Meat Quality on Sentul Cocks with Different Immunoglobulin Yolk Concentrations

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ABSTRAK

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Ayam jantan Sentul adalah salah satu ayam lokal Indonesia yang awalnya dikembangkan masyarakat Kabupaten Ciamis, Provinsi Jawa Barat. Sel tubuh ayam yang sehat dapat berfungsi dengan baik, terutama dalam proses metabolis. Ayam sehat dapat menghasilkan perkembangan otot yang lebih baik. IgY adalah substansi protein otot yang mampu menetralisir sejumlah mikroorganisme penyebab infeksi. Tujuan dari penelitian ini adalah untuk mengevaluasi efek konsentrasi IgY pada kualitas fisik dan organoleptik daging. Penelitian ini menggunakan 20 ekor ayam jantan berumur 4 bulan dengan 2 perlakuan (konsentrasi IgY di atas 9.30 ± 0.45 mg mL^{-1} dan di bawah 9.30 ± 0.45 mg mL^{-1}). Variabel yang diamati ternasuk kualitas fisik dan organoleptik daging yang diuji menggunakan Rancangan Acak lengkap. Data dianalisis menggunkan T-test. Dapat disimpulkan bahwa ayam jantan dengan konsentrasi IgY di atas 9.30 ± 0.45 mg mL^{-1} memproduksi daging dengan melonaldehida lebih rendah. Keberadaan konsentrasi melonaldehida yang rendah dalam daging ini menunjukkan daging yang lebih sehat.

Kata Kunci: Ayam Sentul Jantan, IgY, Kualitas Daging

ABSTRACT

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Sentul cocks is one of the native chicken breeds in Indonesia which is originally raised by villagers in Ciamis District, West Java. Healthy chicken cells can function properly, especially in the metabolic process. Healthy chickens are expected to produce better muscle development. IgY is a protein molecule substance that can neutralize a number of microorganisms that cause infection. The purpose of this study was to evaluate the effect of IgY concentration on physicochemical and organoleptic qualities of meat. This study used 20 cocks, 4th month ages, consist of 2 treatments (IgY concentrations above 9.30 ± 0.45 mg mL^{-1} and IgY concentrations below 9.30 ± 0.45 mg mL^{-1}). The variable observed include physicochemical and organoleptic quality of meat. The study was used completely randomized design. Data were analyzed by t-test. The result concluded that cocks with concentrations above 9.30 ± 0.45 mg mL^{-1} produced meat with lower malonaldehyde. The low content of malonaldehyde in meat shows that the meat produced is healthier.

Key Words: Sentul Cocks, IgY, Meat Quality

INTRODUCTION

Sentul cock is one of the germplasm originating from villagers in Ciamis District, West Java. This chicken is very potential to be commercially bred to fulfill people's nutrition and increase farmers' income (Sulandari et al. 2007). Muhsinin et al. (2016) stated that sentul cock was able to neutralize *S. pullorum* bacteria by 26% -60% through in vitro testing using the method of clearance test with a dose of 10^7 CFU mL^{-1}. This situation proves that the resistance of sentul cocks varies greatly. IgY is a protein molecule substance that can neutralize a number of microorganisms that cause infection. According to Regar et al. (2013) livestock that has high resistance can fight infectious agents so they can produce a good performance.

Sentul cocks have a very large role in producing offspring and increasing the performance of the next generation. Sentul cocks that has high IgY is a chicken that is more resistant to disease attacks and healthier (Setyawati et al. 2019). Wiryawan et al. (2005) stated that broilers given antibacterial (*alicin*) in their feed produced healthy chickens and high body weight. Healthy chicken cells can function properly, especially in the metabolic process. Healthy chickens are expected to produce better muscle development. The importance of IgY concentration in the metabolic process, the purpose of this study was to evaluate the quality of sentul cocks meat that has different IgY concentrations.

MATERIALS AND METHODS

Cocks Research

The cocks used were 20 sentul cocks, 4 months old. Cocks body weight at the start of the study was around 1.6-2.2 kg bird^{-1} with an average of 1.9 kg bird^{1}.

Testing the IgY concentration of Sentul cocks

Testing of IgY concentrations was carried out on 20 sentul cocks. Testing of total IgY in blood serum was carried out using the indirect method of ELISA (Enzyme-Linked Immunosorbent Assay) according to Yokoi et al. (2002). Cocks that have IgY concentrations above the average are classified as chickens with high IgY concentrations. Cocks that have an IgY concentration equal to or below the average are classified as cock with low IgY concentrations.

