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Broth Characteristics of Broiler Chicken, Free-Range Chicken, and IPB D1 Chicken

Karakteristik Kaldu Ayam Broiler, Ayam Kampung dan Ayam IPB D1

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ABSTRACT

Broth is a product made from beef or poultry by cooking ingredients rich in protein and water, with or without the addition of spices, vegetable fat and sodium chloride. This study aims to determine the physicochemical properties including crude protein, ash, fat, carbohydrates, water activity, and pH as well as organoleptic tests of three types of broth from different chicken meat, namely broiler, free-range chicken, and IPB-D1 chicken. An organoleptic test was performed using quantitative descriptive analysis (QDA). The results showed that the different types of chicken strains did not significantly affect the value of water content, ash content, protein content, pH value and viscosity. The descriptive quantitative analysis (QDA) test followed by the ANOVA test showed that the difference in the types of chicken strains has no significant effect on the sensory attributes of chicken taste, salty taste, tastelessness, bitter aftertaste, and carnation aftertaste. Chicken broth made from native chicken gave the best characteristic results for the analysis of physicochemical and organoleptic properties.

Keywords: broiler, broth, free-range chicken, IPB-D1 chicken

ABSTRACT

Kaldu adalah produk yang dihasilkan dari daging sapi atau unggas dengan memasak bahan yang kaya protein dan air, dengan atau tanpa penambahan bumbu, lemak nabati dan natrium klorida. Penelitian ini bertujuan untuk mengetahui sifat fisikokimia meliputi protein kasar, abu, lemak, karbohidrat, aktivitas air dan pH serta uji organoleptik tiga jenis kaldu dari daging ayam yang berbeda yaitu daging ayam pedaging, ayam kampung, dan ayam IPB-D1. Uji organoleptik dilakukan menggunakan uji kuantitatif deskriptif analisis (QDA). Hasil penelitian menunjukkan bahwa perbedaan jenis galur ayam tidak berpengaruh nyata terhadap nilai kadar air, kadar abu, kadar protein, nilai pH dan viskositas. Uji kuantitatif deskriptif analisis (QDA) menunjukkan bahwa perbedaan perbedaan jenis galur ayam tidak berpengaruh nyata terhadap atribut sensori rasa ayam, rasa asin, hambar, *aftertaste* pahit, dan *aftertaste* anyir. Kaldu ayam yang terbuat dari ayam kampung memberikan hasil karakteristik terbaik untuk analisis sifat fisikokimia dan organoleptik.

Kata kunci: ayam IPB-D1, ayam kampung, ayam pedaging, kaldu

INTRODUCTION

The broth is a product made from cattle or chicken by heating protein-rich foods with water, with or without seasonings, edible fat, sodium chloride, and spices to improve flavor (BSN 1996). Broth, according to Permata *et al.* (2019), is a form of taste that is added to everyday processed foods. The flavor is essential for food ingredients since it improves the scent and flavor of the food.

Broiler chicken is a type of chicken grown to suit the needs of animal protein.Broiler chickens are currently an affordable source of protein for the general people. According to a report by the Central Bureau of Statistics in 2021, the average consumption of chicken meat in Indonesia will reach 0.14 kilograms (kg) per capita per week (BPS 2022). Currently, the price is IDR 38,148.00 – 45,000 / head in Jakarta (Jakarta food info, 2022). Broiler chicken breast protein content is 20.6 g / 100 g, while broiler chicken thighs are 16.8 g / 100 g (Sariano Santos, 2010).

According to Mansjoer (1985), free-range chickens have the closest genetic distance to the red jungle fowl, namely the Sumatran red jungle fowl (Gallus gallus gallus) and the Javanese red jungle fowl (*Gallus gallus* javanic). *Gallus Gallus* Domesticus Free-range chicken has advantages when compared to broiler chickens, such as the texture and taste of local chicken meat which have their characteristics and advantages (Nursal 2017). According to Sartika (2016) generally, free-range chickens can be harvested at around 70 days of age or around 2.5-3 months.

