2.88	2.96	2.59	2.81 [a]
P2	3.53	3.49	3.66	3.56 [b]
P3	4.01	4.29	4.24	4.18 [c]
P4	4.50	4.87	4.73	4.70 [d]
KK = 4.23% (BNT ≤ 5%)				

Table 3 shows that the average crude fiber content of corned chicken with varying proportions of chicken meat and tofu dregs flour ranged from 2.81% to 4.70%, with the highest value at P4 (4.70%) and the lowest at P1 (2.81%). The ANOVA results showed a very significant effect between treatments, so the BNT test was continued (KK = 4.23%), where differences in letter notation indicate that each treatment is statistically different.

Fiber content increases with increasing tofu dregs flour concentration and decreasing chicken meat proportion. P4 with the highest tofu dregs flour yields the highest fiber content, while P1 has the lowest, indicating that tofu dregs flour is the primary source of fiber because chicken meat contains almost no fiber. The high fiber content of tofu dregs, which remains after soybean processing, leads to an increase in fiber in the final product (Fajariyanti & Oktafa, 2022). Therefore, the higher the tofu dregs flour content, the fiber content of corned chicken tends to increase significantly.

2. Organoleptic Test

Organoleptic testing is a crucial step in this research because it directly impacts consumer acceptance of corned chicken products formulated with tofu dregs flour. Organoleptic testing is conducted to assess the corned beef's sensory characteristics, including color, flavor, and aroma, which collectively reflect the product's quality from the panelists' perspective. This assessment complements chemical quality testing, as a product with good nutritional content may not be acceptable to consumers if its sensory characteristics do not meet their preferences.

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Color

Color is an initial organoleptic attribute that plays a crucial role in shaping panelists' impressions and interest in corned beef. Variations in the proportions of chicken meat and tofu dregs flour are thought to influence the product's color characteristics, both in terms of brightness and uniformity. The addition of tofu dregs flour can cause color changes due to natural pigments and reactions during the cooking process, potentially affecting panelists' acceptance of the resulting chicken corned beef.

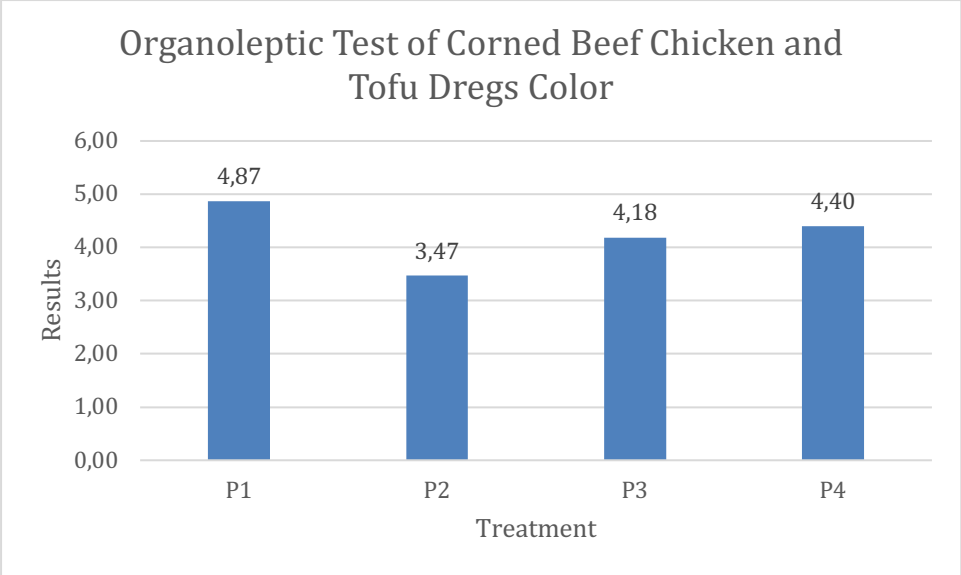

Figure 1. Histogram of Organoleptic Color Test

Figure 1 shows the differences in panelists' preference for the color of corned beef with the addition of tofu dregs flour. Treatment P1 obtained the highest score (4.87; very liked), followed by P4 (4.40) and P3 (4.18) which are in the like category, while P2 received the lowest score (3.47). Panelists tended to prefer the bright, even, and not too dark color of corned beef as in P1, while P2 was considered less attractive because it was suspected to be paler due to the tofu dregs flour composition. Color is an initial sensory attribute that influences product acceptance before tasting. These results are in line with Winarno's (2004) opinion that color plays an important role in the perception of quality and assessment of food quality, and that the addition of fibrous vegetable ingredients can change the final color of the product. Thus, P1 was the best treatment for producing the corned beef color that was most preferred by panelists, while P2 had the lowest acceptance level.

