Meat Quality Characteristics of IPB-D1 Chicken and the Final Stock from Different Locations

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ABSTRAK

Adelta KB, Arief II, Sumantri C, Wulandari Z. 2023. Karakteristik kualitas daging ayam IPB-D1 dan final stock-nya dari lokasi yang berbeda. JITV 28(3):197-207. DOI:http://dx.doi.org/10.14334/jitv.v28.i3.3121.

Peningkatan permintaan protein hewani mendorong pengembangan inovasi jenis atau bangsa baru ternak. Ayam IPB-D1 merupakan ayam lokal hasil seleksi yang menghasilkan peningkatan produktivitasnya. Pemeliharaan ayam IPB D1 dilakukan di Kabupaten Sukabumi dan Kabupaten Bekasi. Pengujian kualitas fisik, kimia dan mikrobiologi daging ayam IPB-D1 dilakukan di Laboratorium IPTP Terpadu dan Laboratorium Mikrobiologi Hasil Ternak, sementara pengujian organoleptik dilakukan di Ruang Organoleptik, Fakultas Peternakan, IPB University. Penelitian dilaksanakan pada Februari sampai Juni 2022. Ruang lingkup penelitian ini mencakup pemeliharaan ayam yang dilaksanakan pada dua lokasi berbeda dan pengambilan sampel yang bertujuan untuk pengujian kualitas fisik, kimia, mikrobiologi dan organoleptik. Ayam yang di ujikan adalah ayam IPB-D1 Sukabumi, ayam IPB-D1 Bekasi, ayam IPB-D1 *final stock* Sukabumi, ayam IPB-D1 *final stock* Bekasi dan ayam Kampung, Sentul, dan broiler yang terdiri dari 15 ekor masing-masing. Pada tiap lokasi tersebut pengambilan sampel dilakukan sebanyak 10 kali sebagai ulangan. Teknik pengambilan sampel yang digunakan adalah simple random sampling. Hasil penelitian menunjukkan kualitas daging ayam IPB-D1 dan final stocknya menunjukkan hasil tidak berbeda nyata ($P>0.05$) pada aspek kualitas fisik daging yang berupa pH dan Daya Mengikat Air (DMA) tetapi memiliki pengaruh yang signifikan ($P<0.05$) pada parameter susut masak dan keempukan apabila dibandingkan dengan ayam Kampung, Sentul dan broiler. Sementara itu, kualitas kimia daging ayam IPB-D1 dan final stocknya menunjukkan hasil yang berbeda signifikan ($P<0.05$) pada kandungan lemak daging. Adapun untuk parameter kadar abu, protein, mineral dan kolesterol menunjukkan hasil yang tidak berbeda signifikan ($P>0.05$). Analisis kualitas mikrobiologi berupa total koloni bakteri (total plate count) daging ayam IPB-D1 dan Final Stocknya yakni sebesar 105 CFU/g. Hasil tersebut masih dalam Batas Maksimum Cemaran Mikroba yang ditetapkan oleh Badan Standarisasi Nasional Indonesia tahun 2009. Berdasarkan hasil penelitian ini, perlu dilakukan perbaikan cara penanganan, pengemasan yang higienis hingga sanitasi agar kualitas daging ayam dapat ditingkatkan, dan cemaran mikroba dapat diminimalkan.

Kata Kunci: karakteristik, daging ayam, final stock, IPB-D1, mikrobiologi, organoleptik

ABSTRACT

Adelta KB, Arief II, Sumantri C, Wulandari Z. 2023. Meat quality characteristics of IPB-D1 chicken and the final stock from different locations. JITV 28(3):197-207. DOI:http://dx.doi.org/10.14334/jitv.v28.i3.3121.

The increasing demand for animal protein encourages innovations development of new livestock types or breeds. IPB-D1 chicken is an improved local chicken for their productivity. Its rearing was carried out in Sukabumi and Bekasi Regency. Physical, chemical, and microbiological quality testing of IPB-D1 chicken meat was carried out at the Integrated IPTP Laboratory and the Microbiology Laboratory of Livestock Products, and organoleptic testing was carried out in the Organoleptic Room, both of the Faculty of Animal Husbandry, IPB University. The research was carried out from February to June 2022. The scope of this research includes chicken rearing at two locations and sampling that aims to test the physical, chemical, microbiological, and organoleptic quality. The chickens tested were the IPB-D1 Sukabumi chicken, IPB-D1 Bekasi chicken, IPB-D1 final stock Sukabumi chicken, IPB-D1 Bekasi final stock chicken, and Kampong, Sentul, and broiler chickens, which consist of 15 chickens each. At each location, sampling was carried out 10 times as a replication. The sampling technique used is simple random sampling. The results showed that the quality of IPB-D1 chicken meat and its Final Stock did not have a significant difference ($P>0.05$) in physical quality aspects such as pH and water holding capacity (WHC) but had a significant difference ($P<0.05$) in cooking loss and tenderness than Kampong, Sentul, and broilers. Meanwhile, the chemical quality of IPB-D1 broilers and their final stock showed significantly different results ($P<0.05$) in the fat content of the meat. As for the parameters of ash content, protein, minerals, and cholesterol showed no significant difference ($P>0.05$). Microbiological quality analysis in the form of total bacterial colonies (total plate count) of IPB-D1 broilers and its Final Stock was 105 CFU/g. These results are still within the Maximum Microbial Contamination Limits set by the Indonesian National Standardization Agency in 2009. Based on the results of this study, it is necessary to improve handling methods, hygienic packaging, and sanitation so that the quality of broilers can be improved and microbial contamination can be minimized.

