JWPR
Journal of World's
Poultry Research

2023, Scienceline Publication
J. World Poult. Res. 13(1): 127-135, March 25, 2023

Research Paper, PII: S2322455X2300014-13

DOI: https://dx.doi.org/10.36380/jwpr.2023.14

Effects of *Lactobacillus*-Fermented Feed on Production Performance and Carcass Quality of Broiler Chickens

Rizki Palupi*, Fitri Nova Liya Lubis, Anggriawan Naidilah Tetra Pratama, and Muhakka

Department of Technology and Livestock Industry, Faculty of Agricultural, Sriwijaya University, Indralaya, South Sumatera, Indonesia

*Corresponding author's Email: palupiarda@yahoo.com

Received: 21 December 2022
Accepted: 13 February 2023

ABSTRACT

The quality of broiler chicken carcasses is greatly influenced by feed management and the number of nutrients digested in the digestive tract that will be utilized for optimal meat production. The study aimed to determine the effect of feeding fermented feed at different times on the production performance and quality of broiler chicken carcasses. The number of day-old chicks used in this study was 180 broiler chickens strain Cobb. This study was carried out experimentally using a complete randomized design consisting of four treatments and five replications. Each treatment carried out in this experiment consisted of a different length of time, namely feeding for 2, 3, 4, and 5 weeks. Experimental parameters included feed consumption, weight gain, and ration conversion. In addition, the carcass quality was investigated as live weight, carcass percentage, and percentage of broiler chicken abdominal fat. The results showed that the longer the time of fermentation feed significantly increased feed consumption by 40.07% and increased 13.77% weight gain, as well as decreased ration conversion by 25.33%. Furthermore, the same results were also obtained regarding live weight by 17.80% and increased percentage of the carcass by 8.84%, while the percentage of abdominal fat decreased by 12.90%. It can be concluded that the provision of fermented feed for 5 weeks can improve the production performance and carcass quality of broiler chickens.

Keywords: Broiler chicken, Carcass quality, Fermented feed, Performance

INTRODUCTION

Broiler chickens have a role as a source of animal protein that is in demand by consumers. This demand is because broiler chicken carcasses can be produced faster than other livestock. However, the quality of broiler carcasses is greatly influenced by feed management and the number of nutrients digested in the digestive tract that will be utilized for optimal meat production (Baéza et al., 2022). Various attempts have been made to increase the amount of digested nutrients and increase digestibility by processing feed before consumption. Feed processing that can be pursued is fermenting the feed. One of the feed processing that can be done is by fermenting the feed. The fermentation process can increase feed digestibility and crude protein content and reduce crude fiber in feed (Khempaka et al., 2014). The fermented feed provides several benefits, including improving nutritional properties (reducing fiber and increasing protein content) and intestinal health. It will accelerate broiler chicken's growth (Sugiharto, 2019).

The fermentation process requires an inoculant to speed up the breakdown of nutrients in the feed (Romero et al., 2017). *Lactobacillus* are lactic acid bacteria often used in fermentation (Romero et al., 2017; Singracha et al., 2017; Nair et al., 2019). Lactic acid bacteria will grow and develop on the substrate during fermentation, so the feed contains probiotics utilized by livestock to help the food digestion process. Astuti et al. (2015) found that probiotics could be given at a concentration of 0.6 v/w in broiler up to 28 days of age. The higher the level of the probiotic *Lactobacillus* species in feed, the better the effect on the growth (Pradikta et al., 2018). Previously, Mcnaught and MacFie (2001) stated that many probiotics could attach firmly to intestinal cells, including several types of lactic acid bacteria, such as *Lactobacillus* *casei*, *Lactobacillus acidophilus*, *Lactobacillus plantarum,* and a large number of *Bifidobacteria*. The ability to stick to the digestive tract will cause probiotic microbes to develop appropriately, and pathogenic microbes such as *Escherichia coli* and *Salmonella* *Typhimurium* in the digestive tract will be reduced from the animal host cells (McNaught and MacFie, 2001).