IPB-D1 chicken is a cross between Pelung, Sentul, Free-range, and broiler chickens with fast growth. IPB-D1 chickens have been studied for 6 generations and IPB-D1 G5 chickens aged 12 weeks have achieved a slaughter weight of 1-1.2 kg with better results than their parents' pelung, Sentul, and free-range chickens (Pangestu 2018). The IPB-D1 chicken is a new family of composite local chickens which has been officially released by the Indonesian Ministry of Agriculture based on Decree No.693/KPTS/PK.230/M/9/2019. IPB-D1 chickens were formed through a crossbreeding program between F1 PS males (Pelung×Sentul) and F1 KM females (Free-range×parent stock Cobb) (Sumantri and Darwati 2017).

Research on chicken broth from three types of chicken is expected to provide basic knowledge related to the organoleptic quality criteria of the broth. So that later it can be developed broth from more chicken strains. This study aims to analyze the physicochemical and organoleptic properties of chicken broth produced from IPB-D1 chickens, free-range chickens, and commercial broilers.

MATERIALS AND METHODS

This was an observational study with a completely randomized design (CRD) that included three chicken treatments: broiler chickens (P1) with a harvest age of 5 weeks and a carcass weight of 1.5 kg, free-range chickens (P2) with a harvest age of 5 months and a carcass weight of 1 kg, and chicken IPB D-1 (P3) with a harvest age of 10 months and a carcass weight of 1.8 kg.

Procedure in brothproduction

Prepare 1 kilogram of broiler chickens, free-range chickens, and IPB D-1 chickens (after cleaning and chopping) in 4 L of boiling water. After boiling, each broth solution is filtered and immediately placed in a sterile closed jerrycan, and allowed to cool.

Analysis Procedure

Physicochemical Analysis

Water content, ash content, fat content, protein content, carbohydrate content, pH (AOAC 2005), and viscosity were all measured in the physicochemical analysis of the chicken broth.

Organoleptic Analysis

To evaluate organoleptic quality, the quantitative descriptive analysis (QDA) method was employed, which comprised color, scent, taste, and overall tests. The panelist preparation stage, group discussion forum (FGD), and quantitative descriptive test/scoring test are all part of the QDA stage. The QDA test panelists were trained panelists ranging in age from 6 to 18 who were vetted via the selection stage utilizing the duo trio test. The sensory attribute assessment by the product panelists is done on a scale of 1 to 5, with 1 = very weak, 2 = weak, 3 = between weak and strong, 4 = strong, and 5 = very strong (Dearozhasma 2021).

RESULTS AND DISCUSSION

Physicochemical Characteristics of Chicken Broth from Various Chicken Strains

Table 1 shows the results of physicochemical testing on chicken broth from various chicken strains.

Water content

The water content obtained from each treatment was 97.34% for (P1), 91.38% for (P2), and 89.18% for (P3). The results of the one-way ANOVA test showed that there was no significant difference (P>0.05) between the treatments. These results are lower than the research by Jun Qi *et al.* (2022) that the water content of chicken broth ranges from 98.78% -99.06%. According to Hasanah (2019), the water content of chicken meat ranges from 65% -75%.

Ash Content

The one-way ANOVA test results revealed that there was no significant difference (P>0.05) between the treatments. The ash level of chicken broth ranges from 0.23% to 0.33%, according to Jun Qi *et al.* (2022). The ash level of chicken meat ranges between 1.62-1.72, according

Table 1. Physicochemistry of chicken broth and various chicken strains

Variable	Treatment		
	P1	P2	P3
Water Content	97.34±1.47	91.38±4.72	89.18±9.51
Ash Content	0.10±0.005	0.10±0.022	0.08±0.022
Fat Content	0.33±0.043a	0.57±0.193ab	0.69±0.063b
Protein Content	0.57±0.067	0.50±0.173	0.55±0.244
pH Value	6.52±0.117	6.63±0.047	6.14±0.588
Viscosity	0.37±0.026	0.39±0a	0.38±0.015

*Different superscripts in the same column/row show a significant difference (P<0.05). The treatment used is a different strain of chicken, Pl: Broiler chicken, P2: Kampung chicken, P3: IPB-DI chicken.

to Rukmini *et al*. (2019). The ash content of chicken broth was found to be lower than that of fresh chicken meat. This is because not all of the mineral and vitamin content in chicken meat dissolves entirely in the broth. The difference in texture between broth and fresh chicken influences the ash concentration as well; fresh chicken has a denser texture than broth, so the ash content is higher.

