



Physical and Chemical Qualities of Spent Layer Duck Meat Fed Diets Supplemented with *Garcinia atroviridis* Leaf Meal

DEDE KARDAYA*, DEWI WAHYUNI, ELIS DIHANSHIH

Universitas Djuanda, Indonesia.

Abstract | This study aims to improve the physical and chemical qualities of the meat of spent layer duck through *Garcinia atroviridis* supplementation. Although their meat quality is not as good as that of young ducks, spent layer ducks can still be used as a meat source. In general, quality of ducks' meat can be improved by providing the ducks with rations that meet their needs for nutrients. However, to improve the meat quality of spent layer ducks, relying on the provision of rations is not appropriate; antioxidant supplementation is considered necessary. Leaves of Asam gelugur (*Garcinia atroviridis*) contain hydroxy citric acid and other active substances that function as antioxidants, so the use of them in ration is expected to improve the meat quality of spent layer ducks. Sixty spent layer ducks were fed four rations including commercial rations (R1), nonconventional rations + 2% Asam gelugur leaf meal (AGLM) (R2), nonconventional rations + 4% AGLM (R3), and nonconventional rations + 6% AGLM (R4) in a completely randomized design with five replicates containing three ducks each. Ducks were reared in battery cages for five weeks. Measurements were taken on meat physical quality (pH, water binding capacity, cooking loss, tenderness) and chemical quality (moisture content, protein, fat, ash, and phosphorus) parameters. Data were subjected to an analysis of variance and a Duncan's multiple range test. Results revealed that meat cooking loss and fat content were significantly lowered ($P < 0.05$) in ducks treated with treatment rations. No significant differences were found in other physical and chemical quality parameters. It was concluded that supplementation of 2, 4, and 6% AGLM reduced cooking loss and fat content of spent layer duck meat.

Keywords | Antioxidant, Cooking loss, Hydroxy citric acid, Spent layer duck, Nonconventional rations

Received | April 13, 2022; **Accepted** | May 20, 2022; **Published** | July 15, 2022

***Correspondence** | Dede Kardaya, Universitas Djuanda, Indonesia; Email: dede.kardaya@unida.ac.id

Citation | Kardaya D, Wahyuni D, Dihansih E (2022). Physical and chemical qualities of spent layer duck meat fed diets supplemented with *Garcinia atroviridis* leaf meal. J. Anim. Health Prod. 10(3): 347-351.

DOI | <http://dx.doi.org/10.17582/journal.jahp/2022/10.3.347.351>

ISSN | 2308-2801



Copyright | 2022 by the authors. Licensee ResearchersLinks Ltd, England, UK.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

Ducks are primarily reared for producing eggs and meat. They are usually reared for egg production until 72 weeks before rejection. The rejected ducks, usually known as spent laying ducks, can still be used as meat source even though the quality of the meat is not as good as that of young ducks. The meat of spent layer duck has a high-fat content, a tough texture, and a sharper off-flavor (Rukmiasih et al., 2011). As waterfowl, ducks have more

subcutaneous fat. The fat content of duck meat is two times higher than that of chicken meat and mainly consisted of unsaturated fatty acids, which often cause off-flavor in duck meat (Hustiany, 2001). This has made demand for duck meat lower than that for broiler meat.

Meat palatability is the primary sensory trait of consumer acceptance (Choi & Kim, 2009). The main attribute of palatability that influences consumer acceptance and consumer decision is tenderness (Grunert et al., 2004; Men-

necke et al., 2007; Piao et al., 2015). Physical and chemical qualities of animal meat can, in general, be improved by providing the animal with ration supplying nutrients needed by the animal. However, in spent layer ducks, this is considered inappropriate and antioxidant supplementation in ration is required.

The leaves of Asam gelugur (*Garcinia atroviridis*) contain hydroxy citric acid and other active substances having antioxidative property. The use of Asam gelugur leaf meal (AGLM) by up to 6% in rations of spent layer ducks did not give significant effects on their performance, but it lowered cholesterol and low density lipoprotein cholesterol and increased triglycerides in meat (Dihansih et al., 2019). Based on the above notion, a study on the supplementation of AGLM in rations of spent layer ducks and its effects on the physical and chemical qualities need to be conducted.

