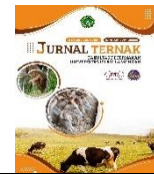




Available online

S4-Accredited – SK No. 85/M/KPT/2020

Journal Page is available at <http://www.jurnalpeternakan.unisla.ac.id/index.php/ternak/index>

The Physical Quality of Broiler Chicken Meat Given Basal Ration Containing Avocado Seed Flour (*Persea Americana Mill*)

Adi Gunawan^a, Edi Erwan^{b*}, Muhamad Rodiallah^c and Zumarni^d

^{a,b,c,d}Animal Science Department, Faculty of Agriculture and Animal Science, State University of Sultan Syarif Kasim Riau, Jl. H.R. Soebrantas No.155 KM.15 Simpang Baru Panam Pekanbaru 28293, Riau, Indonesia

*email: erwan_edi@yahoo.com

ARTICLE INFO

Article history:

Received 17 Nopember 2020
Revised 28 Nopember 2020
Accepted 17 Desember 2020
Available online 31
Desember 2020

Keywords:

Avocado seed flour,
broiler chicken, pH, water
holding capacity and,
cooking loses

IEEE style in citing this article:

A.Gunawan, E. Erwan, M. Rodiallah and Zumarni, "The Physical Quality of Broiler Chicken Meat Given Basal Ration Containing Avocado Seed Flour (*Persea Americana Mill*)", Jurnal Ternak Universitas Islam Lamongan, vol. 11, no. 2, pp. 78 - 85, 2020

ABSTRACT

P Americana Mill contains some phytochemicals such as phenols, saponins, and flavonoids which have beneficial effect on meat quality of broiler chicken. The aim of the present study was to determine the effect of inclusion of avocado seed flour (ASF) in basal diet on meat quality of broiler chickens. A total of 80 broiler chicks of Cobb- strain were randomly assigned with following treatments: T0 (basal ration without ASF as the control), T1 (inclusion of 5% ASF in 1 diet), T2 (inclusion of 10% ASF in diet) and T3 (inclusion of 15% ASF in diet) and were kept for 5 weeks. The parameters measured were meat pH, cooking loses after slaughtering and water holding capacity. The completely randomized design was used in this experiment with 4 treatments and 5 replicates. The result showed that the inclusion of ASF significantly ($P<0.01$) decreased the meat pH and cooking loses after slaughtering but significantly increased ($P>0.01$) water holding capacity. It is concluded that the best level inclusion of ASF in broiler diet in order to improve the physical quality of broiler's meat is 15%.

Jurnal Ternak (Animal Science Journal)
Faculty of Animal science - Lamongan Islamic University) with CC BY NC SA license.

1. Introduction

Nowadays, one of the commodities to meet the needs of animal origin protein for Indonesian people come from a broiler breed. Some of the advantages of broiler chicken aging are the high nutritional value with a soft meat texture, good aroma and taste, and relatively cheap price, so that it is liked by almost everyone [1]. The chemical composition of chicken meat consists of 65.95% water, 18.6% protein, 15.06% fat, and 0.79% ash. Two factors that affect the quality of meat and carcasses are before-slaughter and after-slaughter factors [3]. Some factors before the cutting that affect the quality of meat are genetic, nation, type, species, sex, livestock, age, including feed (antibiotic, and mineral) and stress. Meanwhile, some factors after slaughter that affect the quality of meat are electrical stimulation, harvesting, method of harvesting, carcass pH, and meat, additional

ingredients including meat crushing enzymes, intramuscular fat and storage methods [3].