Flavor

Flavor is an organoleptic attribute that significantly determines consumer acceptance of corned chicken with the addition of tofu dregs flour. Variations in the proportions of chicken meat and tofu dregs flour affect the product's deliciousness, crunchiness, and flavor balance. Chicken meat primarily contributes to flavor, while tofu dregs flour influences flavor characteristics through its protein and fiber content. This discussion of flavor focuses on evaluating the relationship between ingredient formulation and panelists' preference for the resulting corned beef.

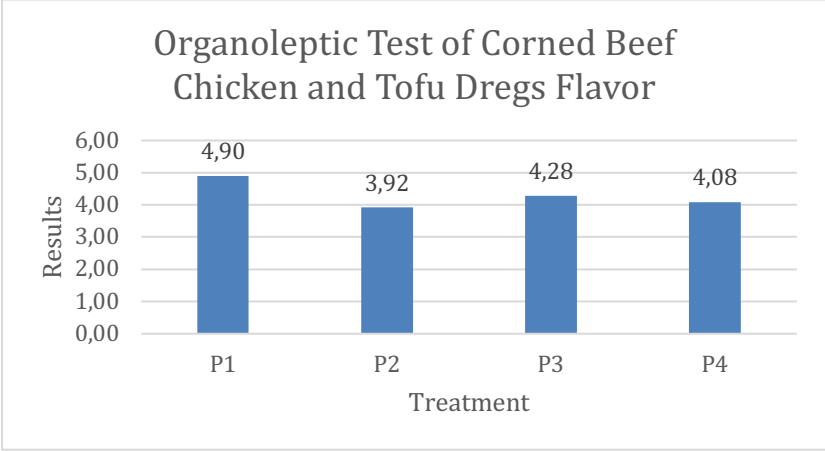

Figure 2. Histogram of Organoleptic Taste Test

Figure 2 shows the differences in panelists' preference for the taste of corned beef with the addition of tofu dregs flour. Treatment P1 received the highest score (4.90; very liked), followed by P3 (4.28) and P4 (4.08; liked), while P2 received the lowest score (3.92; quite liked). Panelists tended to prefer corned beef with a balanced savory taste, where the proportion of chicken meat and tofu dregs flour in P1 was considered the most optimal, resulting in a distinctive corned beef flavor without a rancid aftertaste. Conversely, P2 was less favored because the imbalance

in the composition of the ingredients made the chicken flavor less dominant. These results are in line with Winarno (2004) who stated that flavor is influenced by the combination of main and additional ingredients as well as the processing process, and the proportion of vegetable ingredients must be adjusted so as not to reduce flavor intensity. Thus, P1 was the best treatment for producing the taste of corned beef with tofu dregs that was most preferred by panelists, while P2 had the lowest acceptance level.

Aroma

Aroma is an important sensory attribute that influences the appeal and taste of chicken corned beef. Variations in the proportions of chicken meat and tofu dregs flour are thought to influence aroma because each ingredient has a distinct aroma character and undergoes changes during cooking. The distinctive aroma of chicken meat interacts with the aroma of tofu dregs flour, forming a specific aroma profile that influences panelist acceptance. The discussion of aroma focuses on the effect of treatment variations on corned beef aroma and panelist preference.