MATERIALS AND METHODS

36 MATERIALS AND EXPERIMENTAL DESIGN

41 applicable international, national, and institutional guidelines for the care and use of animals were followed. The research was conducted for five weeks in the Trial Farm of the Animal Science Department, Djuanda University. Sixty spent layer ducks aged 72 weeks were allocated into 4 treatments in a completely randomized design. Treatments consisted of commercial rations (R1), nonconventional rations +2% AGLM (R2), nonconventional rations +4% AGLM (R3), and nonconventional rations +6% AGLM (R4). Each treatment consisted of 5 replicates and 3 ducks were allocated into each replicate. Nonconventional rations were formulated from corn, rice bran, soybean meal, 26 fish meal, fermented coconut meal, and palm kernel cake fermented by *Aspergillus niger*, and AGLM (Table 1).

RESEARCH PROCEDURES

Prior to the commencement of the trial, cages and all equipment were cleaned and disinfected. Ducks were physically examined to assure that only those with excellent health and physical conditions were used. The ducks were then weighed before they were randomly placed into individual cages.

Asam gelugur leaves were sun-dried before they were dried in an oven at 62°C. Dried leaves finely ground by using a blender to produce AGLM. Treatment rations were fed to the animals in gradual amount within a week feeding adaptation period. Full amount of treatment rations was given within five-week feeding period.

15 In the end of the feeding period, ducks were slaughtered in accordance to Islamic slaughtering method. The slaugh-

tered ducks were hung to drain the blood as completely as possible before the feather were 16 remove to get the carcass. After the carcass was obtained, samples of breast meat were taken and subjected to physical and chemical quality tests.

MEASURED PARAMETERS

Measurements were taken on meat physical quality parameters including pH, tenderness, water binding capacity, and cooking loss and meat chemical quality parameters including water, protein, fat, crude fiber, ash, and phosphorus content.

Meat pH values were measured by using a calibrated pH meter based on the method adapted from van Laack et al. (2000). Meat tenderness was examined based on the method used by Bouton et al. (1976) as follows:

Cooking loss (%) = (initial weight-final weight)/(initial weight)×100%.

Free water content in the meat is an indicator that determines the binding power of water in the meat. In this study, it was measured by using 0.3 g of a sample placed between 2 sheets of filter paper number 41 and then pressed with a load of 35 kg/cm² on an iron plate for 5 minutes. The area on the filter paper was covered with flattened meat samples, and the wet area around it was marked (Soeparno 2005). Meat free water content was calculated by using the following formula:

$$23 \text{ H}_2\text{O}(\text{mg}) = (\text{wet area (cm}^2\text{)})/0.0948-8.0.$$

The percentage of free water is calculated using the following formula:

$$\text{H}_2\text{O}(\%) = (\text{H}_2\text{O}(\text{mg})) / (300 \text{ mg}) \times 100\%.$$

The nutritional contents of meat (water, protein, crude fiber, ash, and phosphorus content) were analyzed by using the AOAC (2005) procedure.

11 STATISTICAL ANALYSIS

Data were subjected to an analysis of variance (ANOVA) and a Duncan's multiple range test using the SPSS 25 application.

RESULTS AND DISCUSSION

MEAT PHYSICAL QUALITY

Meat of spent layer ducks fed diets supplemented with AGLM was shown to have significantly different cooking loss but no differences in other physical quality parameters were found (Table 2). The average meat pH ranged from 6.00 to 6.09, however, no significant effects (P>0.05) of AGLM supplementation were found. For comparison, breast meat of male and female Pekin ducks

Table 1: Nutrient composition of the experimental ration.

Composition	Experimental ration			
	R1	R2	R3	R4
Water content (%)	11.61	10.74	10.23	9.21
Ash (%)	8.43	7.71	7.54	7.80
Extract ether (%)	2.57	3.76	3.74	3.34
Crude protein (%)	13.32	13.08	13.18	12.00
Crude fiber (%)	4.25	6.20	8.97	9.30
Nitrogen free extract (%)	59.82	58.51	56.34	58.35
Gross energy (kcal/kg)	3814	4099	3918	4022

R1 = ration + 0% of Asam gelugur leaf meal (AGLM), R2 = ration + 2% AGLM, R3 = ration + 4% AGLM, and R4 = ration + 6% AGLM.

Table 2: Average physical quality of spent layer duck meat fed Asam gelugur leaf meal in unconventional rations.

