



Effect of Additional Herbal Mix on Feed on Physical Quality of Broiler Meat

AUTHORS INFO

Muh Rafli

Universitas Islam Negeri Alauddin Makassar
muhrafl9937@gmail.com
+6282311932808

Muhammad Nur Hidayat

Universitas Islam Negeri Alauddin Makassar
muhammad.nurhidayat@uin-alauddin.ac.id
+62081245384448

Ayu Lestari*

Universitas Islam Negeri Alauddin Makassar
ayu.lestari@uin-alauddin.ac.id
+62085242492793

(*) Corresponding Author

ARTICLE INFO

p-ISSN: 2548-5504

e-ISSN: 2548-3803

Vol. 7, No. 2, December 2022

URL: <https://dx.doi.org/10.31327/chalaza.v7i2.1809>

Abstract

Physical characteristics or physical properties of meat include pH, cooking loss, and texture, while organoleptic qualities include color, taste, texture, and aroma. These factors will simultaneously determine the quality of meat in livestock. This study aims to determine the effect of giving a combination of herbs, mineral zinc, expired milk powder, and vitamin C on the physical quality of broiler meat. This research was conducted at the Samata Integrated Farming System (SIFS), Jalan Veteran Bakung, Samata Village, Gowa Regency. Physical quality testing of meat was carried out at the Laboratory of Animal Products Technology, Universitas Islam Negeri Alauddin Makassar. The research design used in this study was a completely randomized design (CRD) with four treatments and five replications, each replication consisting of 2 broilers with treatment P0= commercial feed (Control), P1 = commercial feed + 1% herbs, P2= commercial feed + 2% herbs and P3= commercial feed + 3% herbs. Meat sampling was carried out on day 35 for analysis of physical quality including pH value, cooking loss, and meat tenderness. Data analysis used analysis of variance (ANOVA) and continued with Duncan's test. The results showed that the addition of a combination of mixed herbs to broiler feed had a significant effect ($P < 0.05$) on pH but had no significant effect ($P > 0.05$) on cooking loss and meat tenderness. Duncan's test results showed that the pH value with P0 treatment was significantly different ($P < 0.05$) with P1, P2, and P3. All the treatments with different percentages of the herbal mix did not show significant differentiation between them.

Keywords: broiler, meat quality, sand ginger flour, turmeric flour, vitamin C, zinc

A. Introduction

Broiler meat is a product that comes from poultry that is liked by everyone because the price is relatively cheap and also has high nutritional value, good taste, and a soft texture. Currently, Indonesian people are more familiar with broiler meat as chicken meat that is usually consumed, because of the advantages it has such as high nutritional value or content so that it can meet the nutritional needs of the body.

The good physical capacity of meat is influenced by chemical texture which includes water content, protein content, fat content, and mineral content. Physical characteristics or physical properties of meat include pH, cooking loss, and texture, while organoleptic qualities include color, taste, texture, and aroma. These factors will simultaneously determine the quality of meat in livestock, as a result of which the analysis in the experiment is useful as a reference for understanding the chemical quality, physical quality, and organoleptic quality of meat (Variyani et al., 2017). Steps that can be taken to increase the value of poultry products are to add feed additives to the feed. Feed additives are non-food substances that are added but in small amounts, to accelerate growth and increase the population of beneficial microbes found in the digestive tract of chickens. Feed additives can cause growth as well as enhance the usability of feed in chickens, including antibiotics and hormones (Nuningtyas, 2014).

Herbal plants have pharmacological activities such as natural antibiotics, antiviral, antimicrobial, anti-inflammatory, anti-cholesterol, and anti-cancer as well as enhancing the appetite and digestibility of poultry (Cahyono, 2011). The use of herbal plants, such as sand ginger and turmeric, seems to be effective in making good quality meat, besides that these ingredients are cheap and easy to obtain. In addition, herbal plants are also beneficial for the health of livestock and humans as consumers of chicken meat (Tahalele et al., 2018). According to Hidayat et al. (2018), herbal plants contain curcumin which acts as an active compound that can maximize the absorption of nutrients that will later be decomposed into meat. Nutrients that are absorbed optimally will optimize the formation of better tissue, the higher the connective tissue and marbling, the more tender the meat will be. In addition to herbal plants, the provision of animal feed is also a very important factor in the continuity of a livestock business. One of the reasons for the use of sand ginger plants in this study is that herbal plants have good properties for livestock and are halal to use.

