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The Effect of Different Strains and Commercial Feeds on the Small Intestine Characteristics and Broiler Meat Quality

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Abstract:

The objective of this study is to ascertain the impact of different strains and severals types of commercial feeds on carcass quantity (final body weight, carcass percentage, and breast meat deposition), small intestine characteristics (viscosity, length, and number of villi), and broiler meat quality (tenderness, meat fat, and meat protein). The study employed two strains of broiler (Strains A1 and A2), with day one chick (DOC) and total of 96 DOC at strain. The maintenance period was 35 days. The treatment was administered using three commercial feed brands (PT. B1, PT. B2, and PT. B3). This research employed a completely randomized design with a 2x3 factorial pattern comprising 6 treatments and 4 replications. The results demonstrated that the interaction between strain and feed A2B2 had a impact ($P < 0.05$) on breast meat deposition. A1B2 resulted in a different effect ($P < 0.05$) on meat protein, while A2B3 influenced viscosity and tenderness to a very different effect ($P < 0.05$).

Keywords — **Strain, Commercial Feed, Carcass Quantity and Quality, Small Intestine**

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I. INTRODUCTION

The population of Indonesia is experiencing a sustained period of growth on an annual basis. This increase in population is directly proportional to the increase in national food needs due to high public demand for meat consumption. The ability of broilers to grow quickly and produce meat at a relatively young age makes broilers one of the sectors that can meet national food needs. According to the National Food Agency (BAPAANAS) report, in 2023 the total need for broiler meat will reach 2.08 million tons/year. This figure represents a 5.4% increase from the requirement in 2022, indicating a continued rapid growth in the productivity of broiler farms.

The ongoing increase in broiler consumption must be balanced with the existing production of broiler livestock. Strain classification is a result of the genetic improvement initiatives undertaken by breeding companies with the objective of maximizing broiler growth. These initiatives entail the crossing of livestock breeds and the crossing of strains within a single breed. The strain names provided by breeders indicate that there are discrepancies between the production companies. Risnajati (2012) additionally noted that the distinctions primarily pertain to each chicken's productivity.

The genetic advantages of broilers include rapid growth, efficient feed utilization, a short harvest period, the production of soft, fibrous meat, substantial meat deposits, and a smooth skin. Broilers have a brief maintenance period, typically harvested at 30-35 days with a body weight of 1.2–1.9 kg/head (Pratama et al., 2015). Consequently, the prospects for the development of broiler chicken farming are favourable, both in terms of large-scale operations and small-scale farming (including backyard farming).).

Consequently, the advent of genetic engineering will necessitate enhancements in other areas, including the optimization of feed quality. Feed represents a significant factor in the maintenance management of broilers. As stated by Anggitasari et al. (2016), commercial feed is formulated to achieve optimal growth, development, health, and appearance, as it has been regulated according to the nutritional requirements of the animal's body. As noted by Harmayanda et al. (2016), each feed supply company has a unique feed formulation and utilizes a variety of confidential ingredients, which may contribute to variations in growth responses.

Today's broiler breeders not only want broilers that grow efficiently but also want broilers with good carcass quality and quantity, so research is carried out on broiler strains and several types of commercial feed circulating in Indonesia with the aim of being evaluation material and a source of information to obtain results. nutritional content in feed as well as differences in the genetic response of strains to the quantity and quality values of broiler production which include carcass quantity (final body weight, carcass percentage, breast meat deposition), meat quality (tenderness, meat protein, meat cholesterol), small intestine characteristics (viscosity, number and length of villi).

II. MATERIAL AND METHODS

This research was carried out in November – December 2023 with a cage preparation time of 2 weeks and broiler rearing time of 35 days. This research was conducted in a cage located on Jl. Oro-Oro Ombo, Junrejo District, Batu City, East Java.
Variable sample tests were carried out on the 35th day of maintenance.

- Meat Protein, Fat and Cholesterol tests are carried out at the FTP-UB Food Quality and Safety Testing Laboratory
- Tenderness tests and small intestine characteristics (viscosity, number and length of villi) were carried out at the Healthy Animal Laboratory, Malang.