Variables	Experimental ration			
	R1	R2	R3	R4
Tenderness (kg/cm ²)	6.04±0.06	6.06±0.26	6.00±0.02	6.09±0.08
Cooking loss (%)	5.69±0.38	5.40±0.44	5.45±0.53	5.12±0.32
Water holding capacity (%)	49.46±2.62 ^a	46.65±2.26 ^b	43.35±0.35 ^a	42.44±0.33 ^a
	39.58±1.86	39.81±0.92	42.22±2.37	41.80±1.97

Different superscripts on the same row showed significantly different results ($P < 0.05$).

R1 = ration + 0% of Asam gelugur leaf meal (AGLM), R2 = ration + 2% AGLM, R3 = ration + 4% AGLM, and R4 = ration + 6% AGLM.

Table 3: Chemical quality of spent layer duck meat fed with Asam gelugur leaf meal in nonconventional feed.

Variables (%)	R1	R2	R3	R4
Water content	71.96±2.46	71.39±0.90	72.55±2.10	71.88±1.08
Crude protein	15.40±0.87	15.18±0.51	15.22±0.78	15.09±0.55
Crude fat	20.03±0.49 ^b	12.64±1.52 ^a	15.10±0.56 ^a	13.85±1.05 ^a
Crude fiber	0.24±0.07	0.21±0.10	0.25±0.10	0.30±0.05
Ash	4.81±0.20	4.79±0.25	4.58±0.25	4.85±0.09
Phosphorus	0.75±0.01	0.74±0.01	0.73±0.01	0.74±0.01

Different superscript on the same row shows significantly different results ($P < 0.05$).

R1 = ration + 0% of Asam gelugur leaf meal (AGLM), R2 = ration + 2% AGLM, R3 = ration + 4% AGLM, and R4 = ration + 6% AGLM.

aged 112 weeks had pH values of 5.7 to 6.1 and 5.8 to 6.2, respectively (Kokoszynski et al., 2020). In recent studies, meat pH of the spent layer ducks was in the same range as that of layer ducks (5.81–6.62) (Alvarado & Sams, 2000; Wawro et al., 2004; Qiao et al., 2015). A high meat pH value was associated with a shorter shelf life (Lacin et al., 2008) and darker color (Fletcher et al., 2000).

In recent studies, the average tenderness of spent layer ducks was 5.12–5.69 kg/cm², which was almost the same as that (5.20–5.88 kg/cm²) of meat at 9-week old Muscovy duck (Tugiyanti et al., 2013; Qiao et al., 2017). However, these meat tenderness figures spent layer duck were lower than those of spent layer hens (1.26 kg/cm²) (Semwogerere et al., 2018) and crossbred ducks (Oiao et al., 2016). In an-

other study by Hadi et al. (2021) feeding spent layer ducks with different types of vegetable oils including 4% palm oil, 4% canola oil, and soybean oil resulted in meat tenderness of 2.98 ± 0.53, 2.28 ± 0.44, and 2.38 ± 0.43 g/cm², respectively. Meat tenderness of spent layer duck was shown to be similar results ($P > 0.05$) among the treatments (Table 2). This insignificant meat tenderness between treatments was thought to be closely related to the same muscle fiber diameter size of spent layer ducks in each treatment. This agrees with those of Lepetit (2008) who found a close relationship between muscle fiber diameter and meat tenderness; meat with a smaller muscle fiber diameter tends to be more tender.

In this study, meat cooking loss was found to be signifi-

cantly different ($P < 0.05$). The highest meat cooking loss (49.46%) was found in the control group. Supplementation of 2, 4, and 6% AGLM resulted in lower cooking loss ($P < 0.05$) of 46.65, 43.35, and 42.44%, respectively. Meanwhile, in a study by Ali et al. (2017), the inclusion of rice meals in rations did not change the cooking loss of the duck meat. However, in another recent study, the cooking loss was higher than that 20.26–21.08% reported by Qiao et al. (2016). Moreover, in 110-week-old Peking ducks, the cooking loss of males duck meat was higher than that of females (Kokoszynski et al., 2020). In contrast, sex did not influence cooking loss (Tanganyika & Webb, 2019). The cooking loss was closely correlated with meat final product; therefore, it became an essential indicator of meat quality in the food industry (Huda et al., 2011). A lower value of the cooking loss indicated a better meat quality (Patriani et al., 2021). Cooking loss is also an indicator of water holding capacity (WHC), which influences meat quality (Tanganyika & Webb, 2019).