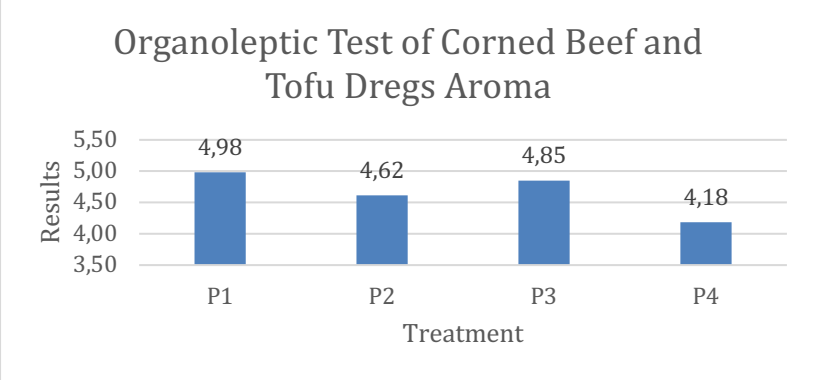

Figure 3. Histogram of Aroma Organoleptic Test

Figure 3 shows the differences in panelists' preference for the aroma of corned beef with the addition of tofu dregs flour. Treatment P1 obtained the highest score (4.98; very like), followed by P3 (4.85; very like) and P2 (4.62; like), while P4 received the lowest score (4.18; like). Panelists tended to prefer the distinctive aroma of savory, non-offensive chicken meat, where in P1 the meat aroma was more dominant and not overshadowed by the tofu dregs flour. Conversely, in P4, increasing the proportion of tofu dregs flour caused a more pronounced vegetable aroma, thus decreasing acceptance. These results are in line with Winarno (2004), who stated that the aroma of food products is formed through chemical reactions during cooking, such as the Maillard reaction and fat degradation, and is influenced by the proportion of raw materials. Thus, P1 was the best treatment for the aroma of corned beef with tofu dregs, while P4 had the lowest aroma acceptance, confirming that the balance of chicken meat and tofu dregs flour is crucial for aroma quality and consumer acceptance.

3. Determination of Best Treatment (Effectiveness Test)

An effectiveness test was conducted to determine the best treatment based on the results of chemical and organoleptic quality tests of corned chicken with the addition of tofu dregs flour. This test aimed to evaluate the extent to which each treatment was able to produce a product that not only had good nutritional quality but also a high level of acceptance by panelists. By integrating all tested parameters, the effectiveness test became a crucial step in determining the most optimal corned beef formulation and one that was feasible for development.

Table 4. Effectiveness Test Results

Parameter	Treatment Result Value			
	P1	P2	P3	P4
K. Protein	0.18	0.18	0.18	0.18
K. Fat	0.00	0.02	0.05	0.16
K. Fiber	0.01	0.00	0.00	0.05
Color	0.05	0.00	0.00	0.02
Flavor	0.06	0.02	0.00	0.00
Aroma	0.05	0.04	0.02	0.01
Total	0.35	0.26	0.26	**0.42***

The effectiveness test results showed that each treatment had a different total value as an accumulation of all chemical and organoleptic quality parameters. Treatment P4 obtained the highest yield value (NH) of 0.42 and

was determined as the best treatment, while P1, P2, and P3 each had NH of 0.35; 0.26; and 0.26, respectively. In chemical quality, all treatments had a uniform protein contribution (0.18), while differences were seen in fat and fiber content, where P4 had the highest values of 0.16 and 0.05, respectively, indicating that increasing the proportion of tofu dregs flour affected the chemical composition of corned beef, especially fiber content. For organoleptic parameters, P1 obtained the highest values for color (0.05), taste (0.06), and aroma (0.05), reflecting good panelist acceptance of the formulation with a higher proportion of chicken meat. Despite its relatively lower organoleptic value, P4 still had the highest total value due to the large contribution from fat and fiber content. With NH of 0.42, P4 has a protein content of 6.22%, fat content of 6.27%, fiber content of 4.70%, color of 4.4 (like), taste of 4 (like), and aroma of 4.18 (like), so it can be recommended as the best formulation for corned chicken based on tofu dregs flour, especially in increasing nutritional value through fiber content, although the level of sensory acceptance is lower than treatments with a higher proportion of meat.

CONCLUSION

Based on research on the variation of the proportion of chicken meat (*Gallus domesticus*) and tofu dregs flour on the chemical and organoleptic quality of corned beef, it can be concluded that the variation of the proportion has a very significant effect on the levels of protein, fat, and crude fiber, and has a significant effect on color, taste, and aroma. The best formulation was obtained in treatment P4 with the highest yield value (NH) of 0.42%, which resulted in a protein content of 6.22%, a fat content of 6.27%, a fiber content of 4.70%, and an organoleptic score of 4.4 color, 4.0 taste, and 4.18 aroma, so this combination is recommended for corned chicken based on tofu dregs flour.

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