A. Material

This research used DOC (Day Old Chick) with a rearing period of 35 days from strains A1 and A2 with a total of 96 individuals from each strain so that there were a total of 192 individuals whose gender was not differentiated (unsexed). The average weight of DOC broilers used was 38.36 ± 1.77 g and the coefficient of diversity was 4.35%

Weekly performance standards for broilers with strains A1 and A2 used in this study can be seen in Table 1

Table 1. Weekly Performance Standards for Strains A1 and A2

week	Body weight (g/head)	Intake (g/head)	FCR
Strain A1			
1	187	165	0.885
2	477	532	1.115
3	926	1.176	1.270
4	1.498	2.120	1.415
5	2.140	3.339	
Stra n A2			
1	175	150	0.857
2	486	512	1.052
3	932	1.167	1.252
4	1.467	2.105	1.435
5	2.049	3.283	1.602

Source: PT performance brochure. A1 and PT. A2

The feed used is commercial feed from the animal feed company PT. B1, PT. B2, PT. B3. The feed given is a starter type in the form of mash feed starting from DOC until harvest. Feed is given ad libitum according to the consumption requirements table

A comparison of the ingredient formulations and prices of 3 types of commercial feed brands can be seen in Table 2

Table 2. Ingredient content of commercial feed

Feed Brand	Feed Content	
	Feed Ingredients	Feed Additives
B1	Corn, MBM, CGM, PALM OLEIN	Lysine, Methionine, Sodium Bicarbonate, Vitamins, Minerals
B2	Soybean Meal, Fish Meal, Corn Gluten, Meat and Bone Meal, Oil, Corn	Calcium Phosphate, Vitamins, Minerals, Amino Acid, Phytase Enzyme
B3	Corn, Soybean Meal, Groats, Rice Bran, DDGS, Corn Gluten, Meat and Bone Meal, Palm Oil, Palm Oil	Essential Amino Acids, Vitamins, Premise Minerals, Phytase Enzyme

Source: Product labels for each brand

B. Methods

The research method used was experimental, designed using a Completely Randomized Design (CRD) with a

2x3 factorial pattern, with 6 treatments and 4 replications so that there were 24 treatment combination units, namely:

A1B1 : PT strain. A1 which was treated with commercial feed produced by PT. B1
A1B2 : PT strain. A1 which was treated with commercial feed produced by PT. B2
A1B3 : PT strain. A1 which was treated with commercial feed produced by PT. B3
A2B1 : PT strain. A1 which was treated with commercial feed produced by PT. B1
A2B2 : PT strain. A2 which was treated with commercial feed produced by PT. B2
A2B3 : PT strain. A3 which was treated with commercial feed produced by PT. B3

III. RESULT AND DISCUSSION

The results of the proximate analysis of the three commercial feed brands used can be seen in Table 3:

Table 3. Nutrient content of commercial feed

Content (%)	Commercial Feed		
	B1	B2	B3
Dry Ingredients (105°C)	90.30	90.42	89.03
Ash	6.77	5.27	6.60
Proteins	23.77	25.62	22.02
Crude fat	5.67	7.56	6.86
Crude fiber	1.42	1.87	2.26

Source: Results of Proximate Analysis of the Central Laboratory of Muhammadiyah University of Malang

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Table 4. Average Treatment for Broiler Appearance During the Research

Treatment	Final body weight (g/head)	Carcass Presentation (%)	Breast Meat Deposition (%)
A1 B1	1990 ± 64.19	74.45 ± 1.91	18.69 ± 0.77
A1 B2	2141 ± 79.72	78.38 ± 2.06	23.17 ± 3.98
A1 B3	2159 ± 131.12	75.41 ± 5.14	25.75 ± 4.38
A2 B1	1986 ± 96.26	74.92 ± 5.51	25.42 ± 3.50
A2 B2	2189 ± 66.00	84.18 ± 6.05	28.60 ± 2.22
A2 B3	2172 ± 124.96	76.97 ± 8.81	24.29 2.25

Influence on final body weight

The results of the statistical analysis indicated that factors A (different strains) and B (different commercial feeds) had no statistically significant influence on the final body weight ($p > 0.05$). The highest final body weight was observed in the A2B2 treatment, with a mean value of 2189 g per animal. It is postulated that this phenomenon is attributable to the feedstuff's elevated protein content, which reaches 25.62% (Table 3). It is postulated that this is due to the influence of the nutritional content of the type of feed provided and the different types of strains. Growth is the result of an interaction between genetic factors and environmental factors. This is in accordance with the statement by Anggitasari et al. (2016), which explains that the success of broiler rearing is influenced by several factors, including genetics, the content of the feed used, feed additives used in the feed, maintenance management, and environmental temperature.