Fat level

The one-way ANOVA test results revealed that there were significant differences (P<0.05) between treatments. P2 differs greatly from P1 and P3, which is a free-range chicken broth sample. According to Dewi (2013), the fat content of meat is influenced by factors such as country, muscle location, muscle type, sex, and age of animals. The percentage of fat in the body grows with age, although it can fluctuate at any time based on the foods consumed. These findings are consistent with BSN (1996), which states that the quality criteria for broth fat content are at least 0.3%.The fat percentage of the broth in this study ranged from 0.33% to 0.69%, which was reported to meet the standards for the fat content of the broth. P3 fat content is higher because P3 hens are older in breed and age than P1 and P2. According to the Ministry of Health of the Republic of Indonesia (2010), fresh chicken meat has a fat content of 25% per 100 grams.

Protein Content

The protein content of the broth obtained from each treatment was 0.57% for (P1), 0.50% for (P2), and 0.55% for (P3). The one-way ANOVA test results revealed that there was no significant difference (P>0.05) between the treatments. These results meet the quality parameters established by BSN (1996) for broth protein content of at least 0.6%. This is due to the age of the chicken, the lines utilized, and the less-than-ideal procedure of preparing the chicken broth.

pH

The one-way ANOVA test results revealed that there was no significant difference (P>0.05) between the treatments. These findings are consistent with BSN's (1996) observation that the pH of the broth ranges from 4.6 to 6.5. The pH of the broth in this investigation ranged from 6.14 to 6.63, which was considered normal. According to Hasanah (2019), the pH of chicken meat ranges between 5.7 and 5.9. According to the findings of this study, the pH level of chicken broth is greater than that of raw chicken meat. This is because the chicken meat is processed into a more concentrated broth, which raises the pH value.

Viscosity

The one-way ANOVA test results revealed that there was no significant difference (P>0.05) between the treatments. This finding is lower than that of Chi and Chen (1993), who found that the viscosity of chicken broth at 25-35˚C is 8.0-6.65 cp or 0.8-0.665 dPa. The variation in viscosity results was attributable to the study's technique of preparing broth, which differed from Chi and Chen's research (1993). In this study, the broth was made by boiling chicken carcass with a ratio of 1:4 B/B at a temperature of ±60˚ C, whereas Chi and Chen (1993) used a ratio of 1:3 B/B chicken carcass with boiling water in a closed container.

Organoleptic Characteristics of Chicken Broth from Various Chicken Strains

The QDA test panelists were trained panelists of around ten persons who were vetted via the selection stage utilizing the duo-trio test. The second stage of the QDA test in this study is forum group discussion (FDG), which is used to assess the sensory qualities of chicken broth from distinct chicken breeds. Based on the observations and consensus of all panelists, there were 13 sensory attributes owned by all treatments, namely yellowness, fat deposits, rancid aroma, chicken broth aroma, thickness, savory taste, salty taste, chicken taste, bland, fat taste, oily, bitter, and carnation, which consisted of the quality criteria for color/appearance, aroma, texture, taste/flavor, mouthfeel, and aftertaste (P1, P2, and P3).

The QDA organoleptic exam concludes with a quantitative descriptive test or scoring test. This step takes the sensory qualities agreed upon by the panelists and moderators in the FGD stage and assesses the intensity using the trained panelists' five senses. The outcomes were then tested again and incorporated into a spider web diagram.

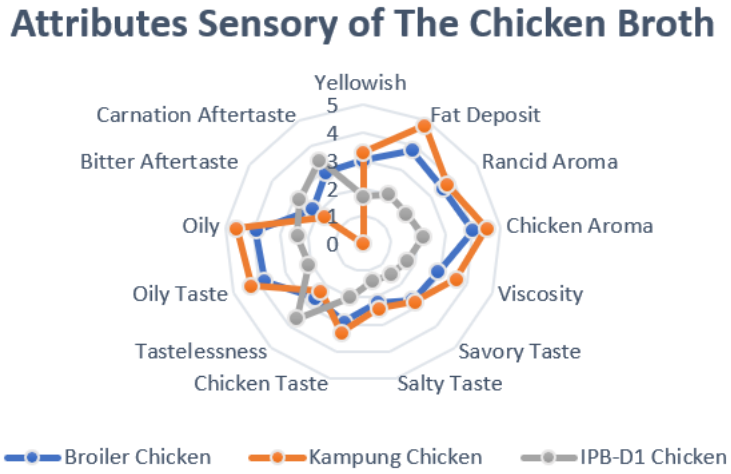

Figure 1. Profile attributes sensory of various chicken broth

Variance from sensory qualities that may be compared across treatments revealed that 8 out of 13 sensory tests were substantially different (P<0.05), including yellowness, fat deposits, rancid fragrance, chicken broth aroma, thickness, savory flavor, fat taste, and oily mouthfeel. Figure 1 shows the sensory characteristics of all parts.