Avocado seeds contain antioxidants[4] and are thought to have an effect on the physical quality of broiler chicken meat. The natural antioxidants are comprised of phenol derivatives, coumarins, sinamat hydroxy, tocopherols, diphenols, nonphenols, and ascorbic acid [5]. In addition, avocado seeds contain secondary metabolite compounds belonging to the class of alkaloids, triterpenoids, tannins, flavonoids, and saponins [6]. Antioxidants in food contribute an important role to maintain product quality, to prevent rancidity, and to change in nutritional values, discoloration and aroma, and other physical damage caused by oxidation reactions [7]. In previous research, Harahap *et al.* [8] concluded that the use of 5% avocado seed flour in basal rations had no effect on weight gain, ration conversion and income over feed *cost* of broiler chicken. Afterwards, Nurrohman *et al.* [9] reported that the use of 7.5% avocado seed flour in rations did not decrease the ingest of pure metabolic energy despite lowering the ingest of coarse fat. Moreover, Nelwida [10] also reported that the replacement of corn with avocado seed flour does not affect dry ingredients, organic matter and coarse protein of broiler chicken. Nonetheless, research on the influence of avocado seed flour in rations on the quality of broiler chicken meat has never been reported. Based on the description above, the researcher conducted research by inclusion of avocado seed flour (ASF) in basal diet on meat quality of broiler chickens for the quality of meat in broiler chickens.

2. Method

2.1. Material

This study used broiler chickens aged 1 day (DOC) amounted to 80 heads without distinguishing gender (*unsexing*). The ration given in the study was basal ration with the utilization of ASF with different levels of administration. The tools used in the manufacture of ASF were grinder machines, analytical scales, plastics, buckets, and 20 units of battery cage sand on each cage that consisted of 4 chickens. ASF processing was done by means of kapok that was previously cleaned and washed using clean water to remove dirty attached to the surface of avocado seeds. After that, avocado seeds were sliced and boiled for 25 minutes in boiling water (temperature 100°C) to decrease the tannin content in avocado seeds. After the boiling process was finished, avocado seeds were drained by winding, and then sun-dried until dry or using an oven with a temperature of 60 ° C for 10 hours. Lastly, avocado seeds were mashed using a grinder to become flour and can be given to broiler chickens, as well as cage equipment, feed, drinking places, cage lighting lamps, cage cleaning tools, scales and handsprayer. Equipment used for meat sampling are knives, analytical scales, stationery, and plastic clips (sample plastic).

Method

This study applied experimental method using a Complete Randomized Design (CRD) with 4 treatments; P0, P1, P2, and P3. Each treatment was repeated 5 times with respective test consisting of 5 heads. Treatment on this study used ASF rations.

The treatments model used in this study were as follows:

P0 = ration without of ASF (control)

P1 = ration contains 5% of ASF

P2 = ration contains 10% of ASF

P3 = ration contains 15% of ASF

Table 1. Nutritional content of research ration ingredients

Feed Ingredients	Crude Protein (%)	Crude Fiber (%)	Crude Fat (%)	Energy Metabolism (Kcal/kg)	Calcium (%)	Phosphorus (%)
A ^{corn}	8.48	2.08	6.50	3,182 ^c	0.22 ^c	0.60 ^c
Avocado Seed Flour ^b	15.88	13.45	11.12	3,570 ^{and}	0.65	0.13
Fish Meal ^a	47.70	1.99	8.00	3,468 ^c	5.10 ^c	2.80 ^c
Fine Bran ^c	13.2	6.35	6.07	3,350 ^f	0.19	0.73
Soybean Meal ^a	42.72	6.28	3.50	2,955 ^g	0.87 ^g	0.50 ^g
Kapur ^d	-	-	-	-	49.00	-
Vitamin – mineral premix ^c	-	-	-	-	5.38	1.44

Source : a. Results of Laboratory Analysis of Agricultural Products Unri, 2018

b. Results of Laboratory Analysis of Agricultural Products Unri, 2019

c. Pesik *et al.* [11]

d. Departement of Nutrition and Feed Technology, 2013

and. Djulardi [12]

F. Results of Analysis laboratory of Feed Science and Technology Faculty of IPB

G. Fitasari *et al.* [13]

Table 2. The composition and nutritional content of rations used during starter periode