The influence of factor A (different strains) on final body weight was not statistically significant ($p > 0.05$). This discrepancy can be attributed to the variation in the average day-old chick (DOC) weight, with strain A1 exhibiting an average weight of 40 grams and strain A2 demonstrating a mean weight of 38 grams. Hidayat et al. (2018) posited that the performance of each strain is contingent upon the breeding company responsible for its production.

The impact of Factor B (different commercial feed) was found to be highly significant ($p>0.01$), with the highest performance observed in the case of commercial feed B2. This is due to the fact that feed supply companies utilize specific feed formulations and employ diverse sources of ingredients. As elucidated by Harmayanda et al. (2016), discrepancies in the raw materials and ingredients utilized in the feed resulted in variations in the final body weights observed across the various treatments.

Influence on carcass percentage

The results of the statistical analysis indicated that factors A (different strains) and B (different commercial feeds) had no statistically significant influence on carcass percentage ($p > 0.05$). This was attributed to the final body weight of the treatment group during the study, which exhibited minimal impact. However, a distinction was observed between the highest treatment achieved by strain A2 and feed B2. This is due to the fact that the chicken in question exhibited a high final body weight, specifically 84.18%. This finding aligns with the conclusions of Melly et al. (2016), who posited that carcass percentage is influenced by a range of factors, including genetics, age, fat content, body weight, gender, feed quality and quantity.

The influence of factor A (different strains) on final body weight was not significantly different ($P>0.05$). The best results were achieved by A2, which was due to the differing genetic response capabilities. Hidayat et al. (2018) posited that the performance of each strain is contingent upon the breeder company responsible for its production. Consequently, the rearing of disparate broiler strains and their disparate feed consumption abilities will inevitably result in disparate growth outcomes.

The influence of Factor B (different commercial feed) on carcass percentage was not statistically significant. This was due to the absence of a statistically significant interaction between feed and strain on final body weight. Amal et al. (2018) posited that broilers with a high slaughter weight tend to have a higher breast weight. The B2 feed treatment yielded the most favorable outcomes when compared to those of other feed companies.

Influence on the percentage of breast meat deposition

The results of the statistical analysis demonstrated that factors A (different strains) and B (commercial feed) exerted significantly disparate influences on breast meat deposition. The treatment interactions yielded the most optimal outcomes when strain A2 was combined with feed B2. The chest is a measure of broiler carcass quality, as the majority of muscle is found in this area (Massolo et al., 2016). This is due to the fact that the development of meat in the chest is also influenced by genetics and the composition of the diet. The quality of meat can be influenced by a number of factors, including the type of livestock, breed, age, feed, and maintenance management (Rizal, 2006).

A significant difference ($P < 0.05$) was observed in the effect of Factor A (different strains) on breast meat deposition. The Duncan test revealed that the A2 and A1 strains exhibited statistically significant differences ($P < 0.05$), with the A2 strain demonstrating the most favorable outcomes. This is due to the direct proportionality between breast meat deposition and the increase in final body weight and carcass weight, as illustrated in Table 4. This finding aligns with the assertion put forth by Listyasari et al. (2022), which posits that the deposition of chicken breast meat is directly correlated with the increase in carcass weight and live weight. There are notable differences in growth, meat production, and feed consumption between strains A1 and A2. It is postulated that this discrepancy is attributable to the differing capacities of the two strains to adapt to their external environment, which in turn influences the rate of growth and meat production.

Table 5. Average Treatment for Broiler Meat Quality During the Research.