Key Words: Characteristics, Chicken Meat, Final Stock, IPB-D1, Microbiology, Organoleptic

INTRODUCTION

The increasing public demand for animal protein encourages the birth of various innovations related to the development of new breeds and types of livestock that can grow with high productivity and a relatively fast time. The consumption of chicken meat in Indonesia increases every year. The average amount of chicken meat consumed per capita daily in Indonesia in 2021 is 0.02 kg (BPS 2022). One of the livestock commodities that are in great demand by the community is local chicken. Local chicken has a distinctive taste, but its productivity is lower than broilers (Mahmud et al. 2017). Various efforts continue to be made to increase the productivity of local chickens, namely by conducting various research and development. One of the results is IPB-D1 Chicken.

The chickens of IPB-D1 have been officially announced by the Indonesian Ministry of Agriculture based on Decree No.693/KPTS/PK.230/M/9/2019 as a new family of composite local chickens. Currently, various studies through the application of molecular genetics are widely used by experts to increase the productivity and quality of local Indonesian chickens. Based on Sumantri & Darwati (2017), the chickens of IPB-D1 are the result of crosses between Pelung chicken, Sentul chicken, Kampong chicken, and broilers. The superiority of the IPB-D1 chicken is because, genetically, it is a chicken composite with varying gene diversity from each parent Sumantri & Darwati (2017). The slaughter weight of IPB-D1 chickens reached 1.2−1.7 kg at the age of 12 weeks Sumantri and Darwati (2017). Sumantri & Darwati (2017) reported that IPB-D1 chickens had similar body weight performance characteristics at the age of 10-12 weeks of slaughter, body weight at 12 weeks of age in hens ranged from 1.04±119.24 grams, and as for roosters about 1.18±203.4 gr. Sumantri & Darwati (2017) added that IPB-D1 chickens are adaptable and can develop well despite being in a Tetelo endemic area. IPB-D1 chickens can be further developed to produce higher productivity with faster growth.

IPB-D1 chickens have been developed in various rearing sites with different conditions and rearing management; this allows for differences in the quality of the resulting chicken meat. The chickens of IPB-D1 have the character of having more remarkable body weight growth than Kampong chickens and are more resistant to disease than purebred chickens (Susanti et al. 2020). Many things, including public perception, influence the success of innovation in being accepted and developed in society. Perception can play one of the important roles in determining an innovation, in this case, the IPB-D1 chicken, so that the wider community can accept it. It can continue to be developed to the industrial stage. One of the things that can be done to shape public perception is by conducting further research on IPB-D1 chickens, especially regarding the physical and chemical quality of meat, microbiological, and consumer acceptance. The meat quality in question includes physical, chemical, and biological qualities as well as organoleptic. Therefore, further research is needed to determine the physical, chemical, and organoleptic qualities of IPB-D1 chickens from various locations and rearing management systems.

MATERIALS AND METHODS

Location

The maintenance of IPB-D1 chickens is carried out by partners of the Faculty of Animal Husbandry of IPB intensively with unique methods of rearing located in Sukabumi Regency (CV Sinar Harapan Farm) and Bekasi Regency (CV Citra Lestari Farm). Tests for the physical and chemical quality of meat and microbiology are carried out at the Integrated Laboratory of the Faculty of Animal Husbandry IPB, Laboratory of Animal Husbandry Microbiology, Faculty of Animal Husbandry IPB, and Inter-University Center Laboratory of IPB. Organoleptic testing was conducted in the Organoleptic Laboratory of the Faculty of Animal Science IPB.

Materials

The tools used for physical analysis are a pH meter's meat, aw meter, chromameter, biuret, measuring flask, pipette, beaker, and Erlenmeyer flask. This study also used a freezer (-18°C), Petri dishes, hot plate stirrer, test tubes, Erlenmeyer tubes, digital scales, measuring cups, volumetric pipettes, micropipettes, Pasteur pipettes, Bunsen heaters, aluminum foil, plastic wrap, tips, sealer, caliper, incubator, refrigerator, autoclave, oven, vortex, sprayer, paper disc, and burette. This study used chicken breast, which was taken by sampling from 3 locations. The final stock chicken comes from Bekasi. The chickens of IPB-D1 came from Sukabumi and Bekasi. The Sentul, Kampong, and Broiler chicken was purchased from Sukabumi and Bogor, each with 15 chickens for comparison study. At each location, sampling was carried out 9 times as replication. The sampling taken using the technique is simple random sampling. Samples were taken in the morning to prevent increased contamination in the open area. Furthermore, the meat samples were put into sterile plastic, labeled per each sample with a different location, and put in a coolbox, then brought to the laboratory for further testing.