One of the roles of animal feed is to increase body resistance. Minerals in feed are thought to play a role in increasing the immune system of livestock. Zinc is essential in regulating cells and also acts as a medium for the body's immune function (Regar et al., 2014). The mineral zinc is an essential nutrient that the body needs to regulate fitness. Zinc is needed in small amounts but completely needs to be present in the feed because zinc cannot be converted to other substances. This mineral functions in various enzyme activities, cell development, and division (Widhyari, 2012). In addition to the use of zinc, other feed additives that can be used are vitamins. Vitamins have active substances that cannot be produced naturally by poultry to the maximum extent so external input is needed as additional feed.

Completeness of feed substances is an important thing in the preparation of rations. The high demand for feed at this time, therefore various studies were carried out to improve feed efficiency with good feeding. Feed ingredients that can be used as additional feed are rejected milk powder derived from industrial waste. Where the rejected milk powder is milk that has exceeded the specified usage limit (expired date) so that it can no longer be enjoyed by the public. Rejected milk powder can be used as a mixture in animal feed, to minimize the high price of feed ingredients. The nutritional content of rejected milk powder is very complex, so it is good to be added to feed. The addition of rejected milk powder as an additional food ingredient for nutrition, especially micronutrient nutrients such as minerals, vitamins, and amino acids (Sukma, 2019). Based on these data and cases, it was necessary to study the effect of alternative feeds such as herbal mix, vitamins, and minerals, along with the addition of expired milk on the meat quality of the broiler.

B. Methodology

1. Research Time and Location

This research was carried out from September to October 2021 and took place at the Samata Integrated Farm System (SIFS) Jalan Veteran Bakung, Samata Village, Kab. Gowa.

2. Research Tools and Materials

The tools used in this study were buckets, light fittings, gasolec, cables, drum litter that has fiber, 15-watt lamps, a meter, a spray gun, 3 kg gas cylinder, a drinking holder, a feed holder, a

digital scale, pH meter, and a breaker. meat fiber (CD-Shear Force) and water bath. The materials used in this study were 1-day-old broiler or DOC (Day Old Chick), water, disinfectant (Rodalon®), commercial feed (B-11A), vita stress (Medion), vita chicks (Medion), Medivac ND La Sota, water, newsprint, husks, sand ginger flour, turmeric flour, mineral zinc (ZnO), rejected milk powder (SGM explore Soya), vitamin C (Ascorbic Acid) and husks.

3. Research Design

The research design used in this study was a completely randomized design (CRD) with four treatments and five replications, each of which consisted of 2 broilers for a total of 40 broilers. The treatment given is as follows:

P0: Commercial Feed (Control)

P1: Commercial Feed + Herbs 1%

P2: Commercial Feed + Herbs 2%

P3: Commercial Feed + 3% Herbs

4. Research Procedure

1) Preparation Stage

1) Production of sand ginger flour (*Kaempferia galangal* L.)

Clean the rhizome of fresh sand ginger to remove dirt and soil that is still attached. After cleaning, sand ginger is sliced into \pm 2-3 mm slices, then spread on a paper mat to wither for 1-2 days at room temperature. Then in the oven for 24 hours at a temperature of 60° C and after drying sand ginger is milled to obtain sand ginger flour.

2) Making turmeric flour (*Curcuma domestica* Vahl)

Turmeric powder is made by first washing the rhizome of *Curcuma*, scraping the outside, leaving the roots and soil, and thinly slicing. Then the turmeric slices are aired for 2 days and in the oven at \pm 50 °C for 1 day. Furthermore, the turmeric is mashed with a blender and filtered through a sieve to form turmeric powder.