Treatment	Tenderness (mm/g/10s)	Meat protein (%)	Meat fat (%)
A1 B1	12.6± 0.51	21.89± 0.91	1.18 ± 0.57
A1 B2	13.7± 0.77	23.40±0.96	0.93± 1.31
A1 B3	13.4± 0.51	22.96±1.56	0.32± 0.16
A2 B1	14.2± 0.92	23.10±0.22	0.82± 1.31
A2 B2	15.2± 0.87	23.05±0.57	0.53± 0.27
A2 B3	12.1± 0.73	21.17±0.62	0.77± 0.13

Influence on Tenderness

The statistical analysis demonstrated that factors A (different strains) and B (different commercial feed) had a markedly disparate impact on the tenderness of broiler meat ($p>0.01$). These differences are influenced by variations in feed composition and the genetic response capacity of each strain. Duncan's further test demonstrated that B2, with the highest protein content (25.62%), exhibited the greatest tenderness (15.2%), as shown in Table 3. Conversely, treatment Feeding B3 yielded the lowest results for strains A1 and A2, which is attributed to differences in feed composition. Swcita and Suada (2020) posit that tenderness is attributable to feed factors, specifically that a relatively high protein content in the feed results in the production of greater quantities of fat, thereby enhancing the tenderness of the meat. Protein is highly efficacious in the formation of fat within the body.

The effect of Factor A (different strains) on tenderness was not found to be significantly different ($P > 0.05$). The numerical results for strains A1 and A2 were found to be statistically different. This is due to the fact that tenderness is a quality factor inherent to meat, the characteristics of which are influenced by a multitude of internal and external factors. Internal factors include livestock genetics, gender, and age. External factors include the composition of the feed provided, the methods of livestock maintenance, and the procedures employed in meat handling subsequent to the slaughter of the livestock.

The effect of Factor B (different commercial feeds) on tenderness was found to be highly significant ($P > 0.01$), with the optimal results obtained with feed B3. This is due to the fact that the rough ratio of B3 feed is higher than that of the other feeds, specifically 2.26%. This finding aligns with the conclusions of Stefanus et al.

(2015), who posited that crude fiber can reduce the fat content in chickens. A low tenderness rating for broiler meat indicates that the meat is denser and contains less fat. Furthermore, the protein content of the diet can impact the tenderness of the broiler meat, as protein plays a role in regulating growth, abdominal fat, body fat, muscle fiber diameter, and meat tenderness.

Effect on Meat Protein

The statistical analysis demonstrated that factors A (different strains) and B (different commercial feeds) exhibited markedly disparate effects (p>0.05) on broiler meat protein. The observed differences in meat protein content are influenced by the varying protein content of the basal feed used. Duncan's further test demonstrated that the highest meat protein content was achieved with the combination A1B2 (23.40%), while the lowest meat protein content was observed with the combination A2B1 (21.17%). The highest protein content is found in B2 feed, and the crude fiber in B3 feed is higher than that of other commercial feeds. This finding aligns with the research of Suthama et al. (2010), which suggests that feed consumption can influence protein deposition in meat. The observed protein content is not significantly different from the results of a study conducted by Roselin et al. (2023), who investigated the addition of bitter melon fruit (Momordica charantia) to basal feed, resulting in average meat protein content of 21.74–22.66%.

The effect of Factor A (different strains) on meat protein was not found to be significantly different (p > 0.05). Nevertheless, the numerical outcomes indicated that the treatment utilising strain A2 yielded superior results. This is attributable to disparate genetic response capabilities. This finding aligns with the conclusions of Risnajati (2012), who posited that the disparity in strains may influence meat protein by affecting the conversion of feed nutrients into growth.