Chicken meat sample preparation and effect of maintenance management pattern

The chicken meat was obtained from the slaughter of IPB-D1 chickens, and the final stock was taken from the chest and thighs. The final stock chickens came from Bekasi (CV Citra Lestari Farm) and Sukabumi (CV Sinar Harapan Farm). The chickens of IPB-D1 came from Bekasi (CV Citra Lestari Farm) and Sukabumi (CV Sinar Harapan Farm). For the analysis of physical properties, 45 samples of chicken breast were taken with fifteen chicken meat from IPB-D1 Bekasi (CV Citra Lestari Farm), fifteen chicken meat from IPB-D1 Sukabumi (CV Sinar Harapan Farm), fifteen chicken meat from IPB-D1 Bekasi. The final stock came from Bekasi (CV Citra Lestari Farm), fifteen final stock chickens from Sukabumi (CV Sinar Harapan Farm), five free-range chickens, five Sentul chickens, and five broiler chickens. The chicken meat used as material for analyzing physical properties, chemical properties, and total microbes was carried out by a separation process between the meat and bone parts (deboning). For organoleptic testing, use the chicken breast as much as 200 grams of each chicken in small pieces. In addition to taking samples, IPB-D1 chickens and their final stock were checked to see how they correlated with the chicken-rearing management system at each location.

Physical quality analysis of meat samples

Meat pH

Measurement of meat pH is carried out with a unique pH meter for meat. The pH meter was previously calibrated at pH 4 and 7. The electrodes were rinsed with aqua dest and dried. Then 10 grams of chicken meat are mashed using a blender by adding 100 ml of water until homogeneous for one minute; the blender results are poured into a measuring cup. The electrode will go into the sample, and the pH value will appear on the pH meter. If the measurement of the pH value is carried out on different meat samples, the tip of the pH meter should be washed first using distilled water and then dried with tissue paper. The pH value listed on the pH meter display is read and recorded.

Water Holding Capacity (WHC)

Measurement of the water holding capacity value using a carper press and a planimeter. The initial stage of measuring the water holding capacity is a 0.3 g meat sample, which was accurately weighed using a Sartorius scale, placed between Whatman 41 filter paper, and then pressured using a carper press (35 $kgcm^{-2}$) for 5 minutes. Two circular areas show the meat under pressure (Inner Circumference = LD) and the water from the meat sample (Outer Circumference = LL or wet area). LD and LL on Whatman filter paper number 41 are marked with a pen. The amount of free water that comes out is measured using a planimeter. The formula calculates the value obtained from the measurement results, according to Soeparno (2016).

Meat tenderness

Texture testing was done using a texture analyzer (TA) to test cooked chicken meat's hardness, springiness, cohesiveness, fractubility, gumminess, and chewiness. The probe used in this analysis is cylindrical. A sample with a thickness of 1 cm is placed on top of the testing sample; then, the load cell will move the probe down to press the sample and back up. The texture analyzer's working principle is the product's durability by the compressive force of the tool or the ability to return the pressed food material to its initial condition after the pressure load is removed (Soeparno 2016).

Cooking loss

The cooking loss can be calculated by weighing the sample before boiling as the initial weight. The sample was pierced with a bimetallic thermometer and then boiled in boiling water until the internal temperature of the meat reached 71-81ºC. The sample was then removed and weighed. Cooking loss is calculated based on the formula according to Bouton (1971).

Chemical quality analysis of meat samples

Proximate analysis

Chemical quality analysis was observed by proximate test on parameters of moisture, ash, fat, and protein content—analysis using a food scanner NIRS (Near Infrared Reflectance Spectroscopy). Samples of 30 grams were chopped, then checked using a special petri dish. Sample examination was carried out in triplicate.

Mineral content analysis

The mineral content analysis was done following Fahruzaky et al. (2020) methods. Testing for mineral content uses X-Ray Fluorescence (XRF) which produces quantitative data on specific mineral levels. Before measuring the mineral content in the sample, measurement, and energy calibration are first carried out. Energy calibration aims to keep the elements contained in a material at its energy level, while measurement calibration aims to determine measurement deviations from the tool. The sample is inserted into the XRF device. The working principle of this tool is irradiating X-rays into the sample so that the photoelectric effect is obtained and then displays the mineral content.

Cholesterol level analysis

A total of 50 mg of chicken meat extract, each part of the thigh and breast in a composite, was put in a 25 mL flask and dissolved with chloroform to the mark. About 1 mL of sample solution was added to 2 mL of Liebermann-Burchard reagent in a 5 mL volumetric flask, then filled to the mark with chloroform. Each mixture was incubated for 5 minutes. The absorbance was measured at the maximum wavelength. The solution was made three times. Cholesterol levels were calculated by the formula following the research of Sahriawati et al. (2019).

Chicken meat microbiological quality

Total Plate Count (TPC) analysis

TPC calculation by pour plate method. A total of 25 g of mashed chicken meat samples were put into 225 ml of sterile 0.1% Peptone Water (BPW) media and obtained a dilution of 10^{-1} (P1). A total of 1 ml of suspension from P1 was transferred with a sterile pipette into 9 ml of sterile 0.1% BPW medium until a dilution of 10^{-2} (P2) was obtained. Do the same way until the dilution is obtained up to 10^{-7} (P7). Each 1 ml of the 10^{-5}, 10^{-6}, and 10^{-7} dilutions was taken to be put into a sterile petri dish and carried out in duplicate. Furthermore, prepared previously, 10-15 ml of agar plate count (Oxoid CM 0325) is poured into a petri dish. Smooth it over the entire surface of the cup. The next step is to incubate at 37-38 ^{0}C in an inverted dish for 24-48 hours. Colony counting was done using a colony counter based on the Standard Plate Count (SPC) provisions.