The feeding duration of specific feeds will allow probiotics to stick to poultry's digestive tract for a more extended period, affecting livestock production (Al-Khalaifah, 2018; Al-Khalaifa et al., 2019). The results of the research by Zulfan and Zulfikar (2020) and Naji et al. (2015) indicated that fermented feed ingredients could be given in commercial rations without disturbing the growth and increasing the income over feed costs of broiler. Furthermore, feeding in the early phase of growth or during the brooding period can affect the growth of broiler day-old chicks (DOC; Al-Khalaifa et al., 2019). Cell multiplication or hyperplasia occurs when chicks are 1 to 14 days old. The multiplication of these cells includes the development of the digestive tract, respiratory tract, and immune system. Body cells will increase in number by way of cell division. The hyperplasia process will affect further growth in the form of hypertropia growth, cells will increase in size or cell maturation (Fatmaningsih and Nova, 2016). Based on the description above, the current study aimed to determine the effect of fermented feed at different times on the production performance and carcass quality of broiler chickens.

MATERIALS AND METHODS

Ethical approval

An animal feeding experiment was conducted at the experimental station, Department of Animal Science, Faculty of Agriculture, Universitas Sriwijaya, South Sumatera, Indonesia. The animals were cared for according to the Indonesian Institute of Sciences Animal Welfare Guidelines. The approval of the experiment was granted from Universitas Sriwijaya with approval number KPPHP-2021-1.

Methods and sampling preparation

This study used 180 DOC of Cobb strain broilers obtained from Charoen Pokphand, Indonesia, with an average weight of 38 g and placed in 20 postal cages with a size of 100 cm × 100 cm. The temperature of the cage environment when conducting the study ranged from 32.2-33°C, with humidity ranged 68.1-85.7. Nine broilers were placed in each cage. The cages had feed dishes, water containers, and 60-watt incandescent lamps for lighting and warmth while the chicks were in them. Water and feed were prepared *ad libitum*. The feed used during the starter period was HI Pro (Charoen Pokphand, Indonesia), the feed is given to DOC up to the age of 14 days, and at the time, the finisher was MR1-P (Cheiljedang, Indonesia), the finisher feed given at the age of 3 to 5 weeks of age. The composition of the nutrients in the feed used during the study is shown in Table 1.

Table 1. Nutrient composition of feed given at the starter and finisher period in broiler chickens strain cobb

Nutrient	Starter feed (1-21 days of age, HI Pro)*	Finisher feed (22-35 days of age, MR1 – P)**
Water content (%)	13	13
Crude protein (%)	22.00-23.00	21.50-23.00
Crude fibre (%)	5.00	4.00
Fat (%)	5.00	8.00
Ash (%)	7.00	6.50
Calcium (%)	0.90	0.90-1.20
Phosphor (%)	0.60	0.70-1.00
Metabolizable energy (kcal/kg)	3,020-3,120	2,750-2,768
Methionine	0.61	0.56
Methionine plus Cysteine	0.78	0.75
Lysine	1.28	1.28
Vitamin C (IU)	300	300
Selenium (ppm)	0.1	0.5

* Incorporated Company Charoen Pokphand, Indonesia, produces the feed. ** Incorporated Company Cheil Jedang Super Feed, Lampung produces the feed.

Before the feed was given to the experimental animals, the feed was fermented for 7 days using Super lacto, a product of the Central Proteina Prima Tbk company, Indonesia, containing the *Lactobacillus burlgarius* bacteria of 8.9x10^{8-} CFUmL^{-1}. Based on the product label, the fermentation process was carried out by diluting Super lacto at a concentration of 15%. Afterward, feed inoculation process was performed by spraying the inoculant evenly (4% w/v) on the feed. The feed was stirred evenly so that the fermentation process ran optimally. After evenly packing, it was stored for 7 days. Then, 10% of the fermented feed was used in the broiler ration (Sun et al., 2022) based on the length of time defined for the treatments.

As for the measurement of carcass quality in research carried out at the final stage of the study. Samples were taken randomly as many as 2 in each treatment and replicated. Then the chicken samples were fasted for 8 hours before being slaughtered.

Experimental design

This research was conducted using a completely randomized design consisting of four treatments and five replications for each treatment. Each treatment carried out in this experiment consisted of a different length of time, namely feeding for 2 (P1), 3 (P2), 4 (P3), and 5 weeks (P4).

Observed variables

All parameters for calculating the value of observations made in this study are based on research conducted by Palupi et al. (2022).

Feed consumption

The investigated parameters included consumption of ration (g/head/day), which was measured based on the difference between the ration given (g) and the rest of the ration given (g) during a specific period (days).

Body weight gain

Body weight gain (g/head/day) was measured by weighing the difference between body weight at the end of the study (g) and the initial body weight (g), then divided by the length of rearing time (days).