Yellowish

Chicken stock has a distinctive yellowish color. This yellowish color is caused by melted fat and lumps from the chicken's boiling procedure. In each treatment, the intensity of the yellowish color of chicken broth was 3 for (P1), 3.3 for (P2), and 1.7 for (P3) (Table 2). There was a significant difference between treatments (P<0.05). P3 differs from P1 and P2, which are samples from IPB D-1 hens with a lesser yellowish color. This is because the fat deposits in P3 are lower than in P1 and P2, causing the broth to be yellowish.

Table 2. Test results for the various attributes sensory of the chicken broth

Quality Criteria	Sensory Attributes	Treatment		
		P1	P2	P3
Color	Yellowish	3.0±1.247a	3.3±1.116a	1.7±0.675b
	Fat Deposit	3.8±0.422a	4.8±0.422b	2.0±1.054c
Aroma	Rancid Aroma	4.8±0.422b	3.7±1.252a	1.9±0.994b
	Chicken Aroma	2.0±1.054c	4.5±0.850a	2.2±0.919b
Texture	Viscosity	3.5±0.972a	3.6±1.075a	1.7±1.252b
Taste	Savory Taste	4.0±0.943a	2.8±1.317ab	1.5±0.972b
	Salty Taste	4.5±0.850a	2.4±1.350	1.4±0.516
	Chicken Taste	2.2±0.919b	3.3±1.494	2.0±0.667
	Tastelessness	2.9±0.876a	2.3±0.949	3.6±1.578
	Oily Taste	2.7±1.160a	4.3±0.823a	2.1±1.197b
Mouthfeel	Oily	2.2±0.789	4.6±0.516a	2.4±1.265b
Aftertaste	Bitter Aftertaste	2.9±1.449	1.7±0.949	2.8±1.751
	Carnation Aftertaste	2.6±1.174	3.4±1.350	3.4±1.430

*Different superscripts in the same column/row show a significant difference (P<0.05). The treatment used is a different strain of chicken, Pl: Broiler chicken, P2: Kampung chicken, P3: IPB-DI chicken. Quality Criteria Scale: 1=very weak, 2=weak, 3=mid, 4=strong, dan 5=very strong.

Fat Deposits

Chicken broth has yellowish fat deposits on the surface. The intensity of fat deposition in each treatment was 3.8 for (P1), 4.8 for (P2), and 2 for (P3) (Table 2). There was a significant difference (P<0.05) between treatments. P1, P2, and P3 differ from each other where P2 has more fatty deposits than P1 and P3.

Rancid aroma

Broth's rancid aroma is created by lipid oxidation, which happens in foods high in unsaturated fatty acids, such as vegetable oils and meat. This reaction produces a chemical with an off-flavor scent and taste (Dearoshazma 2021). The varied rancid aromas are induced by the variable unsaturated fatty acid concentration in each treatment. The high level of unsaturated fatty acids will facilitate the formation of volatile components as a result of lipid decomposition, therefore the higher the fatty acid content, the stronger the scent (Lestari *et al*. 2015). The age and sex of the fowl might also affect the off-flavor of the meat. This is associated with differences in metabolic control, differences in sex hormones, and differences in puberty (Lestari *et al*. 2015). The intensity of the rancid aroma in each treatment was 3.5 for (P1), 3.7 for (P2), and 1.9 for (P3). There was a significant difference (P<0.05) between treatments, and P3 was significantly different between P1 and P2, which was a sample of broth made from IPB-D1 chickens. The rancid aroma of sample P3 is weaker than P1 and P2 because the content of unsaturated fatty acids in P3 is less than that of P1 and P2.

Chicken aroma

The main compound that affects the aroma of chicken is 2-methyl-3-furanthiol which is obtained from the Maillard reaction and lipid oxidation in chicken meat (Jayasena *et al.* 2013). In addition, the distinctive aroma of chicken is produced from the volatile content of unsaturated aldehydes which comes from polyunsaturated fats in the muscles (Dearoshazma 2021). The intensity of chicken aroma in each treatment was 3.5 for (P1), 3.7 for (P2), and 1.9 for (P3). There was a significant difference (P<0.05) between treatments. The chicken aroma produced by the P3 sample is weaker than P1 and P2. This is because the fat contained in P3 is less than P1 and P2.