Organoleptic test

A hedonic quality test was conducted to assess the acceptability and quality of food products by rating test method using 5-value intervals. The variables assessed included color, the intensity of chicken breast meat aroma, and the intensity of mucus. The organoleptic quality testing of each treatment combination was carried out simultaneously. The test was conducted on 40 semi-trained panelists. Based on this hedonic organoleptic quality test, it is known that the panelists still accept the best treatment and the suitability of the meat for consumption**.**

Data analysis

The design used was a *Completely Randomized Design* (CRD). Data on meat's physical and chemical quality and microbiology were analyzed using the t-student test (Mattjik and Sumertajaya, 2013). The *Duncan Multiple Range Test* (DMRT) was performed if there was a difference between the three locations with a 95% confidence interval. Organoleptic data were tested using a 95% confidence interval. Data that does not meet the statistical rules are described descriptively. The treatment level with a significant or very significant effect is tested for significant differences in the mean value using the Mann-Whitney test.

RESULTS AND DISCUSSION

Physical quality

Factors of texture, color, taste, tenderness, smell, and juiciness can influence consumers' assessment of meat quality before buying meat. Poultry production management is reflected mainly in the meat's juiciness, tenderness, and taste (Mir et al. 2017). Analysis of the physical properties of IPB-D1 chicken meat using chicken breast. The chickens of IPB-D1 in this study were differentiated based on different rearing and management locations. The results of testing the physical properties of IPB-D1 chicken meat can be seen in Table 1.

pH value of meat chicken

Physical quality analysis in the form of the pH value of IPB-D1 meat reared at different locations and free-range chicken, Sentul, and broiler as comparison are shown in Table 1. The location of IPB-D1 chicken rearing is different, and free-range, Sentul, and broiler chickens, for comparison, had no significant effect on the meat pH. The results of this study showed that the pH of meat at various rearing locations was in the range of 5.90 to 6.04; this indicates that the difference in the location of rearing chickens IPB-D1 did not cause a significant change in the pH value of the meat when compared to kampong, Sentul, and broiler chickens.

Table 1. Analysis of the physical quality of IPB-D1 meat reared at different locations and Kampong chicken, Sentul, and broiler meat for comparison

Parameter	Rearing Location						
	IPB D1 Sukabumi Chicken	IPB D1 Bekasi Chicken	D1 Sukabumi Final Stock Chicken	D1 Bekasi Final Stock Chicken	Kampong Chicken	Sentul Chicken	Broiler Chicken
pH	5.90±0.25	5.93±0.19	6.01±0.30	6.04±0.16	5.93±0.13	5.98±0.15	6.00±0.07
Water Holding Capacity (% mg H2O)	31.48±3.27	31.28±3.78	30.19±1.79	30.72±3.00	31.28±0.98	30.52±1.97	30.29±2.42
Cooking Loss (%)	12.94±4.1^{ab}	15.35±3.1^{a}	14.48±2.9^{a}	14.20±4.5^{ab}	16.37±0.8 ^{ab}	17.04±0.2^{ab}	8.37±0.7^{b}
Tenderness (gr cm $^{-1}$)	2.95±0.8^{a}	2.77±0.^{ab}	2.93±0.7^{b}	2.74±0.8^{b}	3.13±0.7^{ab}	2.93±0.7^{ab}	2.76±0.2^{ab}

*Different superscripts in the same row showed significantly different effects of the 5% Tukey test (P<0.05)

The average pH value in this study was still within the normal range. Soeparno (2016) reported that the pH of fresh chicken meat ranged from 5.3-6.5 under normal conditions after slaughter. The optimal pH value of broiler chicken meat without treatment is 5.78 (Benamirouche et al. 2020). The average pH value of IPB-D1 Sukabumi chickens was the lowest (5.90) when compared to other locations, followed by IPB-D1 Bekasi chickens (5.93), Kampung chickens (5.93), Sentul chickens (5.98), Broiler Chicken (6.00), Sukabumi Final Stock Chicken (6.01) and the highest meat pH value (6.04) was D-1 Bekasi final stock chicken. This study showed that the pH value of chicken meat was higher than in the study of Afrianti et al. (2013), with broiler chicken meat without any treatment having an average pH of 6.79 in a shelf life of 6-12 hours.

pH value is one of the important indicators for assessing the physical quality of meat. It can determine the presence of microbes in meat, so it dramatically determines the level of quality and durability (Hajrawati et al. 2016). Biochemical changes after slaughter cause the conversion of muscle to meat which determines the quality of meat at the end. Carcass temperature after slaughter has a physicochemical effect on muscle associated with postmortem glycolysis, temperature, and pH (Mir et al. 2017). Changes in the pH of meat after slaughter are influenced by the availability of lactic acid in the muscles; the availability of lactic acid is influenced by glycogen content, and livestock handling influences glycogen content before slaughter. The pH value directly influences meat quality, such as tenderness, water-holding capacity, color, juiciness, and shelf life. Broiler breast meat with a high pH has a higher water-holding capacity than meat with a low pH (Mir et al. 2017), presumably because the chickens used to have different body weights. Glycogen content was higher in chickens with higher body weight, resulting in higher levels of rigor mortis. Color identification is an easy way to determine the pH of meat. If the meat is very dark, then the pH of the meat is high, and if it is very light, it has a low pH.