Feed Ingredients	Rations			
	T0 (%)	T1 (%)	T2 (%)	T3 (%)
Corn	47.00	42.00	37.00	32.00
Avocado Seed Flour	0.00	5.00	10.00	15.00
Fish Meal	10.00	10.00	9.50	9.00
Bran	13.00	13.50	14.50	15.50
Soybean Meal	28.50	28.00	27.50	28.00
Lime	1.00	1.00	1.00	1.00
Vitamin – mineral premix	0.50	0.50	0.50	0.50
Amount	100.00%	100.00%	100.00%	100.00%
Nutrition Ration Experiment	T0 (%)	T1 (%)	T2 (%)	T3 (%)
Energy Metabolism (kcal/kg)	3,120.02	3,141.39	3,162.61	3,182.96
Crude Protein (%)	22.64	22.87	22.91	22.96
Crude Fiber (%)	3.79	4.36	4.95	5.54
Crude Fat (%)	5.64	5.88	6.11	6.35
Ca (%)	1.24	1.26	1.26	1.25
P (%)	0.83	0.80	0.77	0.74

Table 3. Composition and nutrient content of rations used during finisher periode

Feed Ingredients	Rations			
	T0 (%)	T1 (%)	T2 (%)	T3 (%)
Corn	55.00	50.00	45.00	40.00
Avocado Seed Flour	0.00	5.00	10.00	15.00
Fish Meal	10.00	9.50	9.00	9.00
Fine Bran	12.50	13.00	13.50	14.50
Soybean Meal	21.00	21.00	21.00	20.00
Lime	1.00	1.00	1.00	1.00
Top Mix	0.50	0.50	0.50	0.50
Amount	100.00%	100.00%	100.00%	100.00%

Nutrition Ration Experiment	T0 (%)	T1 (%)	T2 (%)	T3 (%)
Energy Metabolism (kcal/kg)	3,136.20	3,155.01	3,173.82	3,197.17
Crude Protein (%)	20.05	20.25	20.45	20.52
Crude Fiber (%)	3.45	4.04	4.63	5.20
Crude Fat (%)	5.86	6.09	6.31	6.56
Ca (%)	1.23	1.23	1.23	1.25
P (%)	0.83	0.79	0.76	0.74

Description: Estimated content of ration material nutrition based on trial and error count referring to Table 1.

Research Parameters

The parameters observed in this study were physical quality of broiler chicken meat including pH value, water binding power, and milky broiler cooked chicken meat.

Data Analysis

The data were processed using analysis of variance (ANOVA) to determine the effect of treatment on the observed parameters. According to Steel and Torrie [14], if the result of ANOVA were $P < 0.05$, then Duncan's test would be applied.

3. Results and Discussion

Degree of Acidity (pH) of Meat

Average score and pH broiler breed chicken meat given mixed ration with avocado seed flour can be seen in Table 4.

Table 4. Average pH Value of Meat (%)

Treatment	Meat pH
P0 = Ration Without ASF (Control)	6.04 \pm 0.15 ^a
P1 = ration contains 5% ASF	5.82 \pm 0.14 ^{from}
P2 = ration contains 10% ASF	5.64 \pm 0.16 ^{bc}
P3 = ransum contains 15% ASF	5.53 \pm 0.18 ^c

Description: - ASF = Avocado Seed Flour

- The data displayed is Standard deviation \pm Deviation
- Different superscripts in the same column (lowercase) differ very real ($P < 0.01$)

The pH of broiler chicken meat in this study was ranged from 5.53 to 6.04. The provision of ASF ration up to 15% had a very determinant effect ($P < 0.01$) on the pH of broiler chicken meat. The results obtained were classified in the normal range (1). The greater the level of rationing containing avocado seed flour, the more pH of broiler chicken meat will decrease by almost the same pH. This phenomenon was mutual with a study by Kartikasari et al. [1] that state, the pH of chicken meat ranged from 5.77-5.91. The results of this study were lower compared to the results of Prayitno *et al.* [15] which reported that the average pH value of broiler meat fed with the addition of Virgin Coconut Oil (VCO) pulp resulted in a pH of chicken meat ranging from 6.11 to 6.23. In addition, Soeparno [16] stated that pH ultimate value or normal meat is ranging from 5.4 to 5.8.