Feed conversion ratio

Conversion of rations was measured based on the ratio between weight gain and feed consumption.

Live weight

The quality of the broiler carcass included the measurement of live weight, which was measured based on the results of weighing at the end of the study (g).

Carcass percentage

Percentage of the carcass was calculated based on the percentage of weight comparison of broilers without blood, feathers, head, legs, and digestive organs (g) divided by live weight (g). Carcass quality parameters were measured at the end of the study. Slaughtering of chickens is done by as many as two chickens every replication.

Percentage of abdominal fat

Percentage of abdominal fat (%), which is calculated based on the percentage of the comparison between the weight of abdominal fat contained in the abdominal cavity and fat attached to the digestive organs (g) with the live weight of broilers (g).

Statistical analysis

The data will be processed using SPSS software (version 20), based on the design used. Analysis of Variance (ANOVA) analyzes data from observation during the study. If there is a significant difference, a further test is carried out using Duncan's Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Production performance

The average performance of broiler production observed during the research was feed consumption, body weight gain, and feed conversion. The data are presented in Table 2.

Table 2. Production performance at the starter and finisher period in broiler chicken

Treatment	Feed consumption (g/head/day)	Weight gain (g/head/day)	Feed conversion ratio
P1	78.17 ± 3.45^{a}	51.83 ± 6.24^{a}	1.50 ± 0.22^{a}
P2	86.71 ± 4.12^{b}	55.55 ± 4.88^{a}	1.56 ± 1.45^{a}
P3	96.43 ± 3.41^{c}	60.28 ± 5.61^{b}	1.60 ± 1.03^{a}
P4	118.24 ± 2.66^{d}	65.80 ± 3.87^{b}	1.80 ± 1.56^{b}

[abc] Different superscript letters in the same column showed a significant difference ($p < 0.05$). P1: Fermented feed for 2 weeks, P2: Fermented feed for 3 weeks. P3: Fermented feed for 4 weeks, P4: Fermented feed for 5 weeks.

Feed consumption

The analysis of variance revealed that the duration of feeding fermented with *Lactobacillus* had a significant effect on the consumption of broiler chicken ration ($p < 0.05$). The average consumption of broiler rations during the study ranged from 78.17 to 118.24 (g/head/day). The most extended fermented feed would affect the feed consumption; this was assumed because adding feed fermented with *Lactobacillus* has better palatability, so broilers prefer it. Widodo et al. (2013) reported that fermented feed could be given to a level of 15% in the ration because fermented feed with *Lactobacillus* provides aromas, flavors, and shapes that broilers prefer, thereby increasing feed consumption.

Further test results showed that the consumption ratio of P1 was significantly different from P2 ($p < 0.05$). It was hypothesized that the increased consumption at each treatment in this study was due to the duration of the feed fermented with *Lactobacillus* supplementation, which could lead to improved feed quality. Widodo et al. (2013) found that fermented feed had improved quality compared to feed that had not undergone the fermentation process. This improvement in feed quality is because the feed contains *Lactobacillus*, which helps speed up the digestive process, thereby improving the digestibility of the feed. Getachew (2016) revealed that lactic acid bacteria could live and grow in the intestine and produce enzymes, such as proteases and amylases, which could help improve digestion and produce short-chain fatty acids with antibacterial properties to protect nutritive feed. Therefore, feed intake can be improved by adding feed fermented with lactic acid bacteria.

Feed consumption in P2 was significantly different from P3, suggesting that the increased consumption was due to the palatability of the *Lactobacillus*-fermented feed, which was preferred by livestock ($p < 0.05$). Furthermore, the lactic acid produced by lactobacilli in the gut plays a tremendous role in eliminating pathogenic bacteria and maximizing the digestibility of the feed by ensuring that there is no competition for the utilization of the nutrients ingested. This statement is believed to be due to its impact on consumption (Wikanatsiri et al., 2012).

The consumption of rations at P3 was significantly different from that in P4 ($p < 0.05$); it was suspected that feed fermented with *Lactobacillus* could improve palatability. Furthermore, throughout these 4-5 weeks of treatment, the amount of *Lactobacillus* in the intestine could be increased so that the more extended feeding fermented with *Lactobacillus* caused the more significant population of *Lactobacillus* in the digestive tract of broilers, which caused the ratio consumption and feed digestibility increased. Elbaz (2021) reported that broiler rations supplemented with *Lactobacillus* could increase palatability, feed consumption, broiler immune system (health), productivity, efficiency, and feed consumption. According to Hardiningsih et al. (2006), the benefits of providing *Lactobacillus* in mixed feed to broilers included increased palatability, maintaining microflora, helping increase digestive enzyme activity, reducing bacterial enzyme activity and ammonia production, increased feed consumption and digestion, neutralizing both enterotoxins and toxins, and also stimulates the immune system.