The effect of Factor B (different commercial feed) on meat protein was not statistically significant (P > 0.05). The findings of Dewi et al. (2014) provide compelling evidence that an increase in protein digestibility is strongly associated with enhanced deposition of protein in the form of meat protein mass, thereby promoting an increase in body weight gain. The optimal treatment was observed with commercial feed B2, while the least effective was B3. The inclusion of a feed with a high protein content will result in an increased yield of meat protein. Adnyana et al. (2014) further state that the deposition of protein and amino acids in meat is significantly influenced by protein intake.Effect on meat fat

Effect on Fat Meat

The analysis of variance indicates that the interaction of treatments does not result in a statistically significant difference in the influence of factor A (different strains) and factor B (different feed) on broiler meat fat (P > 0.05). However, the numerical highest treatment was achieved by Strain A1 and Feed B1 (11.18%). This is due to the positive correlation between abdominal fat and carcass fat. The A1B1 combination results in the highest percentage of abdominal fat (1.29%). As posited by Mahfudz et al. (2009), elevated levels of meat fat may result from an excess of protein, which is then stored as fat. This research provides a relative fat content of 1.18–0.32%, which is not significantly different from the results of research conducted by Putra et al. (2022) with an average percentage of meat fat of 0.47–0.66%.

The results of the analysis of variance indicate that factor B (different commercial feed) had no significantly different effect (P < 0.05). 05) on broiler meat fat, but did provide differences between the feed treatments given. The A1B3 treatment exhibited the lowest percentage of fat content (82%). The low percentage of fat indicates that the increase in breast meat weight in this study was due to higher protein deposition compared to fat. This is due to the high crude fiber content of the B3 feed. Meliandasari et al. (2015) posited that a diet comprising a high proportion of crude fiber will result in a reduction in feed consumption, thereby preventing the accumulation of excess energy in the form of fat within the chickens.

Table 5. Average Treatment for Broiler Meat Quality During the Research.

Treatmen t	Viscosity (dPass)	Number of Villi (%)	Villi Height (%)
A1 B1	0.79 ± 0.035e	*3.90 ± 0.06*	*421.3 ± 121.1*
A1 B2	0.80 ± 0.079e	*3.90 ± 1.40*	*684.4 ± 132.7*
A1 B3	0.84 ± 0.061f	*4.00 ± 1.20*	*632.2 ± 217.5*
A2 B1	0.70 ± 0.062c	*3.35 ± 0.34*	*501.6 ± 170.6*
A2 B2	0.69 ± 0.047b	*3.10 ± 0.73*	*524.7 ± 154.6*
A2 B3	0.52 ± 0.037a	*2.95 ± 0.44*	*518.8 ± 93.3*

Influence on viscosity

The results of the analysis of variance indicate that treatment interactions yield an insignificant difference in influence (P > 0.05) between factor A (different strains) and factor B (different feed) on viscosity viscosity. This is attributed to the absence of antibacterial activity added to the treatment feed. This finding is corroborated by Silalahi et al. (2016), who posited that an elevation in intestinal viscosity may be attributed to an imbalance in the number of bacteria within the intestine. Furthermore, Natsir et al. (2016) posited that an increase in the viscosity of the lumen contents of the small intestine can lead to a reduction in digestibility, intestinal performance, and the inhibition of particle and dissolved substance movement within the intestinal lumen.

The effect of Factor A (different strains) on viscosity was found to be significantly different ($P < 0.01$). The mean relative viscosity values ranged from 2.55 to 3.23 dPass, with the highest results obtained by strain A2. A higher viscosity value in the small intestine corresponds with a lower rate of feed movement in the digestive tract (feed passage) (Stef et al., 2009). The increased viscosity of the small intestine results in a reduction in feed consumption. This finding aligns with the final body weight of the A1 treatment, which did not yield outcomes as favorable as those observed in the A2 strain.

The results of the analysis of variance indicate that factor B (different commercial feed) did not exert a significantly different effect ($P < 0.05$) on viscosity. Nevertheless, the numerical best treatment is B3 feed. This is attributable to the disparate composition of the feed ingredients. The crude fiber content of commercial feed B3 is 2.26% (Table 3). According to Prawitasari et al. (2012), a high crude fiber content in feed results in prolonged retention within the digestive tract, which in turn reduces the digestibility of crude protein and energy

Influence on the number of villi

The results of the analysis of variance indicate that treatment interactions have an insignificant impact on the influence of factor A (different strains) and factor B (different feed) on viscosity viscosity ($P > 0.05$). However, the highest numerical value was observed for treatment A2B2 4.00 transversal/cut. This is due to an increase in the number of intestinal villi, which results in an expansion of the absorption area and an enhancement of the absorption capacity. This finding aligns with the observations made by Izadi et al. (2013), who also noted that an increase in the number of villi is associated with chicken growth. The final body weight of the A2B2 group serves as an indicator of maximum food digestion, thereby providing the highest results.