Based on the results of this study, the increase in ASF levels in basal rations was followed by decrease in the meat pH value. Further tests showed that ASF administration at the level of 10% and 15% was very noticeable in lowering pH versus control. Nonetheless, the treatment with the provision of ASF at the level of 5% in rations showed no difference from the control. The decrease in

pH value in P3 treatment was suspected because at that level, the ration contained ascorbic acid or vitamin C which was higher than the other treatments. So that, the pH of the meat was also significantly decreased. The one factor that affected the tendering of the meat was the pH value. Meat with high pH (above 6.0) had a higher fat than meat with a low pH (about 6.0) [17]. Literature on the effect of the use of ASF in rations on poultry meat pH and ruminants is still very limited. Previous research have reported that the addition of 6% avocado seed flour in basal ration can improve the quality of quail meat in terms of protein and cholesterol content [4]. Some literature also reported that the influence of the use of other feed ingredients containing flavonoids in the ration was related to meat pH. In addition, it was reported that the addition of alfafa flavonoids to the level of 15mg/kg in basal rations had no effect on the pH of broiler chicken meat [17]. The consumption of broiler chicken rations can have an effect on the pH of meat. According to Soeparno [16], cattle that consume low and high fiber concentrates produce higher pH value than livestock that consume feed that contains high concentrations and low fiber.

The animals' muscle tissue during their lifespan have pH of about 7.2-7.4 and will decrease after cutting[7]. According to Soeparno [16], variations in *postmortem* muscle pH values are influenced by *postmortem* glycolysis rates, muscle glycogen reserves, ulcerable meat pH, stress before cutting, administration of certain hormones and medications, livestock individuals, muscle kinds, electrical stimulation, and enzyme activity. Lawrie [18], added that high temperatures can also accelerate the decline of *postmortem* muscle pH.

Meat Water Binding Power

The average score water binding power of broiler chicken meat fed avocado seed flour (*Persea americana* Mill.) is displayed in the Table 5.

Table 5. Average Value of Meat Water Binding Power

Treatment (%)	Meat Water Binding Power (%)
P0 = Ration Without ASF (Control)	33.35±1.55 ^a
P1 = Ransum contains 5% ASF	35.39±1.37 ^b
P2 = Ransum contains 10% ASF	38.59±0.99 ^c
P3 = Ration contains 15% ASF	40.20±1.47 ^c

Description: - ASF = Avocado Seed Flour

- The data displayed is Standard deviation ± Deviation
- Superscripting different letters in the same column (lowercase) is very real (P<0.01)

The water binding power of broiler chicken meat in this study ranged from 33.35% to 40.20%. The provision of ASF up to the level of 15% in rations had a very determinant effect (P<0.01) on the water binding power of broiler chicken meat. This was thought to be the cause as ASF contained a number of bioactive substances phenolic compounds that had hydroxyl groups, which were weak acidic and had one of the functions of regulating proteins [17]. Phenolic compounds will coagulate and bind to proteins in broiler meat and can inhibit the content of free water, thereby, increasing the water binding value in meat. According to Ockerman [19], the difference in the meat water binding value is influenced by the protein content. The result of this study is in line with the research of Prayitno *et al.* [15] The average of water binding value of broiler chicken meat fed with the addition of Virgin Coconut Oil (VCO) pulp ranges from 30.93% to 42.21%. Mega *et al.* [20], reported a partial turnover of commercial rations with corn and its effect on the physical quality of broiler meat resulting in water binding power of 15.70% to 34.40%, lower than the results of this study.