Body weight gain

The analysis of variance showed that the feed fermented with *Lactobacillus* had a significant effect ($p < 0.05$) on the increase in the body weight of broilers. It is suspected that feed fermented with *Lactobacillus* can increase feed digestibility in the digestive tract. As mentioned by Astuti et al. (2015), increasing the number of *Lactobacillus* in the intestine will positively affect broilers' growth because *Lactobacillus* bacteria can break down simple carbohydrates into lactic acid. *Lactobacillus* bacteria can maintain the balance of other beneficial bacteria populations in the small intestine so that feed digestibility improves, affecting the increase in broilers' body weight.

The results of further tests showed that the body weight gain of broilers in treatment P1 was not significantly different ($p > 0.05$) with treatment P2 but significantly different ($p < 0.05$) with treatment P3 and P4. This result is thought to be due to the number of *Lactobacillus* in the digestive tract of broiler chickens because the P1 treatment is the same as the P2 treatment; this could be due to various factors. Uzer et al. (2013) *Lactobacilli* maintain beneficial microflora in the gastrointestinal tract, conversely, suppress the growth of pathogenic bacteria, increase digestive enzyme activity, decrease bacterial enzyme activity and ammonia production, increase food intake and digestion, and enterotoxins and neutralize immunity. A stimulating system that does not compete in digesting food.

The body weight gain of broilers in P2 significantly differed from that in P3 ($p < 0.05$), it was suspected that feed fermented with *Lactobacillus* could protect the digestive tract from pathogenic bacteria and streamline feed consumption. According to Astuti et al. (2015), increasing the number of *Lactobacillus* in the intestine will positively affect the growth of chickens which could break down simple carbohydrates into lactic acid. *Lactobacillus*, in addition to maintaining the digestive tract and improving the nutritional value of feed. Body weight gain is closely related to feeding in terms of quantity related to feeding consumption. If feed consumption is disturbed, it will interfere with growth and vice versa; if feed consumption is sufficient, it will increase broiler body weight. The growth of various types of broiler chickens is highly dependent on the feed consumed and is also determined by the development of the digestive tract (Fanatico et al., 2008; Torrey et al., 2021; Singh et al., 2021).

The weight gains of broilers in the P1 and P2 treatments significantly differed from that in P3 and P4 treatments ($p < 0.05$). It is suspected that feeding fermented feed with *Lactobacillus* can increase body weight gain due to its ability to suppress pathogenic bacteria. Furthermore, it can also increase feed digestibility, which has the effect of increasing the digestibility of protein, where feed fermented with *Lactobacillus* produces proteolytic enzymes in the digestive tract, which then can help digest protein, thereby increasing body weight (Muck et al., 2018). A fermented feed with *Lactobacillus,* suppressing pathogenic bacteria, can also improve the digestive organs, stimulating bile and pancreatic juice so that it affects the body weight gain of broiler chickens (Uguru et al., 2022). Nurhayati et al. (2015) indicated that the use of fermented feed with *Lactobacillus* in broiler chickens could increase the functionality of the digestive organs of broilers, namely stimulating the gallbladder wall to secrete bile and stimulating the secretion of pancreatic juice, which contains amylase, lipase, and protease enzymes to improve the digestion of feed ingredients such as carbohydrates, fats, and proteins. Thus, the more extended feeding of fermented feed with *Lactobacillus* resulted in better body weight gain.

Feed conversion ratio

The analysis of variance showed that the addition of fermented feed containing *Lactobacillus* with 5 weeks curing time (P4) had a significant effect ($p < 0.05$) on the conversion of broiler rations. It was reported that the role of fermented *Lactobacillus* in feed is essential because the feed provided is efficient in increasing the body weight of broilers *Lactobacillus* is a gram-positive microorganism found in milk, fruits, and soil. These lactobacilli can maintain the natural balance of the chicken intestine, so they can function as natural antibiotics (Chen et al., 2005; Chen et al., 2017). Kiha et al. (2012) indicated that *Lactobacillus* in the digestive tract could suppress pathogenic bacteria, so they do not compete in digesting nutrients and maximize nutrient absorption in the digestive tract. The longer addition of feed fermented with *Lactobacillus* can increase the body weight gain of broiler chickens; in addition, the increase in body weight of broiler chickens can be influenced by the consumption of feed and the nutritional content contained in the feed or the consumption of nutrients in the feed. The longer the feeding time fermented with *Lactobacillus*, the greater the body weight gain.