In this study, WHC value of spent layer duck meat ranged from $39.58 \pm 1.86\%$ to $42.22 \pm 2.37\%$ and was not significantly changed with the administration of AGLM. These findings indicated that the inclusion of AGLM in ration by up to 6% did not improve meat ability to bind and retain free water. Insignificant differences in meat WHC values found in this study might be attributed to the way AGLM was used. In this study, AGLM was prepared as a feedstock used in ration formulation. Patriani et al. (2021) found that the use of Asam gelugur fruit as a material to marinate meat of culled chickens significantly increased meat WHC values. Meat WHC values in this study were lower than those rejected duck meat soaked 1% NaCl solution (Sumarmono & Warsito, 2010) and of culled chicken meat marinated with Asam gelugur fruits (54.06 ± 3.62) (Patriani et al., 2021), but higher than that (13.28%) of duck meat marinated with 10% ginger extract (Suryanti et al., 2015). In another study that used various types of vegetable oils included in rations, WHC values were not significantly changed (Hadi et al., 2021).

MEAT CHEMICAL QUALITY

The inclusion of 2, 4, and 6% AGLM in rations was found to result in meat containing significantly ($P < 0.05$) lower fat content. No differences were found in other nutrient contents of the meat (Table 3). This lowered meat fat content in treated groups might be attributed to the fact that HCA which is much contained in AGLM increases carbohydrate oxidation rate which then leads to reduced availability of fatty acids to be deposited as adipose tissue (de novo synthesis). Furthermore, inhibited fat accumulation results in greater oxidation of the existing fat tissue to produce energy (Chuah et al., 2013) which, in turn, results in a lower meat fat content.

In this study, the water content of the spent layer duck meat ranged from 71.39% to 72.55%. In a previous study, the water content of duck meat was almost the same as that 71.3–73.3% of meat of spent layer ducks given rations containing 2.91–8.26% ginger (Yadnya et al., 2010) but slightly lower than that 73.29–75.42% of the spent layer duck meat reported by Qiao et al. (2016) and somewhat higher than that 66.2–71.1% of the spent layer Pekin duck meat (Kokoszynski et al., 2020).

Meat protein contents (15.09–15.40%) were not found to be significantly different. These figures of protein contents were lower than those (22.14–24.34%) of meat of 500-day-old spent layer ducks and those (21.73 – 21.96%) of meat of Cerry Valley ducks (Qiao et al., 2016).

CONCLUSIONS

It was concluded that the inclusion of AGLM by up to 6% in rations improved cooking loss and reduce fat content of spent layer duck meat.

ACKNOWLEDGEMENTS

Funding assistance from The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia under the scheme of Applied Research Grant, Decree No. 09/E1/KPT/2021 dated 1 February 2021 and Contract Agreement No. 235/SP2H/LT/DRPM/2021 dated 12 March 2021 was acknowledged.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS CONTRIBUTIONS

Dede Kardaya worked on conceptualization, methodology, supervision, and validation. Dewi Wahyuni worked on investigation, data analysis, and project administration. Elis Dihansih developed proposal and conceptualization.

REFERENCES

- Ali S, Kang GH, Yang HS, Jeong JY, Hwang YH, Park GB, Joo ST (2007). A comparison of meat characteristics between duck and chicken breast. *Asian-Austra. J. Anim. Sci.* 20, 1002–1006. DOI: <https://doi.org/10.5713/ajas>.
- Alvarado CZ, Sams AR (2000). Rigor mortis development in turkey breast muscle and the effect of electrical stunning. *Poult. Sci.*, 79 (2000), pp. 1694–1698. <https://doi.org/10.1093/ps/79.11.1694>
- AOAC (2005). Official methods of analysis of AOAC International. AOAC International. 18th edition, Association of Official Analytical Chemists, Washington