3) Making herbal mixes

Table 1. Sand Ginger and Turmeric Flour, Zinc Minerals, Vitamin C, and Powdered Milk

Materials	Amount
Sand ginger flour	0,4 gram
Turmeric flour	3 gram
Zinc	120 ppm
Vitamin C	500 ppm
Expired powdered milk	40 gram

All ingredients were weighed according to the predetermined dose (0.4-gram sand ginger flour, 3-gram turmeric flour, 120 ppm zinc mineral, 40-gram milk powder, and 500 ppm vitamin C). The five ingredients were put into a container and then homogenized, then mixed into feed with different percentages of 1%, 2 %, and 3% per kilogram of commercial feed.

2) Research Implementation Stage

1) Ration

The ration in this study used commercial feed, which was added with sand ginger flour, turmeric flour, mineral zinc, milk powder, and vitamin C.

2) Chicken rearing

Broiler maintenance is carried out for 35 days, Day Old Chick is put in a cage that has been sprayed with disinfectant. Day Old Chick (DOC) that has just arrived is first given sugar water with a mixture of 60 to 80 grams in 1 liter of water which aims to neutralize the body temperature of the chicken during shipping to its initial condition. Then the DOC was weighed to determine the initial weight. Day Old Chick aged 1 to 7 days is in a critical period so it requires intensive attention or during brooding with a temperature setting of 30 to 32°C. DOC can only regulate their body temperature optimally when they are more than one week old, therefore the role of the brooder (heater) is very important to keep the temperature and humidity of the cage within the comfort zone of the chicks. The heater used is Gasolek which will be turned on at night and during the day when the weather is cold (rainy), while the lighting in the brooding phase is carried out for 16 hours, at night at 22.00-05.00 WITA the lighting or lights are turned off aiming to stimulate growth hormones during the study.



Figure 1. pH Measurement.

C. Result and Discussion

a) Result

The results of the 35-day study which included the addition of mixed herbal plants in the feed on cooking loss, meat tenderness, pH, and water-holding capacity of broiler chicken meat are presented in Table 2.

Table 2. The Average Value of Cooking Loss, Meat Tenderness, and pH in Broiler Meat.

Variables	Treatment				P value
	P 0	P 1	P 2	P 3	
Cooking loss (%)	28.79±3.69	26.77±4.09	27.36±1.06	27.98±1.34	0.72
Tenderness (kg/cm ²)	1.62±0.41	1.12±0.44	0.95±0.70	1.10±0.47	0.23
pH	5.96±0.24 ^b	5.60±0.16 ^a	5.52±0.22 ^a	5.40±0.07 ^a	0.02

Notes: Different superscripts in the same row indicate significantly different treatments (P<0.05), P0 (commercial feed), P1 (commercial feed + 1% herbal ingredients), P2 (commercial feed + 2 % herbal ingredients), P3 (commercial feed + 3 % herbal ingredients). Cooking loss (SM), tenderness, and pH of the meat.

a) Cooking Loss

The quality of broiler meat with the addition of mixed herbal ingredients shows the average cooking loss of meat in the range of 26.77% to 28.79%. Based on Table 1, the results of the study in treatment P0 (28.79%) without the addition of mixed herbal ingredients showed the highest cooking loss value among other treatments, while the lowest average cooking loss was in treatment P1 (26.77%) with the addition of commercial feed + mixed herbal ingredients 1%. The cooking loss value in this study is still within the normal range according to Kartikasari's opinion (2018) which states that generally, the cooking loss value of chicken meat varies between 2.80% to 29.44%.

The use of mixed herbal ingredients to the level of 1% (P1) and 2% (P2) had a better cooking loss than the treatment using commercial feed (control). The use of mixed herbal ingredients up to 1% (P1) and 2% (P2) had a better cooking loss than the treatment using commercial feed (control) (P0). This is because the composition of the feed has a higher crude fat content. The feed that was given mixed herbal ingredients tended to have a higher crude fat content than the composition of the ration using commercial feed (P0), so it can be said that the average cooking loss value of P1 and P2 was better because the lower the cooking loss value, the more tender the meat. This is Kartikasari's opinion (2018) that meat with low cooking loss has a relatively better quality compared to meat with higher cooking loss because the risk of losing

nutrients during cooking will be less. Cooking loss is strongly influenced by the amount of water lost during cooking.