Carcass quality

The average carcass quality of broilers during the study observed was live weight, carcass percentage, and abdominal fat percentage. The data are presented in Table 3.

Table 3. Average carcass quality of broiler chickens

Treatment	Live body weight (g)	Carcass (%)	Abdomen fat (%)
P1	1699.50 ± 13.44^{a}	72.02 ± 6.43^{a}	$1.24 \pm 0.12_{a}$
P2	1797.50 ± 21.06^{a}	75.02 ± 11.03^{a}	1.32 ± 0.11^{b}
P3	1900.75 ± 20.11^{b}	77.65 ± 5.44^{b}	1.40 ± 0.80^{b}
P4	2002.00 ± 16.37^{c}	78.39 ± 7.18^{b}	1.34 ± 0.32^{b}

[abc] Different superscript letters in the same column showed a significant difference ($p < 0.05$). P1: fermented feed for 2 weeks, P2: fermented feed for 3 weeks. P3: fermented feed for 4 weeks, P4: fermented feed for 5 weeks.

Live body weight

The average live weight obtained in this study ranged 1699.50-2002.00 gr. The results of the analysis of diversity on the final weight of broiler chickens showed the addition of fermented feed containing *Lactobacillus* with 5 weeks curing time (P4) had a significant effect ($p < 0.05$) on the live weight of broiler chickens. It is suspected that *Lactobacillus* can produce lactic acid in the digestive tract so that it can lower the pH in the digestive tract. Low pH conditions will multiply beneficial bacteria, allowing for faster nutrient absorption and increased growth, affecting broiler chickens' live weight (Akhadiarto, 2010).

On the other hand, the results revealed that the live weight of broiler chickens at P1 was not significantly different ($p > 0.05$) from P2 but was significantly different ($p < 0.05$) from P3 and P4 regarding the live weight of broilers. This result indicated that the effect of feeding time fermented with *Lactobacillus* for 2-3 weeks could lead to the same live weight because *lactobacillus* activity on the duration of feeding fermented at P1 and P2 gave the same effect. However, feeding fermented with *Lactobacillus* for 4 and 5 weeks could increase live weight higher than P1 and P2. This result is presumably because of the length of time *Lactobacillus* in the digestive tract can increase the intestinal villi's surface areas, so that nutrient absorption is better, reducing the growth of pathogenic microorganisms. In line with the research results of Ignatova et al. (2009), it was shown that giving a probiotic supplement (*Lactobacillus*) for 5 weeks positively increases the live weight of broilers and livestock products that are safe for consumption.

Feeding fermented with *Lactobacillus* at P2 was significantly different ($p < 0.05$) compared to P3 and P4 on the results of the weight of broiler chickens. It is suspected that the duration of feeding fermented with *Lactobacillus* for 3 weeks is still in average conditions to produce a live weight. Moreover, because the feed fermented with *Lactobacillus* is given only up to 3 weeks, after more than 3 weeks, the lactic acid bacteria produced from the *Lactobacillus* fermented feed will be less so that the acidic conditions in the digestive tract are normal. According to Rodríguez-Lecompte et al. (2010), adding *Lactobacillus* to the feed will reduce pH and increase the number of microorganisms in the digestive tract, accelerating the growth of digestive organs and allowing them to develop optimally. Feeding fermented with *Lactobacillus* at 4 and 5 weeks resulted in high body weight gain. It can be assumed that the more extended feeding fermented with *Lactobacillus* will result in greater body weight.

Feeding fermented feed with *Lactobacillus* for 4 weeks was significantly different ($p < 0.05$), compared to feeding fermented feed for 5 weeks. Presumably, the longer the feeding is fermented with *Lactobacillus*, the more lactic acid bacteria are produced, which lower the digestive tracts pH, facilitating the metabolic process and producing a high body weight. This case follows the opinion of Elbaz (2021), which indicated that using *Lactobacillus* in feed aims to balance the microflora in the digestive tract to increase the absorption of nutrients to produce ideal body weight.