- DC, USA.
- Bouton PE, Harris PV, Shorthose WR (1976). Factors influencing cooking losses from meat. *J. Food Sci.*, 41(5): 1092-1095.
- Choi YM, Kim BC (2009). Muscle fiber characteristics, myofibrillar protein isoforms, and meat quality. *Livest. Sci.* 122(2-3): 105-118. <https://doi.org/10.1016/j.livsci.2008.08.015>
- Chuah LO, Ho WY, Beh BK, Yeap SK (2013). Updates on antiobesity effect of garcinia origin (-)-HCA. *Evidence-Based Complementary and Alternative Medicine*. <https://doi.org/10.1155/2013/751658>.
- Dihansih E, Kardaya D, Wahyuni D (2019). Performa Dan Profil Lemak Darah Itik Afkir Yang Diberi Tepung Daun Asam gelugur Pada Ransum Nonkonvensional Terfermentasi. *J. Peternakan Nusantara*. vol 5 No. 2:105-110.
- Fletcher DL, Qiao M, Smith DP (2000). The relationship of raw broiler breast meat colour and pH to cooked meat colour and pH. *Poult. Sci.* 79: 784-788. <https://doi.org/10.1093/ps/79.5.784>.
- Grunert KG, Bredahl L, Brunso K (2004). Consumer perception of meat quality and implications for product development in the meat sector—a review. *Meat Sci.*, 66(2): 259-272. [https://doi.org/10.1016/s0309-1740\(03\)00130-x](https://doi.org/10.1016/s0309-1740(03)00130-x)
- Hadi R, Sudiyono, Khusna W (2021). Physical quality of local duck meat with addition of different vegetable oils in the ration. *IOP Conference Series: Earth Environ. Sci.* 637. 012083. <https://doi.org/10.1088/1755-1315/637/1/012083>.
- Huda N, Putra AA, Ahmad R (2011). Proximate and physicochemical properties of Peking and Muscovy duck breasts and thighs for further processing. *J. Food Agric. Environ.* 9:82-88.
- Hustiany R (2001) Identifikasi dan Karakterisasi Komponen Off-Odor pada Daging Itik. [Tesis]. Sekolah Pascasarjana Institut Pertanian Bogor, Bogor. 78 hlm. <http://repository.ipb.ac.id/handle/123456789/4938>.
- Kokoszynski D, Wilkanoswka A, Arparsova H, Hrncar C (2020). Comparison of some meat quality and liver characteristics in Muscovy and mule ducks. *Archiv. Anim. Breed.* 63(1)137-144. <https://dx.doi.org/10.5194%2Faaab-63-137-2020>.
- Lacin E, Aksu MI, Macit M, Yildiz A, Karaoglu M, Esenbuga N, Yoruk MA (2008). Effects of different raising systems on colour and quality characteristics of Turkish Pekin duck meats. *S. Afr. J. Anim. Sci.* 38: 217-223. <https://doi.org/10.4314/sajas.v38i3.4123>.
- Lepetit J (2008). Collagen contribution to meat toughness: Theoretical aspects. *Meat Sci.* 80:960-967. <https://doi.org/10.1016/j.meatsci.2008.06.016>.
- Mennecke BE, Townsend AM, Hayes DJ, Lonergan SM (2007). A study of the factors that influence consumer attitudes toward beef products using the conjoint market analysis tool. *J. Anim. Sci.*, 85(10): 2639-2659. <https://doi.org/10.2527/jas.2006-495>.
- Patriani P, Hafid H, Wahyuni TH, Sari TV (2021). Physical quality improvement of culled chicken meat with marinated technology using Gelugur acid (*Garcinia atroviridis*) biomass. In *IOP Conference Series: Earth and Environmental Science* (Vol. 749, No. 1, p. 012001). IOP Publishing.
- Piao MY, Jo C, Kim HJ, Lee HJ, Kim HJ, Ko JY, Baik M (2015). Comparison of carcass and sensory traits and free amino acid contents among quality grades in loin and rump of Korean cattle steer. *Asian-Australasian J. Anim. Sci.*, 28(11): 1629. <https://dx.doi.org/10.5713%2Fajas.15.0128>.
- Qiao Y, Huang J, Chen Y, Chen H, Zhao L, Huang M, Zhou G (2016). Meat Quality , fatty acid composition and sensory evaluation of cherry valley, spent layer, and crossbred ducks. *Anim. Sci. J.* 88 issue 1. <https://doi.org/10.1111/asj.12588>.
- Rukmiasih PS, Hardjosworo, Ketaren, Mattitaputy PR (2011). Use of beluntas, vitamin C and E as an antioxidant for reducing off-odor of Alabio and Cihateup duck meat. *JITV* 16(1): 9-16. <https://doi.org/10.14334/jitv.v16i1.629>.
- Semwogerere F, Neethling J, Muchenje V, Hoffman LC (2018). Effects of production systems on the carcass and meat quality characteristics of spent laying hens. *Poult. Sci.*, 97 (2018), pp. 1990-1997. <https://doi.org/10.3382/ps/pey074>.
- Soeparno (2005). Ilmu dan Teknologi Daging. Gadjah Mada University Press, Yogyakarta.
- Sumarmono J, Warsito S (2010). Functional Characteristics of Spent Duck Meat for Use in Emulsion-Type Meat Products. *Indonesian J. Anim. Prod.*, 12(1): 55-59.
- Suryanti U, Bintoro VP, Atmomarsono U, Pramono YB (2015). Physical characteristics of culled magelang duck meat affected by aging and marination in ginger extract. *J. Indonesian Trop. Anim. Agric.*, 40(2): 107-114. <https://doi.org/10.14710/jitaa.40.2.107-114>
- Tanganyika J, Webb EC (2019). Influence of production systems and sex on nutritional value and meat quality of native Malawian Muscovy ducks. *South African J. Anim. Sci.*, 49(6). 1113-1126. <http://dx.doi.org/10.4314/sajas.v49i6.15>.
- Tugiyanti E, Yuwanta T, Zuprizal, Rusman (2013). Improving performance, meat quality, and muscle fiber microstructure of native Indonesian muscovy duck through feed protein and metabolizable energy. *Int. J. Poult. Sci.* 12 (11). <https://dx.doi.org/10.3923/ijps.2013.653.659>.
- Van laack RL, Stevens SG, Stadler KJ (2000). The Influence pH and intramuscular fat content on pork tenderness and tenderization. *J. Anim. Poult. Sci.* 79: 392-397. <https://doi.org/10.2527/2001.792392x>
- Wawro K, Wilkiewicz-Wawro E, Kleczek K, Brzozowski W (2004). Slaughter value and meat quality of Muscovy and Pekin ducks and their crossbreds and evaluation of heterosis effects. *Archiv. Tierzucht.*; 47(3):287-299.
- Yadnya TGB, Sukmawati NMS, Trisnadewi AS, Wibawa APP (2010). The effect of Zingiber officinale Rosc in the diets of performance in culled layer ducks. *J. Ilmu dan Teknol. Hasil Ternak (JITEK)*, 5(2): 41-48.