b) Tenderness

The quality of broiler meat with the addition of mixed herbal ingredients showed that the average tenderness of the meat was in the range of 0.95 kg/cm² to 1.62 kg/cm². Based on the research data, it was found that P0 without the addition of herbal ingredients had the highest value using 1.62 kg/cm² of energy, while the lowest value was in the P2 treatment with the addition of commercial feed + 2% herbal ingredients using 0.95 kg/cm² of energy. The results of the analysis of variance (Table of results) showed that the tenderness value of broiler chicken with mixed herbal ingredients had no significant effect ($P > 0.05$) on the tenderness of broiler chicken meat. This shows that the use of commercial feed combined with mixed herbal ingredients shows the same effect on the tenderness of broiler meat after cooking. Based on the research by (Raharjo et al., 2015) the addition of herbs such as curcuma and ginger did not affect the tenderness of the meat because curcumin and the essential oil content of these herbs did not affect protein or muscle structure. The effect only appears on body resiliencies and small intestine peristaltic moves.

c) pH

The results of the analysis of variance (data table) showed that the pH value of broiler meat with the provision of herbal ingredients had a significant effect ($P < 0.05$) on the pH of broiler meat but the results were not better than the P0 treatment (control). This may be influenced by feed consumption. The lower pH value is related to the level of glycogen which turns into lactic acid after the cutting process. The more levels of glycogen that turn into fatty acids after cutting, the pH value decreases. According to Raharjo et al., (2015), during the glycolysis process, the pH drops not too low so the final pH is relatively high. High pH indicates better meat quality causing the protein to bind liquid better so that the drip loss was low. Legawa (2014) stated that higher absorption of nutrients resulted in excess energy being stored in the form of glycogen so that after slaughtering, it was expected that the pH of the meat would be low. The decrease in pH after slaughter was influenced by the rate of glycolysis and muscle glycogen reserves which were influenced by the energy content of the ration.

2. Discussion

a) Broiler

The broiler is a source of a contributor to the need for animal protein where the meat is used as food for the community as well as an alternative to beef. The specialty of broiler meat is that the harvest period is very fast, which is between 35 days to 40 days, even now broilers can be harvested according to consumer demand (Direktorat Jenderal Peternakan dan Kesehatan Hewan, 2016).

b) Feed

Broiler feed is the most important element to support health, growth, and energy supply so that the body's metabolic processes can run normally. In increasing broiler productivity, and reducing feed costs, it is necessary to increase efficiency through good feed processing to maximize profits. Feed management is one of the management methods in broiler rearing which aims to influence feed treatment, to make the broiler farming business a success (Sari & Romadhon, 2017). Good feed is high-quality feed at a low price because high-quality feed must maintain a balance between protein, vitamins, water, energy, and minerals. The demand for chicken feed depends on the strain of age, activity, chicken size, growth rate, health, and balance of feed ingredients. In livestock, 6 substances are needed, namely carbohydrates, water, fat, protein, vitamins, and minerals (Fitro et al., 2017).

c) Expired Milk

Milk powder rejected or expired milk is milk that is no longer used or consumed by humans because it has passed its expiration date. Milk powder rejected can be used as an ingredient to be added to commercial feed. Refused milk powder can still be used as an additional ingredient in chicken because it is easy to obtain, the price is relatively cheap, and most importantly does not compete with humans and the composition is adequate. The nutritional content of rejected milk powder is very complex so it is very good to be added to commercial feed. Add milk powder rejected for additional feed alternatives such as micronutrients such as vitamins, minerals, and

amino acids. The highest feed consumption was with the addition of 5% milk powder (9.226 g/head/week). The maximum body weight of chickens fed with 5% rejected milk powder (9.377 g/head/week) and on feed, conversion had no significant effect on the addition of rejected milk powder (Sukma, 2019).

Refused milk powder can be used as animal feed because it has good nutritional content, including 25.8% protein, 0.9% fat, and 4.6% lactose, and contains other nutrients such as sodium, potassium, vitamins, minerals, and amino acids. The addition of rejected milk powder with 10% gave the best results in increasing broiler feed consumption (Alim et al., 2012).

d) Herbs

1) Sand Ginger (*Kaempferia galangal* L.)