Carcass percentage

The average percentage of broiler carcass for each treatment during the study can be seen in Table 3. The average percentage of broiler carcasses obtained in this study ranged from 72.02 to 78.39%. The results of the analysis of variance on broiler carcasses showed the addition of fermented feed containing *Lactobacillus* with 5 weeks curing time (P4) had a significant effect ($p < 0.05$) on the percentage carcasses of broilers. This result was because the duration of feeding fermented with *Lactobacillus* can lower the pH of the digestive tract and facilitate the work of the pepsin enzyme so that protein absorption increases. Baéza et al. (2022) stated that the average percentage of broiler carcasses is around 65-78% of the final body weight.

The results of further tests on the percentage carcasses of broiler carcasses showed that the percentage of carcasses in P1 was not significantly different ($p > 0.05$) with P2 but significantly different ($p < 0.05$) with P3 and P4. This result indicated that the effect of feeding fermented feed with *Lactobacillus* for 2 weeks and three weeks resulted in a carcass percentage of 72.02-75.02% lower than P3 and P4. The reason is that feeding fermented with *Lactobacillus* for 2 and 3 weeks has the potential for the growth of pathogenic bacteria, such as *salmonella* bacteria. The fermented feed can minimize the growth of *salmonella* pathogenic bacteria so that the protein digestion process assisted by enzymes will be slower compared to P3 and P4, while the duration of feeding fermented with *Lactobacillus* for 4-5 weeks resulted in a higher carcass percentage than P1 and P2, ranging from 77.64% to 78.39%. *Lactobacillus* acts as a growth promoter which can increase pepsin enzyme in the digestive tract so that the absorption of nutrients in the intestines and the resulting metabolic products can be utilized by the livestock body to form and add new tissues such as meat formation (Ignatova et al., 2009).

Feeding fermented with *Lactobacillus* in treatment P2 significantly differed when compared to P3 and P4 regarding carcass percentage ($p < 0.05$). This reason is that the length of time of fermented feed with *Lactobacillus* will produce a great percentage of the carcass. After all, *Lactobacillus* will produce lactic acid bacteria, which facilitate the work of the digestive tract, resulting in a high percentage of the carcass. Maunatin and Khanifa (2012) stated that lactic acid bacteria in the digestive system could neutralize toxins produced by pathogenic bacteria, affecting enzyme activity in the small intestine so that the blood will circulate nutrients throughout the body to form meat.

Feeding fermented feed with *Lactobacillus* at P3 was not significantly different ($p > 0.05$) with P4. This case was because the 4-week fermented feed had the same number of *Lactobacillus* bacteria as the fermented feed treatment for 5 weeks, so the enzyme performance produced was the same in the P3 and P4 treatments. One of the increased enzyme performances due to the increase in the microbial population is the pepsin enzyme, to break down protein. Then, feed nutrients will be absorbed throughout the body to form meat deposition. Similarly, Mountzouris et al. (2010) found that the use of probiotics in feed can work optimally in the digestive tract by increasing the number of microbial populations, thereby balancing the microflora in the digestive tract, protecting the digestive system, improving intestinal health and increasing livestock productivity.

Abdominal fat percentage

The average percentage of abdominal fat weight ranged from 1.24 to 1.40%. It can be assumed that feeding fermented with *Lactobacillus* facilitates the hydrolysis of carbohydrates in the digestive tract, facilitating the absorption of glucose and monosaccharides. Meanwhile, feed containing easily digestible carbohydrates will result in increased abdominal fat. Following the view of Jha and Mishra (2021), poultry-fed carbohydrate-based diets have a higher abdominal fat content than fibrous; easily digestible carbohydrates tend to be converted into energy reserves in the form of fat. According to Hidayat (2015), fat formation occurs due to excess energy consumed. Excess energy in broilers will be stored in the form of abdominal fat.

