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EFFECTIVENESS OF ADDING AVOCADO SEED FLOUR (*Persea americana* Mill.) IN THE RATION ON PERFORMANCE IN GROWER PHASE VILLAGE CHICKENS

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Abstract

Free-range chickens represent the most widely preferred poultry species among the Indonesian population, irrespective of age groups. In this study, 100 native chickens in the grower phase at 10 weeks of age were used. The experiment lasted for eight weeks and consisted of five dietary treatments, each with five replications, and each group contained four birds. The treatments were R0: 100% basal diet + 0% avocado seed flour, R1: 95% basal diet + 5% avocado seed flour, R2: 90% basal diet + 10% avocado seed flour, R3: 85% basal diet + 15% avocado seed flour, and R4: 80% basal diet + 20% avocado seed flour. During the study, data were collected on feed consumption, weight gain, feed conversion ratio, live weight, and carcass characteristics including breast percentage, thigh percentage, back percentage, and wing percentage. Data were analyzed by one-way variance (ANOVA). The results of the study showed no difference in all treatments compared to the R0 treatment (control). The conclusion is that avocado seed flour can be used as an alternative material for native chickens in the grower phase to replace commercial feed at a usage level of up to 20% without causing negative effects on meat quality.

Key words*: meat, seeds avocado, village chicken.*

INTRODUCTION

Free-range chicken is the most popular poultry among Indonesian people regardless of age, in addition, many free-range chickens are kept by people both in villages and cities. Free-range chicken is one of the important livestock in meeting the animal protein needs of the Indonesian people. Another potential of free-range chicken is local poultry that has a distinctive, delicious and tasty taste, and the trend of public consumption of healthy and natural products, encourages the growth of free-range chicken culinary development. Based on this, free-range chicken farming is very prospective, considering the increasing need for animal protein from poultry meat and is supported by the rapid development of the culinary industry today. Poultry farming is set to expand in the future, and consumers are requiring more sustainable and ethical products. Free-range farming systems produce high-quality meat and also present added value in terms of welfare, sustainability, small-scale farmers' development, and ethical farming (Fionilla et al., 2023).

Livestock has a very complex role and function in the socio-cultural life of the Indonesian people. The role of livestock is not only as a food producer, but also plays an important role in other aspects, such as: (1) Accumulating assets, savings or insurance; (2) Increasing the social status of its owner, or for socio-cultural and religious purposes; (3) Having an integral part of farming as pets for hobbies, sports or pets; and (4) Providing high nutritional value food ingredients, namely milk, meat and eggs (Bohrer, 2017). One of the livestock products that has developed and become a favorite of the community is local chicken, or known as native chicken (non-breed chicken) which is most widely kept by the Indonesian people, especially in rural areas. In addition, there is one effort by the government to increase its nutritional value. The taste of native chicken meat and eggs is very popular with the community because it has a distinctive taste and good nutrition compared to broiler chickens (Suprijatna, 2010). Currently, public attention is oriented towards food security, so it is important to find new alternative natural ingredients that can be used in animal production as food (Moise et al., 2024). Avocado

seeds contain dietary fiber, also contain phytochemicals such as phenolics, tannins and flavonoids which have antioxidant activity (Fadeyi et al., 2024). Antioxidants are compounds needed by humans to ward off free radicals in the body. Dietary fiber and antioxidants are two types of components that are very useful in increasing health activities and can prevent various diseases (Saura-Calixto, 2011). Flavonoids can lower blood cholesterol levels by increasing bile acid excretion and reducing blood viscosity, thereby reducing the occurrence of fat deposits in blood vessels (Z-Carvajal et al., 2005). Avocado seeds contain high unsaturated vegetable fats. This fat is useful for lowering blood cholesterol levels (LDL), which means it can prevent stroke, high blood pressure, cancer, obesity or heart disease. The unsaturated fats found in avocado seeds contain antibacterial and antifungal substances (Bahru et al., 2019). Flavonoids can function as antioxidants in preventing LDL oxidation (Nijveldt et al., 2001). Avocado seeds have hypolipidemic and antioxidant effects in the blood. In this process, total cholesterol is converted into bile acids in the liver which causes hypocholesterolemia (Adeneye et al., 2009).