Sand ginger (*Kaempferia galangal* L.) is a flora that grows densely in the tropics in Indonesia, this flora is widely cared for by the community. Sand ginger is generally used as a food flavoring as well as the manufacture of traditional medicinal herbs. The benefits of sand ginger are many, including being a source of warmth, pain relief as well as and appetite enhancer. Almost all parts of the sand ginger flora contain essential oils that are very useful for the body of living things. One part of the sand ginger traded is the sand ginger rhizome or rhizome (Zulbadri & Gozali, 2015).

2) Turmeric (*Curcuma domestica* Vahl)

Turmeric is sourced from India and Indo-Malaysia and then spread widely to the South Asian continent, South China, Taiwan, the Philippines, and Indonesia. In the tropics, turmeric plants are often found at an altitude of 300-1,600 meters above sea level with rainfall of 2000 to 4000 mm/year. Turmeric plants can grow in shaded locations, but to get large turmeric rhizomes, an open place is needed (Syukur, 2010).

3) Mineral Zinc and Vitamin C

Zinc (Zn) is a micromineral whose functions and uses are important in the body. The impact caused by a lack of minerals is a decrease in appetite to the disruption of the body's defense system. Failure to maintain production usually occurs due to a decrease in the parent's appetite triggered by a lack of available feed quality. Availability of nutrients that are lacking in the feed will cause disturbances in the body's defense system, accompanied by a decreased level of livestock productivity (Widhyari et al., 2012).

From a physiological point of view, zinc functions as a growth and cell division, antioxidant, sexual development, cellular immunity, dark adaptation, taste, and appetite enhancer. From a biochemical point of view, zinc acts as a constituent of 200 types of enzymes that function in polysome formation and conformation, cell membrane stabilization, ultra-cellular free ions, and functions in constituent metabolic pathways. The important benefits of zinc for living things are growth and cell division because zinc functions in the synthesis and degradation of carbohydrates, fats, proteins, nucleic acids, and embryo formation. In addition, zinc is needed as a process to accelerate growth, strengthen cell membrane components, and also activate growth hormones. Zinc also has a function in the immune system and is a potential mediator of the immune system against infection. In zinc deficiency, there is lymphopenia, reduced concentration, and use of T and B lymphocytes. Another role of zinc in the body is the integrity of vision which is a metabolic interaction between zinc and vitamin A (Sampurna, 2016).

Setiawan et al (2013), said that vitamins are essential to complex compounds that are useful for normal growth, basic life, production, maintaining livestock immunity, and animal metabolic processes. Vitamins are important for livestock growth; therefore, vitamins must be present in feed as well as medicine and supplements. Vitamin C can be synthesized by chickens, but if the chickens are under severe stress, the production of vitamin C is reduced by giving it separately in feed and drinking water.

Chickens require additional complete vitamins for all metabolic reactions in their bodies. The important role of vitamin C is to improve the immune system of chickens that are stressed due to the environment, vitamin C also plays a role in repairing damaged tissues due to infectious diseases (Kusumasari et al., 2013). In Indonesia, broiler breeders' efforts to overcome stress in chickens are by adding drugs or feed additives that contain vitamins, minerals and so on that can increase appetite, maintain endurance, and are also anti-stress (Sarengat & Mahfudz, 2016).

e) Physical Quality of Broiler Meat

1) pH value

The pH value greatly affects the quality of the meat, because the pH value is a direct reflection of the muscle acid content, and affects the tenderness, water-holding capacity, and color of the

meat (Toplu et al., 2014). According to Saleh et al., (2012) stated that the level of acidity (pH) is an indicator to determine the acidity or alkalinity of fresh meat or the resulting product. The pH value is one of the important factors in determining the quality of meat. The normal pH value of broiler meat ranges from 5.96 to 6.07. Meanwhile, cattle muscle tissue when it is still alive has a pH value of less than ± 5.1 to 7.2 and will decrease after slaughter, because glycolysis occurs and produces lactic acid which will affect pH.