Further test results revealed that the percentage of abdominal fat given fermented feed with *Lactobacillus* at P1 was significantly different ($p < 0.05$) from P2, P3, and P4 in terms of abdominal fat percentage. It is suspected that the feeding duration fermented with *Lactobacillus* at P1 was still in normal condition resulting in a lower percentage of abdominal fat. In contrast, at P2, P3, and P4, the length of feeding fermented with *Lactobacillus* could reduce the activity of the lipase enzyme that plays a role in the rate of acid synthesis. Fouad and El-Senousey (2014) reported that the decrease in abdominal fat deposition with a decrease in the energy content of the ration was due to the reduced activity of lipase enzymes associated with lipogenic processes in the liver. Lipogenesis is a fat deposition process that includes fatty acid synthesis and triglyceride synthesis that occurs in the liver in the mitochondria, cytoplasm, and adipose tissue. Fat in the body originates from feed and is produced from the synthesis process in the liver (Jensen-Urstad and Semenkovich, 2012). Feeding fermented feed with *Lactobacillus* at P2 and P3 was not significantly different ($p > 0.05$) but significantly different from P4. In this case, presumably because feeding fermented with *Lactobacillus* can optimize the absorption of the digestive tract so that the nutritional content of the feed is more directed at the formation of meat and bones than fat in each treatment. Fouad and El-Senousey (2014) stated that nutrition affects the deposition of abdominal fat in the body of broiler chickens. Reduction of body fat deposits in broilers, including abdominal fat, occurs due to a reduction in fatty acid synthesis in the liver and a decrease in lipase enzyme secretion, thereby reducing fat absorption. Zhang et al. (1999) stated that fatty acids reduce the amount of body fat deposition in broilers by suppressing the activity of the lipase enzyme in plasma.

CONCLUSION

According to the present study's findings, adding fermented *Lactobacillus* feed for 5 weeks could increase body weight gain by 16.30%, decrease feed conversion by 11.10% and improve the carcass quality of broiler chickens. Recommendations for further research are the increased application of fermented feed by *Lactobacillus* as a feed mixture to the number of pathogenic and non-pathogenic microbial populations and the characteristics of the digestive organs in broiler chickens.

DECLARATIONS

Acknowledgments

The authors would like to thank the Incorporated Company Satwa Utama Integrasi as a funding source; and Apriadi, Epanria, and Rafi Megansyah for their assistance during the research.

Authors' contributions

All authors developed the theory and supervised the research. Rizki Palupi contributed to the sample collection and analysis calculations. All authors read and approved the final version of the manuscript for publishing in the present journal.

Competing interests

The authors have declared that no competing interest exists

Ethical consideration

All authors have reviewed the manuscripts for ethical concerns, such as plagiarism, consent to publish, misconduct, data fabrication and falsification, double publishing and submission, and redundancy.

Availability data and materials

The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

REFERENCES

Akhadiarto S (2010). Pengaruh pemberian probiotik temban, biovet dan biolacta terhadap persentase karkas, bobot lemak abdomen dan organ dalam ayam broiler [The effect of addition of probiotics product into drinking water on percentage of carcass, body fat and edible offal]. Jurnal Sains Dan Teknologi Indonesia, 12(1): 53-59. DOI: https://www.doi.org/10.29122/jsti.v12i1.851

Al-Khalaifa H, Al-Nasser A, Al-Surayee T, Al-Kandari S, Al-Enzi N, Al-Sharrah T, Ragheb G, Al-Qalaf S, and Mohammed A (2019). Effect of dietary probiotics and prebiotics on the performance of broiler chickens. Poultry Science, 98(10): 4465-4479. DOI: https://www.doi.org/10.3382/ps/pez282

Al-Khalaifah HS (2018). Benefits of probiotics and/or prebiotics for antibiotic-reduced poultry. Poultry Science, 97(11): 3807-3815. DOI: https://www.doi.org/10.3382/ps/pey160

Astuti FK, Busono W, and Sjofjan O (2015). The effect of liquid probiotics in broiler feed for broiler production performance. EnviIndonesian Journal of Evironment and Sustainable Development, 6(2): 99-104.

Baéza E, Guillier L, and Petracci M (2022). Review: Production factors affecting poultry carcass and meat quality attributes. Animal, 16(1): 100331. DOI: https://www.doi.org/10.1016/j.animal.2021.100331

Chen CY, Chen SW, and Wang HT (2017). Effect of supplementation of yeast with bacteriocin and *Lactobacillus* culture on growth performance, cecal fermentation, microbiota composition, and blood characteristics in broiler chickens. Asian Australia Journal of Animal Sciences, 30: 211-220. DOI: https://www.doi.org/10.5713/ajas.16.0203