Other studies show that the mechanism of action of saponins as anti-cholesterol is by delaying fat absorption in the small intestine by inhibiting pancreatic lipase activity (Han et al., 2007). Avocado seed flour can be used up to 15% in broiler chicken rations without affecting the performance of broiler chickens in terms of feed consumption, body weight gain, feed conversion and income over feed cost (Harahap et al., 2019). There has been no research reporting the use of avocado seed flour up to 20%. Therefore, the purpose of this study was to determine the effectiveness of adding avocado seed flour (*Persea americana* Mill.) in rations on the performance of native chickens in the grower phase.

MATERIALS AND METHODS

Preparation of avocado seed flour

Avocado seeds are washed, cut, and dried until the weight is constant for 3-5 days. The dried avocado seeds are then ground until smooth. After that, it is mixed with other ingredients to mix the feed.

Native chickens in the grower phase, feeding and management

One hundred unsexed native chickens in the grower phase (16 weeks of age) were used for this study . The native chickens in the grower phase were divided into five experimental diets and each was divided into five replicate groups consisting of four native chickens in the grower phase per replicate using a completely randomized design. The control diet (basic diet) was formulated with avocado seed flour, namely 10.40% protein, 6.11% crude fiber, 5% fat, 0.70% Ca, 0.21% P and ME 3570 Kcal/kg. Avocado seed flour was included in four experimental diets at levels of 5%, 10%, 15% and 20%. The treatments were: R0 = 100% control diet (basic diet) + 0% avocado seed flour; R1 = 95% control diet + 5% avocado seed flour; R2 = 90% control diet + 10% avocado seed flour; R3 = 85% control feed + 15% avocado seed meal, and R4 = 80% control feed +20% avocado seed meal. The chemical composition of the treatments is shown in Table 1. Feed and water were provided ad libitum using feeding through and water through. The diet was presented in mashed form. Ration consumption was given daily and measured daily, weight gain was measured weekly, carcass percentage was done at the end of the study. The study was conducted for 7 weeks. Data collected were feed consumption, weight gain, feed conversion, live weight, chest percentage, thigh percentage, back percentage, wing percentage.

Chemical analysis

Proximate analysis of avocado seed flour was determined using the AOAC method (Harahap et al., 2019) .

Statistical analysis

Data were analyzed by one-way analysis of variance (ANOVA). A probability value of < 0.05 was taken to indicate statistical significance. The treatment means were compared using Duncan's multiple range test (Pond et al., 1995).

Table 1. Nutrient composition of formulated livestock rations

Nutrients	Diet				
	R0	R1	R2	R3	R4
Crude Protein (%)	21.50	20.94	20.30	19.83	19.28
Fat (%)	5	5.05	5.11	5.17	5.22
Coarse Fiber (%)	5	5.04	5.08	5.12	5.16
Ca (%)	1.10	1.07	1.06	1.03	1.02
P (%)	0.50	0.48	0.47	0.45	0.44
ME (Kcal/kg)	3000	3028	3057	3085	3114

Table 2. Average Research Results From Each Variable

Treatment	Parameters							
	Ration Consumption (grams/head/ day)	Addition Body Weight (grams/head/ day)	Conversion Rations	Body Weight (grams)	% Weight Chest	% Thigh Weight	% Back Weight	% Weight Wing
R0 (0% TBA)	28.04±0.11	10.06±0.11	2.79±0.03	849.70±0.68	23.80±0.46	35.25±0.11	19.25±0.09	15.25±0.04
R1(5%TBA)	27.74±0.24	10.20±0.08	2.78±0.04	805.95±0.50	23.75±0.13	35.00±0.02	19.20±0.14	15.10±0.02
R2(10%TBA)	27.84±0.48	9.92±0.19	2.81±0.09±	771.50±0.44	22.00±0.17	34.25±0.03	18.00±0.24	14.50±0.10
R3 (15% TBA)	27.74±0.41	9.92±0.08	2.80±0.05	750.95±0.45	21.50±0.42	34.15±0.21	18.10±0.11	14.25±0.09
R4 (20% TBA)	27.66±0.41	9.72±0.47	2.85±0.15	650.50±0.64	20.50±0.43	33.85±0.21	17.50±0.07	13.50±0.19
p Value	P>0.05	P>0.05	P>0.05	P>0.05	P>0.0 5	P>0.05	P>0.05	P>0.05

