

The Effect of Sex and Slaughter Ages on the Chemical Composition, Physical and Sensory Qualities of Merawang Chicken

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ABSTRACT

The purpose of the experiment is to evaluate the effect of sex and slaughter ages on the chemical composition, physical, and sensory qualities of Merawang chicken meat. The materials used in this research were 20 Merawang chickens aged 10 and 20 weeks, consisting of 10 male and 10 female chickens. The variables observed on the chemical compositions included moisture, protein, fat, ash, and carbohydrate contents, while physical quality observation included pH value, water holding capacity (WHC), cooking loss, tenderness, and meat color. The sensory quality included color, odor, texture, tenderness, and acceptability. The data obtained were analyzed statistically using the Nested test. The results of the experiment showed that sex and slaughter ages had a significant effect ($P < 0.05$) on the chemical compositions (moisture, fat, carbohydrate, and ash contents), physical quality (pH, tenderness, color L* and color b*) and sensory quality (odor and tenderness) of Merawang chicken meat. The result showed that sex and slaughter ages had no significant effect ($P > 0.05$) on protein content, WHC, cooking loss, color a*, texture, and acceptability of Merawang chicken meat. This experiment concluded that sex and slaughter ages affected the chemical compositions, especially moisture, fat, carbohydrate, and ash content. Female Merawang chicken meat has higher fat content than male ones but has better tenderness than male Merawang chicken.

Keywords: *Merawang chicken, Sex, Slaughter ages, Chemical composition, Physical and Sensory Qualities.*

1. INTRODUCTION

Merawang chicken is a local chicken from Merawang Village, Merawang District, Bangka Belitung Province, Indonesia. This chicken is a genetic source and asset, as stated by SK Mentan No. 2846/Kpts./LB.4301812012. Makmur et al [1] stated that local chicken is Indonesian germplasm that has the potential to be developed because geographically, it is very supportive of the spread of the population in almost all rural areas in Indonesia.

Currently, the demand for local chicken is increased as reported by [2] from 284,987 in 2016 reached 292,329

tons in 2019. This demand increased due to its taste which is more prevalent among Indonesian consumers [3]. Studies on the Kedu Local chicken revealed that female chicken has higher fat content than male ones [4]. The effect of sex and slaughter ages on the local chicken also has been reported by [5] that affected the weight of carcass and parts of Merawang chicken. However, its effect on the chemical, physical and sensory qualities has not been well known yet. The objective of this experiment is to observe the effect of sex and slaughter ages on the chemical, physical and sensory qualities in Merawang chicken meat.

Table 1. The chemical composition of Merawang chicken meat with different sex and slaughter ages

Variables	Age and Sex			
	10 weeks		20 weeks	
	Male	Female	Male	Female
Moisture content	74.07±0.63 ^a	72.69±1.62 ^b	75.67±0.50 ^a	70.28±2.14 ^b
Protein content ^{ns}	19.99±0.39	20.07±0.39	16.79±4.91	19.31±1.93
Fat content	3.57±1.04 ^a	4.08±1.82 ^b	2.21±0.91 ^a	6.73±2.84 ^b
Carbohydrate content	0.40±0.28 ^c	1.47±0.58 ^c	4.90±4.65 ^d	2.62±2.04 ^d
Ash content	1.71±0.04 ^c	1.70±1.13 ^c	1.37±0.22 ^d	1.43±0.10 ^d

All values expressed as mean ± standard deviation for physical quality.

^{a,b,c,d} mean with different superscript letters in the same row differ significantly (P<0.05)

2. MATERIALS AND METHODS

2.1. Materials

The materials used in this experiment were male and female Merawang chicken with ages of 10 and 20 weeks, buffer pH 4 and 7, aquadest, polyethylene plastic, Sulfuric acid, NaOH-Na₂S₂O₃ solution, boric acid 40%, composite indicator methyl red-methyl blue or methyl-bromine, petroleum ether, asbestos ignited, anti-foaming agent, H₂SO₄ solution, NaOH solution, 10% K₂SO₄ solution, and 95% alcohol. While the equipment used in this experiment were glass beaker, stirrer, knife, cutting board, water bath, tissues, filter paper, glass plate, barbell 35 kg, mica plastic, millimeters block, whiteboard marker, stopwatch, calipers, cylinder, clamp pliers, pH meters "Hanna" HI 98107, electric scale "Ohaus," vacuum machine "Powerpack" DZ300N model, oven "Memmert" UN55 model, warner-bratzler, CR 400 chromameter, grinder, desiccator, porcelain crucible, muffle furnace, electric stoves, Kjeldahl Flask, smoke room, Kjeldahl micro distillatory, Soxhlet, Erlenmeyer, litmus paper, spatula, sensory plate, and questioner paper.