Maintenance of cocks

Sentul cocks were maintained during the pre-layer and layer to determine their production performance. The feed used was commercial phase layer crumble (protein 16-18% and metabolic energy 2700-2800 kcal kg^{-1}). The provision of feed and drinking water was carried out adlibitum on the morning at 07.00 WIB and in the afternoon at 16.00 WIB. Cocks slaughter was carried out at the end of maintenance, 28 weeks.

Cocks Slaughter

Cocks slaughter was carried out at the end of maintenance for observing physicochemical variables of meat. Cocks were fasted for 12 hours before slaughter (Sandi et al. 2012). Slaughter was done lawfully in accordance with CAC / GL 24-1997 (BSN 2009), namely by cutting the neck (carotid artery, jugular, tracheal and oesophageal veins).

Physicochemical Quality Test of cocks Meat

Physicochemical quality testing of cocks meat in this study included pH value, the percentage of free H_2O, cooking shrinkage, tenderness, aw value and the content of malonaldehyde meat. The high content of malonaldehyde in meat shows that the meat produced is not healthy because it undergoes an oxidation process.

Potential Hydrogen (pH) was measured using a meat pH meter (AOAC 2005). The calibrated pH meter was then inserted into the meat sample and left until the numbers printed on the digital measurements did not change. The percentage of free H_2O was analyzed by the Hamm (1972) in Soeparno (2005) using a carper press. 0.3 g of meat was placed on the carper press and the maximum pressure was applied with a load of 35 kg for 5 minutes until a liquid circle (outer circle) and outer circle of meat (inner circle) were formed, then calculation outside the wet area using a planimeter. The percentage of free H_2O was analyzed by the Hamm (1972) in Soeparno (2005) using a carper press. Processing steps as follows, (1) 0.3 g of meat was placed on the carper press and (2) the maximum pressure was applied with a load of 35 kg for 5 minutes until a liquid circle (outer circle) and outer circle of meat (inner circle) were formed, (3) then calculation outside the wet area using a planimeter and (4) the water content that came out of the meat after the emphasis, was calculated by the following formula. The calculation outside the wet area was calculated by the outer circle minus the circumference and divided by one hundred, calculation mg H_2O with the wet area (cm^2) divided by 0.0948 minus 0.8 and the percentage of water that comes out is calculated with mg H_2O divided by 0.3 g then multiplied by one hundred percent.

Water activity (a_w) was measured using the Salejda et al. (2014) procedure using a_w meter. The mashed sample was put into the sample chamber at aw meter, then the sample was left to stand for approximately 15 minutes. The constant a_w value was then recorded. Cooking loss was analyzed using the Tijare et al. (2016) by weighing meat as much as 100 g. The sample was put in boiling water until the meat temperature reached 76^{0}C (about 10 minutes) and was measured using a bimetal thermometer. The measurement of the percentage of cooking shrinkage was done by reducing the weight before and after cooking / draining divided by the initial weight. Tenderness was measured according to the procedure of Bowker et al. (2014) using the Warner-Bratzler shear force tool. Meat samples were pierced with a bimetal thermometer, boiled in boiling water until the internal temperature was 76^{0}C. After that, the meat sample was cooled for 60 minutes. The meat was formed in the same direction as the 1 cm^2 meat fiber and then measured by the WB tool and the meat tenderness would be read on the scale of the tool.

MDA is a marker for the formation free radicals of meat (Nielsen et al. 1997). The content of malonaldehyde (MDA) was measured using the (Nielsen et al. 1997) method modified by Suryati et al. (2013). Meat samples were added with 100 mL of distillate water containing 0.1% propyl galate (PG) and 0.1% ethylene diamin tetra acetate (EDTA) and stirred until smooth. The mixture was then transferred quantitatively into a distillation tube through washing with the addition of 97.5 mL of distillate water containing 0.1% PG and 0.1% EDTA. The mixture was acidified with 2.5 mL of hydrochloric acid (HCl) solution with a ratio of 1: 2 (HCl: aquades) and added 5 drops of anti-froth A (Sigma Aldrich USA). Distillation