RESULTS AND DISCUSSIONS

Chemical analysis of avocado seed flour used in this study showed that it is rich in protein (10.40%). It also contains low crude fiber content (6.11%). The high nutritional content of avocado seed flour makes it a potential source of feed for livestock. The reported variations in the chemical composition of avocado seed flour can be caused by various factors including avocado varieties, soil conditions, fertilizer use, ripeness and processing conditions of avocado seed flour (Siol et al., 2023). The effect of adding avocado seed flour to the ration on the performance of native chickens in the grower phase is shown in Table 2. The results showed that there was no difference (P>0.05) in performance between treatments with increasing levels of avocado seed flour compared to the R0 treatment (control = diet-based). The achievement of the effectiveness of adding avocado seed flour up to 20% globally was similar to the diet-based treatment. In addition, the performance obtained from the four feeds containing avocado seed flour was similar to the control. The fairly high nutritional content of avocado seeds opens up opportunities for avocado seeds to be used as one of the poultry feeds. However, its use as poultry feed must be limited because avocado seeds contain anti-nutrients in the form of tannins. Previous research has shown that broiler chickens can tolerate up to 15% avocado seed flour in the ration (Harahap et al., 2019).

The consumption of rations in the study showed no significant difference (P>0.05), this is thought to be because the increasing use of avocado seed flour in rations does not change the quality of the smell, color and taste of the ration which affects the level of palatability of the ration. Pond et al., (1995) stated that the palatability of rations is the attractiveness of a ration that can stimulate livestock appetite, the relationship between rations and palatability is influenced by several factors, namely taste, smell, color of the ration ingredients. Rations are a combination of several ingredients that are arranged in such a way with a certain formulation to meet the needs of livestock for one day and do not interfere with the health of livestock (Mallick et al., 2020). Rations are said to be of good quality if they are able to provide all nutrient needs appropriately, both in type, quantity, and balance of these nutrients for livestock (Ravindran, 2013). Increasing the productivity of native chickens can be done by improving the quantity and quality of rations given with an intensive maintenance system (Mapiye et al., 2018). Good rations basically contain all the nutrients to achieve optimal growth (Pond et al., 2004).

The weight gain in this study showed no significant difference (P>0.05). Weight gain is closely related to feed consumption, so that to achieve optimal growth, a number of good quality nutrients are needed in terms of quality and quantity (Anderson, 2005). The feed consumed by poultry greatly determines weight gain (Richards

et al., 2010; Custura et al., 2012; Custura et al., 2019).

The ration conversion in this study showed no significant difference (P>0.05). The addition of the percentage of avocado seed flour to the ration indicates that the ration conversion value is also increasing. This is in accordance with Iyayi et al. (2005), that ration conversion is highly determined by consumption and the resulting weight gain. Avocado seeds contain compounds, one of which is unsaturated vegetable fat which can lower cholesterol levels (Cervantes-Paz et al., 2021). In addition to vegetable fat, avocado seeds contain flavonoids, polyphenols, triterpenoids, saponins, quinones and tannins (Bonilla et al., 2022). Choi et al. (2020) that the more tannin content in the ration can reduce the consumption of rations in chickens. Tannin is a type of antinutrient found in feed ingredients naturally. These antinutrients can limit the consumption of rations in poultry because they can interfere with the digestion process of rations in the intestines, ultimately resulting in feedback on consumption (Chilonu et al., 2018). Mallikarachchi (2023) stated that tannins have the ability to precipitate proteins, because tannins contain a number of functional groups that are strongly bound to protein molecules and produce large and complex cross-links in the form of tannin proteins. Tannins cause a decrease in the digestibility of amino acids that should be absorbed by the influence of corn substitution with avocado seed flour on ration consumption in broiler chickens, intestinal villi that are used for the development of poultry body tissue (Achilonu et al., 2018). Situmorang et al. (2013) stated that palatability is one of the factors that can affect ration consumption. Palatability is influenced by the shape, smell, taste and texture of the food given. The decrease in ration consumption is due to the level of palatability of the ration, with the presence of anti-nutrients in the form of tannins in avocado seed waste flour in the ration resulting in a decrease in ration consumption (Tugiyanti et al., 2019). This is because tannins have a dark color so that they reduce palatability (Nawab et al., 2020).