2.2. Methods

Merawang chickens were slaughtered according to the Halal method. The carcasses were cut into several parts such as breast, leg, wings, and back. Chemical composition and color of meat were carried out by sampling Merawang chicken meat parts such as breast, leg, wings, and back consisted of 3 males and 3 females. The physical (pH, tenderness, cooking loss, and water holding capacity of meat) and sensory qualities, the breast was used of each age were 10 consisted of 5 males and 5 females. Physical and sensory qualities observation were conducted at the Laboratory of Meat Science and Technology, Faculty of Animal Science, Universitas Gadjah Mada (UGM), Yogyakarta. Chemical composition and physical quality were determined at the Laboratory of Food Technology and Agricultural Products, Faculty of Agricultural Technology, UGM, Yogyakarta.

The chemical composition (moisture, protein, fat, and ash contents) analyses were carried out according to the [6], while fat content analysis was obtained using the Soxhlet method [7]. Analyze of carbohydrate content analysis was quantified by acid-base hydrolysis (Yenrina, 2015). The physical analysis (pH, cooking loss, and tenderness) was performed based on [8] while Water Holding Capacity (WHC) analysis was carried out according to the [9]. Meat color was measured using a Konica Minolta chromameter (type CR400) calibrated with a standard color close to the meat's color measured by the CIE LAB method [10]. Sensory analysis was assessed with samples of Merawang chicken breast consisting of color, odor, texture, tenderness, and acceptability of the meat, which were tested subjectively by 15 untrained panelists using a questionnaire. The questionnaire contains scores for each parameter using a 5-point hedonic scale, where 5 is 'like very much', 4 is 'like', 3 is 'like moderately', 2 is 'dislike', and 1 is 'dislike very much'

2.3. Data Analysis

The experiment was carried out with two treatments, each with three replications for chemical composition and color and five replications for physical (pH, tenderness, cooking loss, and water holding capacity of meat). Chemical composition, physical and sensory qualities were analyzed statistically using Nested by SPSS program version 25 [11].

3. RESULTS AND DISCUSSION

3.1. Chemical Composition of Merawang Chicken Meat s

The chemical composition of Merawang chicken meat with different sex and slaughter ages is presented in Table 1. The result showed that sex affected the moisture content of Merawang chicken meat indicated by the value (P<0.05) while slaughter ages did not influence its moisture content. It could be because of the higher fat content on the female chicken compared to male ones.

Table 2. The physical quality of Merawang chicken meat with different sex and slaughter ages

Variables	Age and Sex			
	10 weeks		20 weeks	
	Male	Female	Male	Female
pH	5.94± 0.21 ^a	5.76 ±0.76 ^b	6.16±0.05 ^c	6.11±1.28 ^d
Tenderness (kg/cm ²)	2.55±0.14 ^a	1.45±1.03 ^b	2.47±0.31 ^c	2.33±0.24 ^d
Cooking loss (%) ^{ns}	18.32± 2.98	14.65±10.23	20.11±2.16	14.51±10.18
WHC (%) ^{ns}	44.52±10.39	42.65±6.26	43.92±5.65	36.88±7.20
Color				
L*	41.45±0.22 ^a	41.56±0.24 ^b	53.57±1.53 ^c	46.79±0.16 ^d
a*	1.44±0.09 ^a	2.47±0.52 ^b	2.86±1.54 ^a	1.59±0.18 ^b
b*	8.29± 0.33 ^a	10.58±0.16 ^b	5.72±0.26 ^c	4.42±1.21 ^d

All values expressed as mean ± standard deviation for physical quality.

^{a,b,c,d} mean with different superscript letters in the same row differ significantly (P<0.05)

Winarso [12] stated that if the fat content in meat is high, the moisture content in the carcass is lower. Following the study result, the percentage of moisture content of male Merawang chicken meat was higher than female Merawang chicken. Comparing these results (70.28 to 75.67%) with those of [13], the moisture content of local chicken meat was around 63.22%. However, these values are still within the normal range of meat moisture content reported by [14] that the moisture content range of chicken meat is between 65 to 80%.

The result of protein content showed that sex and slaughter ages did not affect the protein content of Merawang chicken meat indicated by the value (P>0.05). The protein contents of this Merawang chicken (16.79 to 20.07%) are within the normal range as stated by [14] that the protein content range of chicken meat is 16 to 22%. The protein content of meat chicken 20 old weeks was lower than meat from 10 old weeks chicken. Sudrajat and Setiyono [15] stated that the older chicken, the meat protein level decreased. The result showed that sex affected the fat content of Merawang chicken meat indicated by the value (P<0.05), while slaughter ages did not influence its fat content. The fat content of female Merawang chicken meat (4.08 to 6.73%) was higher than male Merawang chicken meat (2.21 to 3.57%). Novele et

al. [16] stated that female chicken deposits more body fat than male chicken. The values are still within the normal range of meat fat content, as [17] reported that the fat content range of chicken meat is 1.2 to 12%.