This research showed that the value of meat water binding power increases in line with the increase in ASF levels in basal rations. Further test results showed that the average water binding

value of broiler chicken meat ranged from 33.35% to 40.20%. The increase in the meat water binding power is suspected because ASF contained flavonoids that can cause an inhibitory reaction denaturation of protein (loss of protein structure and function due to stress) [21]. The increase in the meat water binding power is in line with the increasing percentage of ASF in the ration. The protein in meat does have a role in contributing the water binding power [18]. High content of protein will be direct proportion to the ability to withstand water in meat, as to lower the free water content. The larger amount of water that comes out, the less the water binding power will be. Forrest *et al.* [22] states that the capacity of water binding is an important quality factor because it can affect the physical state of the meat such as tenderness, color, texture, juiciness and meatbinding.

The average value of the highest meat water binding power in the P3 treatment is 40.20%, while the average value of the lowest meat water binding power in the P0 treatment is 33.35%. This is allegedly due to the decrease in meat pH content. Consequently, the result of this study showed that the increase of chemical activity in meat was to maintain water content, and to improve the nutritional quality of broiler chicken meat. According to Soeparno [23], the meat water binding power is about 20-60%. The binding capacity of the water is also affected by the pH of the meat [24]. Decreased pH values leads to decrease in meat fat levels. Purnamasari *et al.* [25] adds that the decrease in meat fat lead to increase in the amount of meat protein. Oktaviana [26] states that if the protein content of broiler chicken meat is getting higher, then the meat water binding power is also higher and lower fat levels simultaneously.

Shrink Cook

The average value of cooked broiler chicken meat fed avocado seed flour (*Persea americana* Mill) displayed in Table 6.

Table 6. Average Value of Shrinking Cooked Meat (%)

Treatment (%)	Shrink Cook Meat
P0 = 100% Ration Without ASF (Control)	25.51±2.51 ^c
P1 = 100% ration contains 5% ASF	24.63±2.09 ^{bc}
P2 = 100% ration contains 10% ASF	22.39±1.95 ^{from}
P3 = 100% ration contains 15% ASF	20.40±1.25 ^a

Description: - ASF = Avocado Seed Flour

- The data displayed is Standard deviation ± Deviation
- Superscripting different letters in the same column (lowercase) is very real (P<0.01)

The number of cooked broiler chicken meat in this study ranged from 20.40% to 25.51%. The highest average score of cooked meat is the P0 treatment with the value of 25.51%. Meanwhile, the average value of the lowest meatcooker is the P3 treatment which is 20.40%. The results of this study are classified in the normal range because it is approximately the same with a reported study. [15] The study had the average value of cooked broiler chicken meat fed with the addition of Virgin Coconut Oil (VCO) pulp ranges from 18.87% to 26.79%. Similar average values were also reported by Hamiyanti *et al.* [27]. The research showed that the influence of the addition of basil flour (*Ocimum basilicum*) to the chemical composition and physical quality of broiler meat produces a cooking shrink by 26.41% to 27.82%. The value of cooked milk on the influence of the addition of basil flour (*Ocimum basilicum*) which almost the same as this study is predicted as both contains flavonoids that affect the value of cooked milk. The provision of ASF up to the level of 15% in rations has a very determinant effect (P<0.01) on the cooked broiler chicken meat. Based on the results of this study, it can be seen that the increase in ASF levels in basal rations causes the milky value of cooked meat to decrease. This

is predicted as the percentage of ASF ration given containing different phenolic compounds. This combination results in decreased cooked milk, in contrast with the increase in meat protein coagulation and the increase in water binding power.

This is due to the amount of chemical activity of proteins that are degraded by the process of sedation. The cooked milk is one of the important determinants of meat quality, because it is related to the small amount of water lost and the quality of nutrients that are soluble in water due to the influence of temperature and cooking. Quality meat has a low cooking shrink [28]. Cooked shrink more due to the melting of fat [18].