The live weight of the grower phase native chickens before being slaughtered was fasted for 4 hours. The live weight at the end of the study showed results that were not significantly different (P>0.05). The increase in body weight is greatly influenced by the consumption of rations, so that indirectly the consumption of rations during the study greatly affected the live weight produced (Owens et al., 1993). Commercial carcass cuts are directly proportional to body weight, where increasing body weight tends to produce high commercial carcass cuts (Abdullah et al., 2010).

The percentage of breast weight of the study showed no significant difference (P>0.05). The development of commercial carcass meat cuts is influenced by the protein content of the ration (Park et al., 2021) The thighs and chest are parts of the carcass that contain a lot of meat so that their development is greatly influenced by the protein content of the ration (Mapiye et al., 2008). Lesson and Summers (1980) stated that the chest is the main component of poultry and is quantitatively heavier when compared to the wings, back and thighs. Nematbakhsh et al., (2021) stated that the size of the chest weight is used as a measure of assessing the quality of meat because most of the muscles which are the largest carcass components are in the chest. Adamczak et al., (2018) the most expensive carcass component is meat and the largest part of the meat is in the chest, so the size of the chest is used as a measure to compare the quality of meat in broilers.

The thigh weight percentage of the study showed results that were not significantly different (P>0.05). The largest body weight in commercial carcass cuts was in the thigh because the thigh contains a lot of meat. This is in accordance with the opinion of (Mapiye et al., 2008) who stated that the thigh is a part of the carcass that contains a lot of meat so that its development is greatly influenced by the protein content of the ration. Wademan et al. (2016) stated that the percentage of meat in the lower thigh is a limb so that the meat component is small compared to the meat in the upper thigh. Livestock growth will affect the slaughter weight, carcass weight, and ultimately affect the carcass percentage.

The percentage of back weight of the study showed results that were not significantly different (P>0.05). The weight of the commercial carcass cut from the back had the lowest weight because the back is a commercial cut that has less meat than the thigh and chest. This is in accordance with the opinion of (Rusli et al., 2022) stating that the back and wings of broiler chickens contain a lot of bone tissue, so that the mineral content in the ration has a greater effect on back weight than protein. The weight of the back of this native chicken is not only composed of muscle tissue but also composed of bone framework and the cells that make up the back are stable cells (Sigaha et al., 2019). Bochno et al. (2005) stated that the back contains more bones. Mepiye et al. (2008) stated that the back of broiler chickens is mostly composed of bone tissue and a little muscle tissue.

The percentage of wing weight in the study showed results that were not significantly different (P> 0.05). The wing is a part of the livestock body that has a lot of activity, both used for flying, where when flying the wings have heavy support or support to lift the livestock's body. The weight of the wings and back which is almost the same in each treatment is because the wings and back are not the main places where meat deposition occurs so that during growth, nutrients for meat formation are found in places where meat deposition occurs (Bochno et al., 2012). Tamzil et al. (2015) stated that carcass weight will affect the percentage of carcass and its parts. The chest and thighs are more dominant during growth compared to the wings. Swatland (1994) stated that based on the size and structure of the wing feathers, it can be estimated that nutrients in the form of protein and energy will be used in large quantities for the formation of bones, meat and feathers.