Water Holding Capacity (WHC)

The water-holding capacity of IPB-D1 chickens from different rearing locations and free-range, Sentul, and broiler chickens for comparison are shown in Table 1. The different locations of IPB-D1 chicken rearing and free-range, Sentul, and broiler chickens as comparisons had no effect. Significant on the water-holding capacity of meat, this indicates that the location of rearing in IPB-D1 chickens did not cause changes in the water-holding capacity of the meat, and when compared to native chickens, Sentul chickens, and broiler chickens, there was no significant difference. The water-holding capacity of the meat from this study at various rearing locations was the lowest shown by Final Stock D-1 Sukabumi chicken (30.19%) to the highest 31.48% (IPB-D1 Sukabumi chicken). Meanwhile, for other locations, the water holding capacity was 31.28% (chicken IPB-D1 Bekasi); 31.28% (village chicken); 30.72% (D-1 Bekasi Final Stock chicken); 30.52% (Sentul chicken), and 30.29% (broiler chicken).

The findings of Mahmud et al. (2017) reported the water-holding capacity of broiler chicken meat with different cage densities of about 33.65-34.28%. This study's water-holding capacity (WHC) value is around 30,19-31.48%, which is lower than the findings of Mahmud et al. 2017. The low pH of the meat can reduce the water-holding capacity due to the open structure of the meat. Likewise, high-pH meat can increase the water-holding capacity because the meat structure is closed.

Cooking Loss

The cooking loss of IPB-D1 chicken from different rearing locations and native chicken, Sentul, and broiler chickens as comparisons are shown in Table 1. The different locations of IPB-D1 chicken rearing and native, Sentul, and broiler chickens as comparisons had a significant effect. (P<0.05) on the cooking loss of meat. The cooking lossof meat from this study was in the range of the lowest 8.37% (broiler chicken) to the highest 17.04% (Sentul chicken).

Meanwhile, IPB-D1 Bekasi chickens amounted to 15.35%, followed by IPB-D1 Sukabumi chickens at 12.94%, Final Stock D-1 Sukabumi chickens (14.48%), and Bekasi D-1 Final Stock chickens (14.20%). The results are pretty varied, but according to Soeparno (2016), cooking loss generally varies between 1.% - 54.5%, with a standard range of 15% to 40%. The findings of this study are lower when compared to Mahmud et al. (2017), with a cooking loss value of 34-36%. The cooking loss value of chicken meat in this study was lower than the findings of Mahmud et al. 2017. Moreover, better when compared to the results of Khaerunnisa et al. (2016). Mir et al. (2017) reported that changes in carcass quality associated with unsaturated fatty acids could tear the skin during picking and increase cooking loss. Poultry subjected to heat stress before slaughter generally has a higher body temperature, resulting in a rapid decrease in pH and the development of muscle stiffness. Such pre-cutting conditions usually produce pale, soft, and exudative meat, resulting in lower yields, increased cooking losses, and reduced juices.

Tenderness

Tenderness of IPB-D1 chicken meat from different rearing locations and free-range, Sentul, and broiler chicken meat as comparisons shown in Table 1. Different locations of IPB-D1 chicken rearing as well as free-range chicken, Sentul chicken, and chicken broiler, as a comparison, had a significant effect (P<0.05) on the tenderness of the meat. The tenderness of the meat significantly increased in Final Stock D-1 Bekasi chicken (2.74 gr/cm), followed by IPB-D1 Bekasi chicken (2.77 gr/cm). Meanwhile, the lowest meat tenderness was free-range chicken (3.13 g/cm). The chickens of IPB-D1 chicken breasts were reared in different locations, and when compared to native chickens, Sentul chickens and broiler chickens were included in the very tender category based on the grouping of tenderness. The findings of Mahmud et al. (2017) reported that the tenderness value of broiler village crosses was 1.17-1.58 kg/cm^3.

The study results showed a better tenderness value when compared to the findings of Ariyanti et al. 2019. The cooking process can affect the tenderness of the meat, which causes the myofibril proteins to coagulate and denature. Physically, myofibril proteins react due to heating so that hardening occurs, affecting the meat's tenderness (Mahmud et al. 2017). The chickens of IPB-D1, which are the result of crosses between Pelung chickens, Sentul chickens, native chickens, and broilers, have become a new genetic variation in the poultry sector; this is supported by Mir et al. (2017) reported that differences in quality could be due to genetic variation among birds. Chicken meat quality can be improved by genetic selection. Meat tenderness can be affected by connective tissue and myofibrillar proteins along with heat, environmental stress, poultry, and developmental rigidity.