was carried out to obtain 50 mL of distillate for each sample. Determination of thiobarbituric acid reactive substance (TBARS) was carried out using a spectrophotometer at λ 532 nm. A total of 5 mL of sample distillate was mixed with 5 ml of 0.02 M TBA solution (Sigma Aldrich USA) in a glass tube, and then incubated at 100 o C water baths for 40 minutes before being cooled to room temperature and running water. All sample distillates were analyzed in duplicate. The calibration curve was made from a solution of 4 stock 1,1,3,3-tetra etioxy propane (TEP) (Sigma Aldrich USA) 0.002 M which was reacted with a TBA solution and treated the same as a sample. The standard curve is made from the relationship between absorbance at λ 532 nm with the concentration of TEP or MDA. Numbers of TBARS are expressed as mg MDA per kg of sample. The MDA calculation is done by the formula:

$$\text{MDA grade} = \frac{C_{MDA} \times V_{des}}{M_S}$$

Information :

C_{MDA} : MDA concentration as read on the standard curve

V_{des} : volume of distillate (mL)

M_S : weight (massa) sample (g)

Organoleptic Test

Observations were carried out according to the method (Smith et al. 2012) by cutting meat in the chest size 3 cm^3 and tested in raw and mature conditions on 30 panelists consisting of undergraduate and postgraduate students using IPB questionnaires. The test was in the form of a hedonic test (level of preference which includes color, texture, and aroma) and hedonic quality (level of product quality). In this test, panelists were asked to give an assessment with a score of 1-5.

Data analysis

The design was used a completely randomized design (CRD) with two treatments. The treatment is the different serum (high and low) IgY concentrations. Each treatment was repeated 10 times. Each treatment was repeated ten times. Each replication consists of 1 Sentul cocks. The variables observed were meat quality (physicochemical and organoleptic). The data obtained were analyzed by t-test using Minitab program (Mattjik & Sumertajaya 2013) with the following formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n_1-1)s_1^2 + (n_2-1)s_2^2}{n_1+n_2}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}}$$

Information:

n_1 : number of observations of meat quality with IgY levels above 9.30 ± 0.45 mg mL^{-1}

n_2 : number of observations of meat quality with IgY levels below 9.30 ± 0.45 mg mL^{-1}

x_1 : average meat sample with IgY level above 9.30 ± 0.45 mg mL^{-1}

x_2 : average meat sample with IgY level below 9.30 ± 0.45 mg mL^{-1}

s_1 : standard deviation of meat with IgY level above 9.30 ± 0.45 mg mL^{-1}

s_2 : standard deviation of meat with IgY levels below 9.30 ± 0.45 mg mL^{-1}

RESULTS AND DISCUSION

Physicochemical Quality of Meat

The results of the physicochemical quality observations of sentul cock meat in this study are presented in Table 1. Based on statistical tests it was found that the pH value, percentage of free H_2O, a_w, cooking loss, and tenderness were not statistically significant different, but were significantly different in the malonaldehyde content of breast meat. Sentul cocks that had a high IgY concentration actually produce lower meat malonaldehyde content. The low MDA value indicates that meat is included in the category of health because it does not undergo the process of fat oxidation.

Potential Hydrogen (pH) of sentul cocks (chest part) of this study turned out to be lower than the results of the Khaerunnisa et al. (2016). This is caused by the chicken body weight used is different. Cocks with higher body weight have higher glycogen content so that higher levels of rigor mortis are produced (Pragati et al. 2007).

The cooking loss value of sentul cocks meat in this study amounted to 20.44% -23.06%. These results are better than the value of cooking losses of village cocks at the same age of 28 weeks that is equal to 41.06%-41.50% (Khaerunnisa et al. 2016). The tenderness of cocks boiled breast meat in this study was 2.82-3.41 kg cm^{-2}. According to Bowker et al. (2014), this value is still in the soft category. The aw value produced in this study using sentul cocks meat is lower than the research conducted by Aberle et al. (2001) which uses broiler chicken meat. The higher the aw value, the more water

Table 1. Physicochemical quality of sentul cock meat with different IgY concentrations

Variable	IgY concentration below 9.30 ± 0.45 mg mL^{-1}	IgY concentration above 9.30 ± 0.45 mg mL^{-1}
pH value	5.11±0.06	5.16±0.06
Free of H_2O (%)	30.42±4.10	31.33±6.00
Cooking loss (%)	23.06±0.08	20.44±0.07
Tenderness (kg cm^{-2})	3.41±1.06	2.82±1.05
a_w value	0.90±0.02	0.90±0.01
Malonaldehyde content (MDA, mg kg^{-1})	1.20±0.16a[1)]	0.71±0.15b

Different letters on the same line show significant differences (P<0.05).

activity in the myofibrils, so the bacteria will grow faster and multiply in the flesh (Troller & Christian 1978). This means that bacteria are more difficult to live in sentul cocks (28 weeks) than broiler chicken with an age of about 5 weeks.