The meat of native chickens in the grower phase has received very important attention with the components of its carcass parts because of its continued interest in human nutrition (Raphulu et al., 2015; Custura et al., 2024). However, its inclusion at a lower level may be an advantage because it can help reduce production costs and cholesterol levels in meat (Dinh et al., 2011). In general, the results of whole meat nutrition obtained showed that avocado seed flour feed up to 20% had the same quality as the basic feed so that it could provide a beneficial nutritional impact for native chickens in the grower phase. These results indicate that the use of avocado seed flour in laying hen feed may have a positive effect on the quality of whole eggs. So, this is a possible alternative to satisfy consumer preferences for meat quality.

CONCLUSIONS

There was no difference observed in performance and carcass percentage between treatments with increasing levels of avocado seed flour compared to the R0 (control) treatment. Therefore, avocado seed flour can be used as an alternative feed ingredient in grower phase native chicken feed, at an inclusion level of up to 20% without negative effects on meat quality and carcass percentage.

REFERENCES

Abdullah, A.Y., Al-Beitawi, N.A., Rjoup, M.M., Qudsieh, R.I., & Ishmais, M.A. (2010). Growth performance, carcass and meat quality characteristics of different commercial crosses of broiler strains of chicken. *The journal of poultry science*, *47*(1), 13-21.

Achilonu, M., Shale, K., Arthur, G., Naidoo, K., & Mbatha, M. (2018). Phytochemical benefits of agroresidues as alternative nutritive dietary resource for pig and poultry farming. *Journal of Chemistry*, *2018*(1), 1035071.

Adamczak, L., Chmiel, M., Florowski, T., Pietrzak, D., Witkowski, M., & Barczak, T. (2018). The use of 3D scanning to determine the weight of the chicken breast. *Computers and Electronics in Agriculture*, *155*, 394-399.

Adeneye, A.A, Olagunju, J.A. (2009). Preliminary hypoglycemic and hypolipidemic activities of the aqueous seed extract of *Carica papaya* Linn in Wistar rats, *Biology and medicine Nigeria, 1*(1), 1-10.

Andersen, H.J., Oksbjerg, N., Young, J.F., & Therkildsen, M. (2005). Feeding and meat quality–a future approach. *Meat science*, *70*(3), 543-554.

Bahru, T.B., Tadele, Z.H., & Ajebe, E.G. (2019). A review on avocado seed: functionality, composition, antioxidant and antimicrobial properties. *Chemical Science International Journal*, *27*(2), 1-10.

Bochno, R., Brzozowski, W., & Murawska, D. (2005). Age-related changes in the distribution of lean, fat with skin and bones in duck carcases. *British Poultry Science*, *46*(2), 199-203.

Bochno, R., Murawska, D., & Brzostowska, U. (2006). Age-related changes in the distribution of lean fat with skin and bones in goose carcasses. *Poultry Science*, *85*(11), 1987-1991.

Bohrer, B.M. (2017). Nutrient density and nutritional value of meat products and non-meat foods high in protein. *Trends in Food.*

Bonilla-Loaiza, A.M., Váquiro-Herrera, H.A., & Solanilla-Duque, J.F. (2022). Physicochemical and bioactive properties of avocado (*Persea americana* Mill. cv. Lorena). *International Journal of Food Engineering, 18*(4), 303-315.

Cervantes-Paz, B., & Yahia, E.M. (2021). Avocado oil: Production and market demand, bioactive components, implications in health, and tendencies and potential uses. *Comprehensive reviews in food science and food safety*, *20*(4), 4120-4158. *Science & Technology*, *65*, 103-112.

Choi, J., & Kim, W.K. (2020). Dietary application of tannins as a potential mitigation strategy for current challenges in poultry production: A review. *Animals*, *10*(12), 2389.

Custura, I., Van, I., Tudorache, M., Popescu-Miclosanu, E., & Popa, A. (2012). Research on performances of raising certificate chickens, *Agrolife, Scientific Journal, 1,* 147-151.

Custura, I., Tudorache, M., Van, I., Marin, M.P., Marmandiu, A., & Pana, E.S. (2019). Researches about influence of pro-biotics on broiler production performances, *Scientific Papers, Series D, Animal Science, 62*(2), 135-139.