Chemical quality

Chemical quality analysis of IPB-D1 chicken meat to determine the proximate content of the parameters of water content, ash, fat and protein, mineral content, and cholesterol content. The average and standard deviation results from testing the chemical properties of IPB-D1 chicken meat are shown in Table 2. The high nutritional content of meat makes it a product the body needs. The chemical composition of meat differs in number depending on the species, genetics, age, carcass, storage, sex, nutrition, and handling process of livestock (Liur 2020). The chemical quality of meat is influenced by water, fat, and protein content (Prasetyo et al., 2013). Water, protein, and fat content affect the chemical quality of meat (Prasetyo et al., 2013).

Proximate

The different locations of rearing IPB-D1 chickens as well as native, Sentul, and broiler chickens as a comparison, did not have a significant effect (P>0.05) on the proximate results in the form of ash and protein content. However, there was a difference in fat yield. Quantitatively, the ash content of chicken meat at various rearing locations was the lowest at 0.81% (D-1 Bekasi Final Stock chicken) to the highest at 1.22% (Sentul chicken). Meanwhile, the ash content of other locations, such as IPB-D1 Sukabumi chickens, was (1.13%), and IPB-D1 Bekasi chickens (0.85%). These results align with Mahmud et al. (2017) on broiler crossbreed chicken meat by 1.08-1.15%. The research findings of Liur (2020) are 0.74% of broiler chicken meat in traditional markets. According to Tamzil (2014), fresh chicken meat contains an ash content of 1.14%. Ash content is a determining factor for nutritional content related to mineral content in chicken meat. Ash content can increase with the increasing age of livestock. Qurniawan et al. (2016), the ash content increased with the increasing age of broiler chickens.

Table 2. Analysis of the chemical properties of IPB-D1 meat reared at different locations and chicken, Sentul, and broiler meat for comparison using a composite method

Parameter		Rearing Location						
		IPB-D1 Sukabumi Chicken	IPB-D1 Bekasi Chicken	D1 Sukabumi Final Stock Chicken	D1 Bekasi Final Stock Chicken	Kampung Chicken	Sentul Chicken	Broiler Chicken
Proximate	Ash (%)	1.13±0.20	0.85±0.04	1.09±0.14	0.81±0.13	1.08	1.22	0.93
	Fat (%)	1.37±0.4[ab]	0.36±0.1[b]	3.06±1.5[ab]	1.18±0.5[b]	2.06[ab]	0.33[b]	5.43[a]
	Protein s (%)	20.90±1.41	21.30±0.44	18.62±0.90	20.69±0.42	20.59	21.45	19.53
Mineral	Fe (ppm)	8.35±1.89	11.23±4.04	14.56±0.02	7.48±5.16	3.26	7.69	14.92
	Zn (ppm)	12.27±6.21	23.74±2.24	21.75±4.38	11.01±7.53	4.77	11.21	20.09
Cholesterol	(mg/100g)	78.47	69.49	47.53	60.72	116	164.80	110

Different superscripts in the same row showed significantly different effects of the 5% Tukey test (P<0.05)

The amount of ash content is also related to the level of livestock consumption. The higher the level of consumption, the higher the ash content. The amount of ash content varies depending on sex, species, and age.

Analysis of the variety of meat fat content showed that the location of IPB-D1 chicken rearing affected the fat content of the meat(P>0.05). The lowest fat content was shown in Sentul chicken (0.33%), followed by IPB-D1 Bekasi chicken (0.36%) and IPB-D1 Sukabumi chicken (1.37%). The highest fat content in broiler chickens is 5.43%. Hartono et al. (2013) explained that fat content was negatively correlated with meat protein content. The lower the fat content of the meat, the higher the protein content of the meat, and vice versa. The nutrient digestion and metabolism of livestock influence the chemical quality of meat. In addition, the older the livestock, the fat content will also increase. Fat content is also related to livestock weight; the greater the weight of the chicken, the greater the fat content.

The protein content of meat showed that the location of rearing IPB-D1 chickens and, when compared with sentul chickens, free-range chickens, and broilers, did not affect the protein content of the meat (P>0.05). The lowest protein content of meat was shown by Final Stock D-1 Sukabumi chicken (18.62%), followed by broiler chicken (19.53%). The protein content of IPB-D1, Sukabumi, and Bekasi chicken meat was high at 20.90% and 21.30%, respectively. The results of the meat protein content found by the Liur study (2020) were 21.96%. Research Chepkemoi et al. (2017) reported an indigenous chicken protein content of 15.1%. The protein content in the study was still within that range, so it was considered normal. According to Liu et al. (2015), the amount of feed consumed by livestock will affect the protein content of meat. Rotiah et al. (2019) added that high protein content is also associated with animal weight. Chicken body weight is related to protein consumption which determines the protein deposition of chicken meat. The main components of protein are amino acids that form long chains consisting of essential and non-essential amino acids.

Mineral

Chemical quality analysis of IPB-D1 chicken meat protein content from different rearing locations and free native chicken, Sentul, and broiler as comparisons are shown in Table 2. The location of different IPB-D1 chicken rearing and free native chicken, Sentul, and broiler as comparisons had no significant effect (P>0.05) on the mineral content of Fe and Zn. The Fe and Zn mineral content results in this study were quite varied. Quantitatively, the highest Fe mineral content (14.92 ppm) in broilers and the lowest (3.26 ppm) in native chickens. The highest Zn mineral content (23.74 ppm) in IPB D1 Bekasi chickens and the lowest (4.77 ppm) in native chickens.