Viscosity

The intensity of viscosity in each treatment was 3.6 for (P1), 2.9 for (P2), and 1.7 for (P3). There was a significant difference (P<0.05) between treatments, and P3 was significantly different between P1 and P2, which was a sample of broth made from IPB-D1 chickens. This shows that the thickness of the IPB-D1 chicken broth is more liquid compared to broiler and free-range chicken broth. The content of fat deposits also affects the thickness, the more fat deposits, the thicker the broth.

Savory taste

The inclusion of food components high in protein (HVP and SM), fat (CkF, PO, and MF), and salt can evoke a savory taste (Nadia *et al*. 2004). The savory flavor intensity in each treatment was 2.7 for (P1), 2.8 for (P2), and 1.5 for (P3) (P3). There was a significant difference (P>0.05) between treatments, with P2 being significantly different from P1 and P3, which were free-range chicken broth samples. P2 has a greater savory flavor than P1 and P3. This demonstrates that species has an impact on the delicious flavor of chicken broth.

Salty Favor

The salty flavor of chicken broth is created by sodium dissolved in the chicken carcass during boiling (Dearoshazma 2021). The salty taste intensity in each treatment was 2.4 for (P1), 2.2 for (P2), and 1.4 for (P3) (P3). There was no significant change between treatments (P>0.05). Because no other components are added during the process of creating chicken broth, the salty flavor resulting from this research is not overpowering.

Chicken Flavor

The main compound that affects the aroma of chicken is 2-methyl-3-furanthiol which is obtained from the Maillard reaction and oxidation of lipids in chicken meat (Jayasena *et al.* 2013). The intensity of chicken taste in each treatment was 2.9 for (P1), 3, 3 for (P2), and 2 for (P3). There was no significant difference (P>0.05) between treatments.

Tasteless

In each treatment, the intensity of the bland taste was 2.6 for (P1), 2.3 for (P2), and 3.6 for (P3) (P3). There was no significant change between treatments (P>0.05). This bland flavor is created by the fact that nothing is added to the chicken broth, so there is no very strong flavor attribute.

Fat Taste

The intensity of the taste of fat in each treatment was 3.8 for (P1), 4.3 for (P2), and 2.1 for (P3). There was a significant difference (P<0.05) between treatments, P3 was significantly different from P1 and P2, which were samples of broth made from IPB D-1 chickens. The taste of fat produced by P2 is stronger than P1 and P3.

Greasy Mouthfeel

Mouthfeel is a term often used to describe the tactile aspect of the texture of food and drink when it is in the mouth. The intensity of oily mouthfeel in each treatment was 3.9 for (P1), 4.6 for (P2), and 2.4 for (P3). There was a significant difference (P<0.05) between the treatments, P3 was significantly different from P1 and P2 in the broth samples made from IPB D-1 chickens. Sample P2 has a stronger oily mouthfeel than P1 and P3.

Bitter Aftertaste

The bitter aftertaste strength in each treatment was 2.2 for (P1), 1.7 for (P2), and 2.8 for (P3) (P3). There was no significant change between treatments (P>0.05). The amino acids isoleucine, leucine, phenylalanine, and threonine, according to Lin *et al.* (2016), contribute to the bitter flavor of the product.

Rancid aftertaste

The chicken flavor that results from the high temperature and pressure cooking process is quite intense and rancid. The rancidity of the chicken did not instantly dissipate in the panelists' mouths, resulting in a rotten aftertaste. In each treatment, the intensity of the rotten aftertaste was 2.9. (P1). 3.4 for (P2) and 3.4 for (P3) (P3). There was no significant change between treatments (P>0.05).

CONCLUSION

Chicken broth made from different chicken strains, notably P1 broiler chicken, P2 free-range chicken, and P3 IPB D-1 chicken, differs in both physicochemical and organoleptic qualities. The fat level of IPB D-1 chicken broth is higher than that of broiler and free-range chicken broth. The results revealed that free-range chicken broth was the finest broth because it had higher sensory qualities when compared to broth made from broiler chickens and IPB D-1 chickens.

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