Sentul cocks which have low IgY has low lymphocytes in the blood (Setyawati et al. 2019). Lymphocytes are one of the leukocytes that function to form IgY or antibodies. Lymphocyte concentration in chickens is one indicator of heat resistance. Low lymphocyte value will increase the ratio of heterophils and lymphocytes (H/L). This increase in the ratio indicates that chickens are experiencing stress due to the heat of the maintenance environment (Munck et al. 1984; Davis et al. 2008). The temperature of maintenance of chicken's cages in this study ranged from 24-31 ^{o}C. This condition causes a high-fat oxidation reaction. Increasing the oxidation reaction will produce high free radicals, so the MDA content produced is also high (1.20 mg kg^{-1}). Chickens that have high IgY concentrations in this study produce meat with a lower MDA content (0.71 mg kg^{-1}). However, the high MDA content in meat originating from sentul cocks with low IgY in this study is still lower than the standard MDA content of food, which is 1.8 mg kg^{-1} (Gray 1978). Meat that has sub-standard MDA content is healthy meat. The low MDA value indicates that meat does not undergo a process of fat oxidation which causes free radicals. Foods that experience free radicals can stimulate cancer cell growth.

Organoleptic Quality

The observations of the organoleptic quality of sentul cocks breast meat in this study are presented in Table 2. Based on statistical tests it was found that the color, texture, and aroma of sentul cocks meat with different IgY concentrations did not show any difference in both hedonic and hedonic quality. Based on the panelist's assessment of hedonic quality (product quality), sentul cocks meat in this study was slightly pale in color, textured rather soft and slightly fishy scented. The color of the meat is influenced by the myoglobin content of meat. Myoglobin is a color pigment that resides in meat. The redder the color of the meat, the higher the concentration of pigments in the meat (Ladikos & Wedzicha 1988). Organoleptic tests using raw chicken and observations about the texture using raw and cooked meat.

Hedonic quality (product quality based on panelist assessment); color brightness: 1: very pale, 2: pale, 3: slightly pale, 4: slightly bright reddish, 5: bright reddish; hardness level of texture 1: very hard, 2: hard, 3: slightly soft, 4: soft, 5: very soft; fishy aroma level 1: very fishy, 2: fishy, 3: fishy, 4: not fishy, 5: very fishy. Hedonic (panelist's favorite level): 1: dislike, 2: rather like, 3: like, 4: really like, 5: really like it very much.

Hedonic panelists' assessment (likes) shows that the panelists consisting of post-graduate students rather like the color, texture, and aroma of sentul cocks meat. This is because panelists are accustomed to seeing broiler meat that has the color, texture, and aroma of meat that is quite different when compared to local chicken meat.

CONCLUSION

Sentul cocks with IgY concentrations above 9.30 ± 0.45 mg mL^{-1} were able to produce lower malonaldehyde content, so that the meat produced is healthier.

Table 2. Organoleptic (hedonic and hedonic quality) qualities of cock's meat with different IgY concentrations

Testing	Raw meat		Cooked meat	
	A	B	C	D
Hedonic quality				
Color	2.60±0.85	2.76±0.89	-	-
Texture	3.27±0.83	3.53±0.78	3.00±0.87	3.07±0.79
Aroma	3.17±0.91	3.30±0.79	-	-
Hedonic				
Color	2.37±0.99	2.67±0.80	-	-
Texture	2.83±1.02	2.90±0.89	2.63±1.00	2.70±0.70
Aroma	2.70±1.06	2.87±0.90	-	-

A = IgY concentration below 9.30 ± 0.45 mg mL^{-1}
B = IgY concentration above 9.30 ± 0.45 mg mL^{-1}
C = IgY concentration below 9.30 ± 0.45 mg mL^{-1}
D = IgY concentration above 9.30 ± 0.45 mg mL^{-1}

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