Percentage of carcasses and commercial cuts of spent layer ducks fed fermented-nonconventional diets supplemented with *Garcinia atroviridis* leaf meal in a smallholder farm

ORIGINALITY REPORT

15%

SIMILARITY INDEX

PRIMARY SOURCES

- | | | |
|---|--|---------------|
| 1 | Małgorzata Sobczak, Remigiusz Panicz, Jacek Sadowski, Mirosław Półgęsek, Joanna Żochowska-Kujawska. "Does Production of <i>Clarias gariepinus</i> × <i>Heterobranchus longifilis</i> Hybrids Influence Quality Attributes of Fillets?", <i>Foods</i> , 2022
<small>Crossref</small> | 33 words — 1% |
| 2 | worldwidescience.org
<small>Internet</small> | 29 words — 1% |
| 3 | www.ajol.info
<small>Internet</small> | 27 words — 1% |
| 4 | repository.unida.ac.id
<small>Internet</small> | 25 words — 1% |
| 5 | Siriporn Namted, Kanokporn Pongpong, Wiriya Loongyai, Choawit Rakangthong, Chaiyapoom Bunchasak. "Improving growth performance and blood profile by feeding autolyzed yeast to improve pork carcass and meat quality", <i>Animal Science Journal</i> , 2021
<small>Crossref</small> | 24 words — 1% |
| 6 | fapet.ipb.ac.id
<small>Internet</small> | 19 words — 1% |

7	R F Hadi, Sudiyono, A K Wati. "Physical quality of local duck meat with addition of different vegetable oils in the ration", IOP Conference Series: Earth and Environmental Science, 2021 Crossref	16 words — 1%
8	microbiologyjournal.org Internet	15 words — 1%
9	bp.ueb.cas.cz Internet	13 words — < 1%
10	medpub.litbang.pertanian.go.id Internet	11 words — < 1%
11	www.meatjournal.ru Internet	11 words — < 1%
12	Lilibeth Pulido-Novicio, Toshimitsu Hata, Yasuji Kurimoto, Shuichi Doi, Shigehisa Ishihara, Yuji Imamura. "Adsorption capacities and related characteristics of wood charcoals carbonized using a one-step or two-step process", Journal of Wood Science, 2001 Crossref	10 words — < 1%
13	Y.N. Huang, Q.W. Ao, Q.Y. Jiang, Y.F. Guo, G.Q. Lan, H.S. Jiang. "Comparisons of different myosin heavy chain types, AMPK, and PGC-1 α gene expression in the longissimus dorsi muscles in Bama Xiang and Landrace pigs", Genetics and Molecular Research, 2016 Crossref	10 words — < 1%
14	doi.org Internet	10 words — < 1%
15	Lacin, E, MI Aksu, M Macit, A Yildiz, M Karaoglu, N Esenbuga, and M Yoruk. "Effects of different	9 words — < 1%