The experiment result showed that slaughter ages affected the carbohydrate content of Merawang chicken meat indicated by the value (P<0.05), while sex did not influence the carbohydrate content. This meat carbohydrate content (0.40 to 4.90%) was higher than the study reported by [18] stated that the carbohydrate content of meat is 0.5 to 1.0%. The ash content and slaughter ages affected Merawang chicken meat's ash content indicated by the value (P<0.05), while sex did not influence the ash content. These meat ash contents (1.37 to 1.71%) are higher than the study reported by [19], which stated that the ash content of local chicken meat is 1.0%. Liur and Tagueha [20] stated that the ash content would increase as chicken age increased. Therefore, it can be argued that twenty weeks old Merawang chicken has a lower ash count than 10 weeks old Merawang chicken due to increased meat moisture content.

Table 3. The sensory quality of Merawang chicken meat with different sex and slaughter ages

Variables	Age and Sex			
	10 weeks		20 weeks	
	Male	Female	Male	Female
Color ^{ns}	3.59±0.32	3.38±0.12	3.45±0.19	3.35±1.17
Odor	3.51±0.07 ^a	3.37±0.07 ^a	3.19±0.15 ^b	3.28±0.13 ^b
Texture ^{ns}	3.41±0.19	3.54±0.18	3.38±0.14	3.27±0.22
Tenderness	3.63±0.12 ^a	3.50±0.14 ^a	3.48±0.14 ^b	3.21±0.29 ^b
Acceptability ^{ns}	3.54±0.19	3.60±0.21	3.55±0.14	3.52±0.18

All values expressed as mean ± standard deviation for physical quality.

^{a,b,c,d} mean with different superscript letters in the same row differ significantly (P<0.05)

3.2. The Physical Quality of Merawang Chicken Meat

The physical quality of Merawang chicken meat with different sex and slaughter ages is presented in Table 2. The result of physical quality showed that sex and slaughter ages affected the pH of Merawang chicken meat ($P < 0.05$). The pH values of the age of 20 weeks (6.11 to 6.16) are higher than the age of 10 weeks (5.76 to 5.94). Following [21], the pH value of the meat ranged between 5.82 to 6.79. [8] stated that the pH of the meat is associated with tenderness, where the meat with high pH has a high tenderness compared with low pH. Meat with a pH above (6.0) contains juice, which causes the meat to be more tender. Sex influences the pH of the meat [22]. The genotype of the chicken and the structure of the muscles on the chicken cause a difference in the pH value of the meat chickens. In contrast, the result of tenderness showed that sex and slaughter ages affected the tenderness of Merawang chicken meat ($P < 0.05$). Purnamasari et al. [23] stated that the age of the relatively slaughter ages cause tenderness of the meat is low and less liked by the panelists.

This experiment showed that sex and slaughter ages did not affect the cooking loss of Merawang chicken meat ($P > 0.05$). Soeparno [8] stated that meat cooking loss generally ranges from 1.5 to 54.5%. While for WHC, the result showed that sex and slaughter ages did not affect the WHC of Merawang chicken meat ($P > 0.05$). Purnamasari et al. [23] stated that the factors affecting WHC are age, breed, feed, temperature and humidity, pH, the formation of actomyosin (rigor mortise), the type of meat, and the location of the muscle, muscle function, and intramuscular fat.

3.3. Sensory Quality of Merawang Chicken Meat

The sensory quality of Merawang chicken meat with different sex and slaughter ages is presented in Table 4. The result showed that sex and slaughter ages affected the odor and tenderness of Merawang chicken meat ($P < 0.05$). In comparison, sex and slaughter ages did not affect the color, texture, and acceptability of Merawang chicken meat ($P > 0.05$). Soeparno [8] stated that an important sensory quality element for meat is the appearance of meat color as it is the first sensory that panelists can see. The fat content and age of the slaughtered chickens, according to [24], influence the odor of chicken meat. According to [25], the food industry relies on odor observation to quickly determine acceptable products. According to [26], the texture is linked to a sense of touch, crucial in forming meat quality. While for tenderness, [27] stated that changes in the collagen molecule will affect chicken meat's tenderness as ages increase. The result showed that sex and slaughter ages did not affect the acceptability of Merawang chicken meat (3.52 to 3.60 as 'like moderately'

to 'like'). Soeparno [8] stated that the value of meat is based on the acceptability of consumers. It is based on the satisfaction from meat consumers depending on physiological and sensory responses among individuals.

4. CONCLUSION

This experiment concluded that sex and slaughter ages affected the chemical compositions, especially moisture, fat, carbohydrate, and ash content. Female Merawang chicken meat has higher fat content compared to male ones. Females Merawang chicken meat has better tenderness than male Merawang chicken.

AUTHORS' CONTRIBUTIONS

Conceptualisation ES. and ROS; methodology ANF, GAR, and YDIS, software ROS, validation E. S., formal analysis E. S. and ROS, investigation ES and ROS, resources E. S. and ROS, writing—original draft preparation ES, R. O. S., ANF, GAR, and Y. D. I. S., writing review and editing E. S., and ROS, visualization ES and ROS, supervision ES and ROS, project administration ES All authors have read and agreed to the published version of the manuscript.

ACKNOWLEDGMENTS

We want to take this opportunity and be thankful for our team projects and all participants who have helped and participated in this project from the Faculty of Animal Science, Gadjah Mada University.

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