According to Benamirouche et al. (2020), the mineral Zn is a cofactor of the antioxidant enzyme superoxide dismutase (SOD) in fighting free radicals and is needed for acid and alkaline balance. Zinc is needed by the body of livestock in small quantities, but its presence cannot be stored in the body, so zinc intake from the feed is needed because zinc cannot be converted from other nutrients (Swain et al. 2016; Chepkemoi et al. 2017). Increasing the concentration of zinc and vitamin E in the feed can reduce the concentration of malondialdehyde

(MDA) under stress conditions. Livestock can experience oxidative stress due to high environmental temperatures. Adding zinc minerals to the diet can prevent the occurrence of lipid peroxides and increase the immune system in tissues (Kakhki et al. 2016).

Cholesterol level

Table 2 shows the results of the analysis of chemical properties in the form of cholesterol levels of IPB-D1 chicken meat from different rearing locations as well as free-range chicken, Sentul, and broiler as comparisons. The cholesterol content of meat is quite varied, with a range of 47.53 mg/100g (final stock chicken). D-1 Sukabumi) followed by 60.72 mg/100g (D-1 Bekasi final stock chicken). The cholesterol levels of IPB-D1 Sukabumi and Bekasi chickens were 78.47 mg/100g and 69.49 mg/100g, respectively. This result is higher than Mahmud et al. (2017), 18-20 mg/100 g. The data from this study showed that the cholesterol of IPB D1 Sukabumi and Bekasi chickens was lower than that of native chickens and broilers. The lower cholesterol value in broiler chickens is thought to be due to heterosis. Heterosis can occur due to crossbreeding, which increases the proportion of heterozygous genes (Mahmud et al. 2017). Increased carcass protein and amino acids can reduce dietary fat and increase crude protein or single amino acids.

Microbiological quality

Total Plate Count (TPC)

Microbiological analysis of IPB-D1 chicken meat determines the microbial content in the meat. The results of the average and standard deviation of the TPC test of IPB-D1 chicken meat are shown in Table 3. Analysis of microbiological quality in the form of total bacterial colonies (total plate count) of IPB-D1 chicken meat from different rearing locations and native chicken, Sentul, and broiler meat as comparisons can be seen in Table 3. Different locations of IPB-D1 chicken rearing and free-range chicken, Sentul, and broiler as a comparison significantly affected the total bacterial colonies for all of the samples compared to broiler chicken. The average yield of total bacterial colonies in all locations was 10^5 $CFUg^{-1}$ (5Log $CFUg^{-1}$). The study results showed that the TPC content in chicken meat was above the standard limit of SNI (2009), which was $1x10^6$ (6Log $CFUg^{-1}$). The same problem was also reported by Hafid et al. (2014) on broiler chickens in several traditional markets, which are about 1.7 x 10^7 $CFUg^{-1}$. These data indicate the possibility of contamination of chicken meat by bacteria found in the environment, contact with the equipment used, and storage temperature. Ganie et al. (2015), the level of microbial contamination in chicken meat can occur after the slaughter or when in contact with knives, meat cutting mats, or other equipment. In addition, the temperature factor and storage time are also the cause of bacterial growth. Microbial contamination of meat can occur when the animal is still alive until it is ready to be consumed. The initial contamination comes from microbes that enter the blood circulation at slaughter because the tools used are not hygienic. According to (SNI 2897:2009) the standard content of TPC in fresh, frozen (carcass and boneless), and minced chicken is not more than $1x10^6$ $CFUg^{-1}$.

Organoleptic quality

Organoleptic testing of IPB-D1 chicken meat determined the level of acceptance by consumers. The average results and standard deviation of organoleptic testing of IPB-D1 chicken meat are shown in Table 4. Some of the panelists' considerations in assessing a food ingredient include aroma, color, and taste. The aroma of meat develops during cooking and also gives the meat a distinctive taste, which is due to the fat content in the meat. Semjon et al. (2020), the factors that can affect the aroma, taste, texture, and color of poultry meat are age, sex, nation, cage environment, slaughter conditions, and water content of meat. and intramuscular fat. Analysis using Tukey's test on hedonic testing showed that there

Table 3 . Microbiological analysis of IPB-D1 meat reared at different locations and chicken, Sentul, and broiler meat for comparison

Parameter	Rearing Location						
	IPB D1 Sukabumi Chicken	IPB D1 Bekasi Chicken	D1 Sukabumi Final Stock Chicken	D1 Bekasi Final Stock Chicken	Kampong Chicken	Sentul Chicken	Broiler Chicken
Total bacterial colonies (log $CFUg^{-1}$)	6.12±0.82[b]	6.40±0.82[b]	5.41±0.18[b]	5.62±0.39[b]	5.62±0.02[b]	5.21±0.01[b]	9.00[a]

Different superscripts in the same row showed significantly different effects of the 5% Tukey test (P<0.05)

Table 4. The organoleptic quality of IPB-D1 chicken meat reared at different locations and Kampong chicken, Sentul, and broiler meat for comparison