Custura, I., Tudorache, M., Gheorghe, A., Lefter, N., Habeanu, M., Bahaciu, G.V., Suler, A.D., & Raducuta, I. (2024). Effects of dietary nutrient concentrations on performance, carcass and meat quality traits of

organically reared barred Plymouth Rock chickens, *J. Anim. Plant Sci., 34*(2).

Dinh, T.T., Thompson, L.D., Galyean, M.L., Brooks, J.C., Patterson, K.Y., & Boylan, L.M. (2011). Cholesterol content and methods for cholesterol determination in meat and poultry. *Comprehensive reviews in food science and food safety*, *10*(5), 269-289.

Fadeyi, A.E., Olajide, O.O., & Ndukaire, O.V. (2024). Phytochemical, antioxidant, phenolic, and mineral composition of *Mangifera indica* L. (mango) and *Persea Americana* Mill. (avocado) seed and exocarp (peel). *African Journal of Biological, Chemical and Physical Sciences*, *3*(1), 1-9.

Fiorilla E., Birolo, M., Ala, U., Xiccato, G., Trocino, A., Schiavone, A., & Mugnai, C. (2023). Productive performances of slow-growing chicken breeds and their crosses with a commercial strain in conventional and free-range farming systems. *Animals*, *13*(15), 2540.

Han, X., Shen, T., & Lou, H. (2007). Dietary Polyphenols and Their Biological Significance. *International Journal of Molecular Sciences 8*(9), 950– 88, doi: 10.3390/i8090950.

Harahap, K.N., Erwan, E., & Misrianti, R. (2019). Utilization of avocado seed flour (*Persea americana* Mill.) in rations on broiler chicken performance. *Sriwijaya Animal Husbandry Journal, 8*(2), 45-57.

Iyayi, E. A., Ogunsola, O., & Ijaya, R. (2005). Effect of three sources of fibre and period of feeding on the performance, carcase measures, organs relative weight and meat quality in broilers. *International Journal of Poultry Science*, *4*(9), 695-700.

Lesson, S., & Summer, J.D. (1980). Production and Carcass Characteristic of the Broiler Chickens. *Poult. Sci., 59*, 786-798.

Mallick, P., Muduli, K., Biswal, J. N., & Pumwa, J. (2020). Broiler poultry feed cost optimization using linear programming technique. *Journal of Operations and Strategic Planning*, *3*(1), 31-57.

Mallikarachchi, S.Y. (2023). *Impact of tannin structure on chemical properties of tannin*. Doctoral dissertation, Miami University.

Mapiye, C., Mwale, M., Mupangwa, J.F., Chimonyo, M., Foti, R., & Mutenje, M.J. (2008). A research review of village chicken production constraints and opportunities in Zimbabwe. *Asian-Australasian Journal of Animal Sciences*, *21*(11), 1680-1688.

Moise, A.E., Tudorache, M., Custura, I., Enea, D.N., Osman, A., & Dragatoiu, D. (2024). Technological advances and socio-economic implications in the poultry industry - an analysis of curent trends in poultry meat production and consumption, Review. *Scientific Papers, Series D, Animal Science, 67*(1).

Nawab, A., Tang, S., Gao, W., Li, G., Xiao, M., An, L. & Liu, W. (2020). Tannin supplementation in animal feeding; mitigation strategies to overcome the toxic effects of tannins on animal health: A review. *Journal of Agricultural Science*, *12*(4), 217.

Nematbakhsh, S., Selamat, J., Idris, L.H., & Abdull Razis, A.F. (2021). Chicken authentication and discrimination via live weight, body size, carcass traits, and breast muscle fat content clustering as affected by breed and sex varieties in malaysia. *Foods*, *10*(7), 1575.

Nijveldt, R.J, Nijveldt, R.J., Nood, E.V., Hoorn, D., E.C.V., Boelens, P.G, Norren, K.V., & Leeuwen, P.A.M. (2001). Flavonoids: a review of probable mechanisms of action and potential applications. *American Journals Clinical Nutrition. USA. 74*, 418-425.