raising systems on colour and quality characteristics of Turkish Pekin duck meats", South African Journal of Animal Science, 2008.

Crossref

16 scialert.net 9 words — < 1%
Internet

17 www.kosfaj.org 9 words — < 1%
Internet

18 RUSMAN. "Characteristics of Biceps femoris and Longissimus thoracis muscles of five cattle breeds grown in a feedlot system", Animal Science Journal, 2/2003
Crossref

19 Zhi-Cheng Wang, Xin-Xin He, Yun-Chong Zhao, Yin Wang, Jiang-Xian Wang, Xing Guo, Run-Shen Jiang. "Exercise profile and effect on growth traits, carcass yield, meat quality, and tibial strength in Chinese Wannan chickens", Poultry Science, 2021
Crossref

20 complete.bioone.org 8 words — < 1%
Internet

21 informaticsjournals.com 8 words — < 1%
Internet

22 iojs.unida.ac.id 8 words — < 1%
Internet

23 jitek.ub.ac.id 8 words — < 1%
Internet

24 mafiadoc.com 8 words — < 1%
Internet

- 25 media.neliti.com
Internet 8 words — < 1%
-
- 26 ojs.unida.ac.id
Internet 8 words — < 1%
-
- 27 www.businessperspectives.org
Internet 8 words — < 1%
-
- 28 www.cnr.berkeley.edu
Internet 8 words — < 1%
-
- 29 www.sasas.co.za
Internet 8 words — < 1%
-
- 30 A K Wati, R F Hadi, Sudiyono. "Effect of different vegetable oils in rations on chemical quality of local duck meat", IOP Conference Series: Earth and Environmental Science, 2021
Crossref 7 words — < 1%
-
- 31 Dariusz Kokoszyński, Henrieta Arpášová, Cyril Hrnčar, Joanna Żochowska-Kujawska, Marek Kotowicz, Małgorzata Sobczak. "Carcass characteristics, chemical composition, physicochemical properties, texture, and microstructure of meat from spent Pekin ducks", Poultry Science, 2020
Crossref 7 words — < 1%
-
- 32 Dewi Wahyuni, Burhanudin Malik, Elis Dihansih. "Effects of Giving Asam Gelugur Leaf Meal in Non-Conventional Rations on Carcass Percentage and Carcass Composition of Male and Female Ducks in Grower Phase", Indonesian Journal of Applied Research (IJAR), 2021
Crossref 7 words — < 1%

33 Nuraini, H Hafid, P Patriani, S Sepriadi, S H Ananda. "Organoleptic properties of Free-range chicken meat with the pineapple fruit juice marination", IOP Conference Series: Earth and Environmental Science, 2021 7 words — < 1%

Crossref

34 "Duck Production and Management Strategies", Springer Science and Business Media LLC, 2022 6 words — < 1%

Crossref

35 Lauren Klein, Gary Sakryd. "Case Report: Arthrofibrosis of the Knee After Anterior Cruciate Ligament Reconstruction: Anterior Interval Scarring and Cyclops Lesion", JBJS Journal of Orthopaedics for Physician Assistants, 2022 6 words — < 1%

Crossref

36 Li Wu, Haiwen Zhang, Lin Na, Xihong Zhou, Xiang Li, Yurong Zhao, Zhen Wen, Qinghua He. "Methionine restriction at the post-weanling period promotes muscle fiber transition in piglets and improves intramuscular fat content in growing-finishing pigs", Amino Acids, 2019 6 words — < 1%

Crossref

EXCLUDE QUOTES OFF

EXCLUDE SOURCES OFF

EXCLUDE BIBLIOGRAPHY ON

EXCLUDE MATCHES OFF