The influence of Factor A (different strains) on the number of broiler villi was not significantly different ($P>0.05$). This was due to the fact that the feed provided during the study was unable to suppress the number of pathogenic bacteria in the small intestine, which in turn inhibited the growth of the villi. In their 2023 research, Munthe and colleagues demonstrated that the combination of an acidifier and P4 turmeric flour (at a ratio of 1.5% acidifier to 0.5% turmeric) yielded the most favorable outcomes when compared to the control treatment, which did not include the addition of a feed additive (P0).

The results of the analysis of variance indicate that factor B (different commercial feed) had a significantly different effect ($P < 0.05$) on the number of villi in the small intestine of the boiler. However, the B2 feed treatment yielded the optimal number of villi. An increase in villi length is associated with an expansion in the surface area or number of villi, facilitating the absorption of nutrients entering the bloodstream. This finding aligns with the observations of Iji et al. (2001), who posited that a reduction in villi surface area impedes the absorption of nutrients, ultimately limiting body weight gain in broilers.

Influence on villi height

The results of the analysis of variance indicate that the influence of treatment interactions on the number of villi is not statistically significant ($P > 0.05$) when comparing Factor A (different strains) and Factor B (different feed).

The impact of Factor A (different strains) on broiler villi height was not statistically significant ($P > 0.05$). The length of the villi is positively correlated with the number of villi, indicating that the A2 strain exhibits the highest yield. An increase in the length of the villi of the small intestine can result in a wider absorption surface, thereby facilitating optimal nutrient absorption. As elucidated by Hartono et al. (2016), the number of villi is correlated with the macrosize of the ileum. This is due to the fact that an increase in the length of the ileum results in a corresponding expansion of the surface area of the small intestine, which in turn leads to an augmented number of villi.

The results of the analysis of variance indicate that factor B (different commercial feed) had a markedly disparate effect ($P < 0.05$) on the length of the broiler small intestine villi. This is attributable to the increase in villi length, which is related to the surface area or number of villi for nutrient absorption. The latter also does not have a significantly different effect. This finding aligns with the argument put forth by Samik et al. (2007), who posit that the increase in the length of the small intestine's villi is caused by several factors, including stress levels, the number of pathogenic microbes, and chemical compounds found in the small intestine. These factors can affect the balance of intestinal microflora. This finding aligns with the results of the research conducted by Munthe et al. (2023). The P0 control treatment exhibited an average of 602.40 ± 9.34a, which was the lowest among the treatment groups that included additional feed additives. The incorporation of feed additives has the potential to enhance the microflora within the small intestine, thereby increasing the number of villi.

IV. CONCLUSIONS

- Based on the research results, it is recommended to use strain A2 to improve breast meat deposition, number of villi, WHC and use strain A1 to improve viscosity.
- Based on the research results, it is recommended to use commercial feed B2 to improve final body weight, WHC and commercial feed B3 to improve tenderness and shank color.
- Based on the research results, it is recommended that Broiler maintenance uses interactions between A2B2 to optimize breast meat deposition, A2B3 to optimize viscosity and tenderness and A1B2 to optimize meat protein,

REFERENCES

[1] dnyana, I. W. S., Damayanti, E., dan Marheni, E. (2014). Pengaruh Penambahan Tepung Temulawak (Curcuma xanthorrhiza Roxb) Dalam Pakan Terhadap Kadar Kolesterol Daging Broiler Umur 42 Hari. Jurnal Ilmiah Peternakan Terapan, 2(2), 37-42..

[2] Anggitasari, S., O. Sjofjan dan I. H. Djunaidi. 2016. Pengaruh Beberapa Jenis Pakan Komersial Terhadap Kinerja Produksi Kiantitatif dan Kulitatif Broiler. *Buletin Peternakan.* 40(3):187-196.