2) Tenderness

The tenderness of broiler meat is an evaluation error in meat quality & an important trait that affects the acceptability of meat for buyers. If the average tenderness of broiler meat in the breast is 2.81. The higher the tenderness number in the meat, the harder it will be and vice versa if the tenderness value is lower, it means the meat is getting more tender. The tenderness of broiler meat can be determined using physical methods. A device, mechanically has been created to measure the Warner Bratzler by looking at the breaking strength value of the meat. The relationship between tenderness and pH is that meat with a pH greater than 6.0 is more tender than meat with a pH below 6.0. When the meat is pressed with the fingers, healthy meat will have a chewy to a firm consistency. In addition, tender meat is the most sought-after by consumers (Pangestika et al, 2018).

3) Cooking Loss

Cooking loss is weight loss during cooking, and the higher the cooking temperature and/or the longer the cooking time, the more water content will be lost until it reaches a certain level (Saleh et al., 2012). According to Basri (2017), the cooking loss value is closely related to the water holding capacity. The stronger the water binding, the stronger the water binding, and the less likely it is to leak or waste liquid nutrients during heating, resulting in a slight reduction in most meats. Meat stored in a frozen or chilled state tends to experience changes in muscle protein, resulting in a decrease in the ability of muscle protein to bind to water and an increase in the amount of fluid that leaks from the carcass.

D. Conclusion

Good physical quality of meat will certainly provide good processing products and will make it easier during the processing process, the physical properties of meat include pH, tenderness, and cooking loss. Based on the results of this study, it can be concluded that the addition of mixed herbal ingredients in commercial feed can improve the quality of broiler meat such as cooking loss, meat tenderness, and pH. But all the treatments with different percentages of the herbal mix did not show significant differentiation between them. It is recommended to further study the effect of herbal mix with a higher percentage or higher concentration.

E. References

- Basri, S. H. (2017). *Pengaruh pemberian probiotik terhadap susut masak, keempukan dan ph pada daging broiler*. Makassar, Indonesia: Universitas Islam Negeri Alauddin.
- Cahyono, B. (2011). *Unggas kampung penghasil daging*. publikasi awal, self-help spreader Jakarta, Indonesia: Publikasi Awal, Self-help Spreader.
- Direktorat Jendral Peternakan dan Kesehatan Hewan. (2016). *Statistik Peternakan*. Jakarta, Indonesia: Direktorat Jendral Peternakan dan Kesehatan Hewan.
- Fitro, R., Sudrajat, D., & Dihansih, E. (2017). Performa ayam pedaging yang diberi ransum komersial mengandung tepung ampas kurma sebagai pengganti jagung. *Jurnal Peternakan Nusantara*, 1(1), pp. 1-8.
- Hidayat, M., Zuprizal., Nugroho, F., Kusmayadi, A., & Wati, K. A. (2018). *Pengaruh pemberian nanoenkapsulasi ekstrak kunyit cair dalam air minum terhadap kualitas fisik daging ayam broiler*. Yogyakarta, Indonesia: Universitas Gadjah Mada.
- Kartikasari, L. K., Hertanto., & Santoso, I. (2018). Kualitas fisik daging ayam broiler yang diberi pakan berbasis jagung dan kedelai dengan suplementasi tepung purslane (*Portulaca oleracea*). *Jurnal Teknologi Pangan*, 12(2), pp. 1-8.
- Kusumasari, D. P. I., Mangisah., & Estiningdiati. I. (2013). Pengaruh penambahan vitamin a dan e dalam ransum terhadap bobot telur dan mortalitas embrio ayam kedu hitam. *Animal Agriculture Journal*, 2(1), pp. 191-200.
- Legawa, A. T. (2014). Pengaruh penambahan tepung kunyit pada ransum grower berkadar protein rendah terhadap kualitas fisik daging ayam broiler. (Skripsi, Fakultas Peternakan Universitas Gadjah Mada).