Owens, F.N., Dubeski, P., & Hanson, C.F. (1993). Factors that alter the growth and development of ruminants. *Journal of animal science*, *71*(11), 3138-3150.

Park, S.Y., Byeon, D.S., Kim, G.W., & Kim, H.Y. (2021). Carcass and retail meat cuts quality properties of broiler chicken meat based on the slaughter age. *Journal of animal science and technology*, *63*(1), 180.

Pond, W.G., Church, D.C. & Pond, K.R. (1995). *Basic Animal Nutrition and Feeding*. 4th Edition. New York, USA: John Willey and Sons Publishing House.

Pond, W.G., Church, D.B., Pond, K.R., & Schoknecht, P.A. (2004). *Basic animal nutrition and feeding*. New York, USA: John Willey and Sons Publishing House.

Raphulu, T., van Rensburg, C.J., & Coertze, R.J. (2015). Carcass composition of Venda indigenous scavenging chickens under village management. *Journal of Agriculture and Rural Development in the Tropics and Subtropics (JARTS)*, *116*(1), 27-35.

Ravindran, V. (2013). Poultry feed availability and nutrition in developing countries. *Poultry development review*, *2*(11), 60-63.

Richards, M.P., & Proszkowiec-Weglarz, M. (2007). Mechanisms regulating feed intake, energy expenditure, and body weight in poultry. *Poultry science*, *86*(7), 1478-1490.

Rusli, B., Astuty, A.F., Natsir, S., & Muh, M.L. (2022). Percentage of carcass parts of broiler chicken given additional African leaf flour feed (*Vernonia amygdalina*). *Russian Journal of Agricultural and Socio-Economic Sciences*, *124*(4), 54-61.

Saura-Calixto, F. (2011). Dietary fiber as a carrier of dietary antioxidants: an essential physiological function. *Journal of agricultural and food chemistry*, *59*(1), 43-49.

Sigaha, F., Saleh, E.J., & Zainudin, S. (2019). Evaluation of Percentage of Super Kampung Chicken Carcass with Fermented Corn Straw. *Jambura Journal of Animal Science, 2*(1), 1-7.

Siol, M., & Sadowska, A. (2023). Chemical composition, physicochemical and bioactive properties of avocado (*Persea americana*) seed and its potential use in functional food design. *Agriculture*, *13*(2), 316.

Situmorang, N.A., Mahfudz, L.D., Atmomarsono, U. (2013). Effect of seaweed flour (*Gracilaria verrucosa*) in rations on the efficiency of protein use in broiler chickens, *Animal Agriculture. 2*(2): 49-56.

Suprijatna, E. (2010). Local Chicken Development Strategy Based on Local Resources and Environmental Awareness. *4th National Seminar on Local Poultry*, 55-88.

Swatland, H.J. (1994). *Structure and development of meat animals and poultry*. Boca Raton, USA: CRC Press Publishing House.

Tamzil, M.H., Ichsan, M., Jaya, N.S., & Taqiuddin, M. (2015). Growth rate, carcass weight and percentage weight of carcass parts of laying type cockerels, kampong chicken and arabic chicken in different ages. *Pakistan Journal of Nutrition*, *14*(7), 377.

Tugiyanti, E., Iriyanti, N., & Apriyanto, Y.S. (2019). 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*(10), 1608.

Wideman, N., O'bryan, C.A., & Crandall, P.G. (2016). Factors affecting poultry meat colour and consumer preferences - A review. *World's Poultry Science Journal*, *72*(2), 353-366.

Zarrabal-Carvajal, O., Waliszewiski, S.M., Barradas-Dermitz, D.M., Orta-Flores, Z, Hayward-Jones, P.M., Nolasco-Hipolito, C., Angulo-Guerrero, O., Sanchez-Ricano, R., Infazon, R.M., & Trujillo, P.R.L (2005). The consumption of *Hibiscus sabdariffa* dried calyx ethanolic extract reduced lipid profile in rats. *Plant Foods for Human Nutrition, 60*, 153-159.