The greater the level of ration containing ASF, the better quality the cooked broiler chicken meat will be. The value of cooked milk in this study was influenced by the water binding power of broiler chicken meat. High water binding value produces low cooked milk, on the contrary, low water binding value will result in high cooking shrink. According to Yanti *et al.* [29], some factors that influence the milking of the cooked meat is the water binding power, water content. The higher the water binding power, the lower the water content in the meat. So that, the more cooked milk, the lower the meat quality. Generally, the range of cooked shrink value varies between 1.5% to 54.5% with a range of 15% to 40% [16].

4. Conclusion

This study concludes that the use of avocado seed flour (*Persea Americana Mill*) at the level of 15% in basal rations can improve the physical quality of broiler chicken meat.

5. References

- [1] L. R. Kartikasari, B. S. Hertanto, I. Santoso, and A.M. P. Nuhriawangsa, "Physical Quality of Broiler Chicken Meat Given Corn And Soybean Based Feed With Purslane Flour Supplementation (*Portulaca Oleracea*)," *Journal of Food Technology*, Vol. 12 No. 2, 2018.
- [2] W. J. Stadelman, V.M. Olson, G.A. Shmwell, S. Pasch, "Egg and Poultry Meat Processing," Ellis Haewood Ltd, 1988.
- [3] A. N. Haq,D. Septinova, and P. E. Santoso, "The Physical Quality of Meat from Traditional Markets in Bandar Lampung," *Integrated Livestock Scientific Journal*, Vol. 3(3): 98-103, 2015.
- [4] E. Tugiyanti, & N. Iriyanti, and Y.S. Apriyant. The effect of avocado seed powder (*Persea americana Mill.*) on the liver and kidney functions and meat quality of culled female quail (*Coturnix coturnix japonica*). *Veterinary World*. 12. 1608-1615. 10.14202/vetworld.2019.1608-1615. 2019
- [5] Meronda, G.Rahma, "Antioxidant and sukesteran food supplementary ingredients," Hasanuddin University, Makasar,2008.
- [6] M. Marlinda, M. S. Sangi, and A. D. Wuntu, "Analysis ofsecondary metabolite compounds and toxicitytest of ethanol extract of avocado seeds (*Persea americana Mill.*) ," *J MIPA Unsrat*. 1(1) : 24-28,2012.
- [7] C. H. Widjaya, " TheRole ofAntioxidants AgainsttheBody," HealthyChoice, Edition IV,2008.
- [8] K.M. N. Harahap,E. Erwan,R. Misrianti, "Utilization of Avocado Seed Flour (*Persea americana Mill.*) in Rations on Broiler Chicken Performance," *Sriwijaya Livestock Journal*,Vol. 8, No. 2, pp. 45-57, 2019.
- [9] A. Nurrohman, V. D. Yunianto and I. Mangisah, "TheUse of Avocado Seed Flour and Its Effect onThe Ingest of Coarse Fat and Metabolic Energy of Broiler Chicken Rations," Research Report, Faculty of Animal Husbandry and Agriculture, DiponegoroUniversity, Semarang,2015.