- Nuningtyas, F. Y. (2014). Pengaruh penambahan tepung bawang putih (*allium sativum*) sebagai aditif terhadap penampilan produksi ayam pedaging. *Journal Ternak Tropika*, 15(1), pp. 21-30.
- Pangestika, S. D., Dihansih, & Anggraeni. (2018). Substitusi pakan dasar dengan pakan non konvensional terfermentasi dalam ransum terhadap kualitas fisik daging ayam. *Jurnal Peternakan Nusantara*, 4(2), pp. 99-105.
- Regar, M. N. Mutia, R., Widhyari, S. D., & Kowel, Y. H. S. (2014). Pengaruh pemberian ransum kombinasi suplemen herbal dengan mineral zink terhadap jumlah leukosit, eritrosit dan kadar hemoglobin broiler yang diinfeksi *escherichia coli*. *Jurnal zootek*, 34(2), pp. 82 – 88.
- Saleh, E., Kuntoro, E., Purnamasari., & Zain. (2012). *Teknologi hasil ternak*. Pekanbaru, Indonesia: Suska Press.
- Sampurna, I. P. (2016). *Kebutuhan nutrisi hewan*. Bali, Indonesia: Universitas Udayana.
- Sarengat, W., & Mahfudz, L. D. (2016). Pengaruh pemberian jintan hitam (*Nigella sativa*) pada ransum yang mengandung vitamin C terhadap produksi karkas ayam broiler. *Agromedia*, 34(2), pp. 5-7.
- Sari, M. L., & Romadhon, M. (2017). Manajemen pemberian pakan ayam broiler di desa tanjung pinang kecamatan tanjung batu kabupaten ogan silir. *Jurnal Peternakan Sriwijaya*, 6(1), pp. 2-4.
- Setiawan, E., Praseno, K., & Mardiaty, S. M. (2013). Pengaruh pemberian vitamin a, b12, c dan kombinasi ketiganya melalui drinking water terhadap panjang dan bobot tulang femur, tibia dan tarsometatarsus puyuh (*coturnix coturnix japonica* l.). *Buletin Anatomi Dan Fisiologi Sellula*, 21(1), pp. 36-44.
- Sukma, Y. C. (2019). Pengaruh penggunaan susu bubuk kadaluarsa dalam pakan terhadap pertambahan bobot badan pada ayam kampung. Kediri, Indonesia: Fakultas Peternakan Nusantara PGRI Kediri.
- Syukur, C. (2010). *Turina, varietas unggul kunyit kurkumin tinggi*. Sinar Tani, edisi 3-9 November 2010.
- Tahalele, Y., Montong, R. E. M., Nangoy, J. F., & Sarajar, K. L. (2018). Pengaruh penambahan ramuan herbal pada air minum terhadap persentase karkas, persentase lemak abdomen dan persentase hati pada ayam kampung super. *Jurnal Zootek*, 38(1), pp. 160-168.
- Toplu, G., Nazligül, S., Karaarslan, K., & Yagin. (2014). Pengaruh pengkondisian panas dan suplementasi asam askorbat diet terhadap kinerja pertumbuhan, karakteristik kualitas karkas dan daging pada ayam pedaging stres panas. *Universitas Ankara Fakultas Kedokteran Hewan*, 61, pp. 295-302.
- Variani., Pagala, A. M., & Hafid, H. (2017). Kajian kualitas fisik daging ayam broiler pada berbagai bobot potong dan pakan komersial yang berbeda. *Jurnal Pakan*, 4(2), pp. 40.
- Widhyari, S. D., Esfandiari, A., Wientarsih, I., Widodo S., Soehartono, R. H., Winarsih, W., Regar, M. N., & Sumarni A. (2012). *Pemberian pakan tambahan herbal dan zink terhadap profil sel leukosit pada ayam broiler yang ditantang dengan escherichia coli*. Prosiding Konferensi Ilmiah Veteriner Nasional Ke-12. 10-13 Oktober 2012. Yogyakarta, Indonesia.
- Zulbadri, M., & Gozali, A. N. (2015). Lama pemeliharaan untuk mencapai bobot badan siap pasar ayam broiler melalui penambahan tepung sand ginger (*Kaempferia galanga* l). *Jurnal Peternakan*, 59(6).