[3] Dewi, A., N. Suthama dan U. Atmomarsono. 2014. penggunaan protein dan pertumbuhan pada Broiler yang diberi pakan dengan penambahan tepung temu kunci (Boesenbergia pandurata ROXB.) (Protein Utilization and Growth of Broiler Chicken Fed Dietary Finggeroot (Boesenbergia pandurata ROXB.)). 3(2) : 164-170

[4] Harmayanda, P. O. A., D. Rosyidi dan O. Sjofjan. 2016. Evaluasi Kualitas Telur dari Hasil Pemberian Beberapa Jenis Pakan Komersial Ayam Petelur. Jurnal Pembangunan dan Alam Lestari. 7(1) : 25-32.

[5] Hartono, E., F., Iriyanti N., Suhermiyati S. 2016. Efek Penggunaan Sinbiotik Terhadap Kondisi Miklofora dan Histologi Usus Ayam Sentul Jantan. Agripet, 16:(2) :1-13.

[6] Hidayat, K., S. Wibowo., L. A. Sari. dan A. Darmawan. 2018. Acidifier Alami Air Perasan Jeruk Nipis (Citrus Aurantiun) Sebagai Pengganti Antibiotic Gowth Promotor Broiler. Jurnal peternakan. 1 : 56-59.

[7] Listyasari, N., Soeharsono, S., & Purnama, M. (2022). Perbandingan Susunan Jantan dan Betina Memengaruhi Performa Ayam Pedaging Galur Lohman Broder Mb202. Jurnal Veteriner, , 239-245

[8] Meliandasari, D., B. Dwiloka, dan E. Suprijatna. 2015. Optimasi Daun Kayambang (Salvinia Molesta) untuk Penurunan Kolesterol Daging dan Peningkatan Kualitas Asam Lemak Esensial. Jurnal Aplikasi Teknologi Pangan, 4(1): 22-27.

[9] Melly, P. S., M. A. Pagala dan A. S. Aku. 2016. Produksi Karkas dan Lemak Abdominal Broiler *Strain* Cobb dan *Strain* Lohmann yang Diberi Pakan Berbeda. *JITRO*. 1(1) : 1-6.

[10] Pangesti, U. T., M. H. Natsir, dan E. Sudjarwo. 2016. Pengaruh Penggunaan Tepung Biji Nangka (Artocarpus heteropHyllus) dalam Pakan Terhadap Bobot Giblet Broiler. Journal of Tropical Animal Production. 17(2): 58-65.

[11] Pratama, A., K. Suradi, R. L. Balia, H. Chairunnisa, H. A. Lengkey, D. S. Sutarjo, L. Suryaningsih, J. Gumilar, E. Wulandari, W. S. Putranto. 2015. Evaluasi Karakteristik Sifat Fisik Karkas Broiler Berdasarkan Bobot Badan Hidup. *Jurnal Ilmu Ternak*. 15(2) : 61-64

[12] Prawitasari, Ismadi dan Estiningdriati. 2012. Kecernaan Protein Kasar dan Serat Kasar Laju Digesta pada Ayam Arab yang Diberi Pakan Dengan Beragam Level *Azolla Microphylla. Animal Agriculture Journal. 1(1) : 471-483.*

[13] Risnajati, Dede. 2012. Perbandingan Bobot Akhir, Bobot karkas dan Presentase Karkas Berbagai *Strain* Broiler. *Sains Peternakan.* 10(1):11-14.

[14] Rizal, Y. 2006. Ilmu Nutrisi Unggas. Padang: Andalas University Press Padang

[15] Roselin, G. L. A. Ilminia, K. F. Rinca, Y. H. M. F. Bollyn, M. T. Luju dan P. C. Achmadi.

Evaluasi Penambahan Tepung Buah Pare (Momordica charantia) Sebagai Imbuhan Pakan Terhadap Kualitas Fisik Dan Kimia Daging Ayam Pedaging. Jurnal Ilmiah Peternakan Terpadu. 11(2) : 82-91

[16] Stefanus, Y. T., V. J. Ballo dan M. Sinlae. 2015. pengaruh pemberian tepung bonggol pisang dan tepung daun kelor sebagai pengganti jagung terhadap warna, rasa, dan keempukan daging Broiler. 2(1) : 67-74