- [10] Nelwida, "Effect of Replacement of Corn with Avocado Seeds soaked in Hot Water in Rations Against Retention of Dry Ingredients, Organic Materials and Crude Proteins in Broiler Chickens," *Scientific Journal of Animal Husbandry Sciences*, 12(1): 50-56, 2009.
- [11] H.C. Pesik, J. F. Umboh, C. A. Ratulanga, S. Pontoh, "The effect of replacing fish meal with manggot flour (*Hermetia illucens*) in broiler rations against calcium and phosphorus ingest," *Zoetek Journal*, 36. 271-279, 2016
- [12] A. Djulardi, "Broiler Chicken Response to partial replacement of corn with avocado seed flour in rations," *Journal of Scientific Animal Husbandry Sciences*, 7. 18- 24, 2004.
- [13] E. Fitasari, K. Reo, N. Niswi, "Use of Different Protein Levels in Native Chickens Against The Appearance of Protein Production and Dilution," *Journal of Animal Husbandry Sciences*. 26, 73-83, 2016.
- [14] R. G. D. Steel, and J. H. Torrie, "Statistical Principles and Procedures," Gramedia. Jakarta, 1993.
- [15] A. H. Prayitno, E. Suryanto, and Zuprizal, "Physical and Sensory Quality of Broiler Chicken Meat Fed with The Addition of Virgin Coconut Oil Pulp (VCO)," *Bulletin Of Animal Husbandry*, 34(1): 55-63, 2010.
- [16] Soeparno, "Meat Science and Technology," 4th Printing, Gadjah Mada University Press, Yogyakarta, 2005.
- [17] K. Ouyang, M Xu, Y. Jiang, and W Wang, Effect of alfalfa flavonoids on broiler performance, meat quality, and gene expression. *Canadian Journal of Animal Science* 96(3) : 332-341. 2016
- [18] R. A. Lawrie, "Meat Science," 5th Edition, Translated by Parakkasi, A., and Y. Amwila, University of Indonesia Press, Jakarta, 2003.
- [19] H. W. Ockerman, "Chemistry of Meat Tissue 10th Ed," Department of Animal Science The Ohio State University and The Ohio Agriculture Research and Development Centre, Ohio, 1983.
- [20] Mega, Olfa, B. Brata, and S. Johan, "Partial Replacement of Commercial Rations oleh Corn and Its Effect on the Physical Quality of Broiler Meat," *Journal of Livestock Sciences*, 19(1): 17-26, 2016.
- [21] Antasionasti, I. S. Riyanto and A. Rohman, (Antioxidant activities and phenolics contents of avocado (*Persea americana* Mill.) peel *in vitro*. *Res. J. Med. Plants*, 11(2): 55-56. 2017
- [22] G. J. Forrest, Aberle, H. B. Hendrick, M. D. Judge, and R. A. Merkel, "Principles of Meat Science," W.H. Freeman and Company, San Francisco, 1975.
- [23] Soeparno, "Meat Technology Science," PT Gramedia Pustaka Utama, Jakarta, 2009.
- [24] C. Alvarado, and S. McKee, "Marination to improve functional properties and safety of poultry meat," *J. Appl. Poult. Res*, 16: 113-120, 2007.
- [25] E. Purnamasari, Mardiana, Y. Fazila, W. H. Z. Nurwidada, and D. Febrina, "The physical and chemical properties of beef marinated in betel nut juice (*Areca catechu* L.)," *National Seminar on Livestock and Veterinary Technology*, 19(2): 216-226, 2013.
- [26] D. Oktaviana, "The influence of virgin coconut oil pulp in rations on performance, carcass production, fatty, antibodies and microscopic muscles and digestive organs of broiler chickens," *Thesis, Faculty of Animal Husbandry UGM*, Yogyakarta, 2009.
- [27] A. A. Hamiyanti, B. Sutomo, A. F. Rozi, Y. Adnyono, and R. Darajat, "The effect of the addition of basil flour (*Ocimum basilicum*) to the chemical composition and physical quality of broiler meat," *Journal of Animal Husbandry Sciences*, 23(1): 25-29, 2013.
- [28] I. W. S. Dilaga, and Soeparno, "The effect of giving various levels of clenbuterol to the quality of male pork grower," *Bulletin Of Animal Husbandry*, 31(4): 200-208, 2007.
- [29] H. Yanti, Hidayati, and Elfawati, "Quality beef with pe plastic packaging (*Polyethylen*) and PP plastic (*Polypropylen*) in the market arengka pekanbaru city," *Jurnal Peternakan*, 5(1): 2-27, 2008.