Test	Parameter	Rearing Location						
		IPB D1 Sukabumi Chicken	IPB D1 Bekasi Chicken	D1 Sukabumi Final Stock Chicken	D1 Bekasi Final Stock Chicken	Kampung Chicken	Sentul Chicken	Broiler Chicken
Quality Hedonic	Color	2.49±1.1^{ab}	2.29±1.2^{ab}	2.73±1.1^{a}	2.98±1.2^{a}	1.69±1.2^{a}	1.95±0.9^{b}	2.44±1.0^{ab}
	Scent	2.67±1.3^{abc}	1.95±1.0^{ab}	3.02±1.2^{bc}	2.47±1.2^{bc}	3.28±0.9^{a}	3.09±1.2^{ab}	3.20±1.2^{ab}
	Intensity Mucus	3.42±1.0	3.62±1.0	3.2±0.8	3.24±0.9	3.09±0.9	3.40±0.9	3.36±0.8
Hedonic	Color	3.20±0.8^{ab}	2.89±0.9^{ab}	3.42±0.9^{a}	3.47±0.9^{a}	3.20±0.8^{ab}	2.86±1.2^{ab}	2.66±1.2^{b}
	Scent	3.00±0.9^{ab}	2.15±0.9^{c}	3.29±0.8^{a}	2.57±1.0^{bc}	3.22±0.9^{a}	3.11±0.8^{ab}	2.84±0.8^{ab}
	Texture	3.29±0.82	3.02±0.84	3.42±1.01	3.02±0.91	3.13±0.78	3.16±1.04	3.07±1.01
	General Appearance	3.53±0.9^{ab}	3.00±0.8 b	3.58±0.8^{a}	3.47±0.9^{ab}	3.16±0.8^{ab}	3.02±1.0^{ab}	3.00±1.1^{b}

Color 1= Red; 2= Pale, unattractive; 3= White; 4= White, attractive; 5= White, very attractive. Scent 1= Very odorless meat; 2= Odorless meat; 3= Characteristic aroma of meat, there is a deviant aroma; 4= Distinctive smell of meat, no deviant aroma; 5= Distinctive meat aroma, delicious. Mucus 1= Very slimy; 2= Slimy; 3= Slightly slimy; 4= Not slimy; 5= Very not slimy. Hedonic score: 1= Very dislike; 2= Dislike; 3= Like; 4= Somewhat like; 5= Really like. Different superscripts in the same row showed significantly different effects of the 5% Tukey test (P<0.05)

was a significant difference (P<0.05) in the preference of the panelists on all attributes, namely color, aroma, and general appearance; in other words, differences in the type of chicken affected the level of preference for chicken meat, but not there was a significant difference to the texture. Observational data are in Table 4. It shows that the type of IPB-D1 chicken compared to other chickens gave a significant hedonic quality (P<0.05) on the aroma and color of the meat. However, there was no significant difference in the intensity of mucus; this is due to the different processes of maintaining and meat storing.

The sample type has a significant effect (P<0.05) on the color of chicken meat. The data showed that the panelists' preference for meat color was in the range of 2 (somewhat like) to 3 (liked), while the hedonic quality of the meat was in the range of 2 (pale, less attractive) to 4 (white, attractive). The types of chicken meat samples at different locations did not significantly affect the meat's texture. Panelists' assessment of the level of preference for meat texture ranges from 3 (like) to 4 (somewhat like). The observations showed in Table 4 that the types of chicken meat at different locations had a significant effect (P<0.05) on the aroma of the meat. Panelists' assessment of the level of preference for meat aroma was in the range of 2 (slightly like) to 3 (liked), while the hedonic quality of the meat was in the range of 2 (Odorless meat) to 4 (typical of meat, no deviant aroma). The observed data are in Table 4. It shows that the types of chicken meat samples at different locations significantly affected the intensity of the meat mucus. The hedonic quality of meat ranges from 3 (slightly slimy) to 4 (not slimy). The color of poultry meat is influenced by several factors such as age, sex, breed, cage environment, slaughter environment, conditions before slaughter, slaughter and storage conditions, intramuscular fat, the water content of meat and feed given, meat color also influenced by the water content and pH of the meat (Semjon et al. 2020). The primary texture assessment is firmness (toughness or level of tenderness), compactness, and juiciness. The cooking time and temperature can determine meat texture (Hafid 2017; Herlina et al. 2020).

CONCLUSION

The quality of IPB-D1 chicken meat and its Final Stock in terms of physical quality, such as pH and water holding capacity, had a lower cooking loss and more tenderness than Kampong, Sentul, and broiler chickens and contained high chemical quality in protein and ash. In addition, it has a high mineral content but low in cholesterol. Organoleptic testing also showed an excellent preference for panelists for IPB-D1 chicken meat. Microbiological quality analysis in the form of *total bacterial colonies* (TPC) of IPB-D1 chicken meat and its Final Stock is under the *Maximum Microbial*

Contamination Limit set by the Indonesian National Standardization Agency in 2009 (SNI 2897:2008). All these bacteria are not resistant to high temperatures, so the cooking process is still safe for consumption. Based on the results of this study, it is necessary to improve handling practices, hygienic packaging, to sanitation so that the quality of chicken meat can be improved and microbial contamination can be minimized.

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