Chen YS, Yanagida F, and Shinohara T (2005). Isolation and identification of lactic acid bacteria from soil using an enrichment procedure. Letters in Applied Microbiology, 40(3): 195-200. DOI: https://www.doi.org/10.1111/j.1472-765X.2005.01653.x

Elbaz AM (2021). Effects of diet containing fermented canola meal on performance, blood parameters, and gut health of broiler chickens. Journal of World's Poultry Research, 11(1): 1-7. DOI: https://www.doi.org/10.36380/jwpr.2021.1

Fanatico AC, Pillai PB, Hester PY, Falcone C, Mench JA, Owens CM, and Emmert JL (2008). Performance, livability, and carcass yield of slow- and fast-growing chicken genotypes fed low-nutrient or standard diets and raised indoors or with outdoor access. Poultry Science, 87(6): 1012-1021. DOI: https://www.doi.org/10.3382/ps.2006-00424

Fatmaningsih R and Nova K (2016). Broiler performance in conventional brooding system and thermos. Jurnal Ilmiah Peternakan Terpadu, 4(3): 222-229. DOI: http://www.doi.org/10.23960/jipt.v4i3.p%25p

Fouad AM and El-Senousey HK (2014). Nutritional factors affecting abdominal fat deposition in poultry: A review. Asian-Australasian Journal of Animal Sciences, 27(7): 1057-1068. DOI: https://www.doi.org/10.5713/ajas.2013.13702

Getachew T (2016). A review on effects of probiotic supplementation in poultry performance and cholesterol levels of egg and meat. Journal of World's Poultry Research, 6(61): 31-36. Available at: https://jwpr.science-line.com/attachments/article/35/J%20World%20Poult%20Res%206(1)%2031-36,%20March%202016.pdf

Hardiningsih R, Napitupulu RNR, and Yulinery T (2006). Isolation and resistance test of several isolates of *Lactobacillus* in low pH. Biodiversitas, 7(1): 15-17. DOI: https://www.doi.org/10.13057/biodiv/d070105

Hidayat C (2015). Reducing abdominal fat deposition in broiler through feeding management. Indonesian Bulletin of Animal and Veterinary Sciences, 25(3): 125-134. DOI: https://www.doi.org/10.14334/wartazoa.v25i3.1157

Ignatova M, Sredkova V, and Marasheva V (2009). Effect of dietary inclusion of probiotic on chickens performance and some blood indices. Biotechnology in Animal Husbandry, 25(6): 1079-1085. Available at: https://www.cabdirect.org/cabdirect/abstract/20103274351

Jensen-Urstad APL and Semenkovich CF (2012). Fatty acid synthase and liver triglyceride metabolism: Housekeeper or messenger?. Biochimica et Biophysica Acta - Molecular and Cell Biology of Lipids, 1821(5): 747-753. DOI: https://www.doi.org/10.1016/j.bbalip.2011.09.017

Jha R and Mishra P (2021). Dietary fiber in poultry nutrition and their effects on nutrient utilization, performance, gut health, and on the environment: A review. Journal of Animal Science and Biotechnology, 12: 51. DOI: https://www.doi.org/10.1186/s40104-021-00576-0

Khempaka S, Thongkratok R, Okrathok S, and Molee W (2014). An evaluation of cassava pulp feedstuff fermented with A. oryzae, on growth performance, nutrient digestibility and carcass quality of broilers. The Journal of Poultry Science, 51(1): 71-79. DOI: https://www.doi.org/10.2141/jpsa.0130022

Kiha AF, Murningsih W, and Tristiarti (2012). Pengaruh pemeraman ransum dengan sari daun pepaya terhadap kecernaan lemak dan energi metabolis ayam broiler [The effect of ripening feed with papaya leaf essence ot fat digestibility and metabolic energy in broilers]. Animal Agricultural Journal, 1(1): 265-276. Available at: https://ejournal3.undip.ac.id/index.php/aaj/article/viewFile/207/214

Maunatin A and Khanifa K (2012). Uji potensi probiotik *Lactobacillus* plantarium secara *in-vitro* [*In-Vitro* probiotic test of *Lactobacillus* plantarum]. Alchemy, 2(1): 26-34. DOI: https://www.doi.org/10.18860/al.v0i0.2298

McNaught CE and MacFie J (2001). Probiotics in clinical practice: A critical review of the evidence. Nutrition Research, 21(1-2): 343-353. DOI: https://www.doi.org/10.1016/S0271-5317(00)00286-4

Mountzouris KC, Tsitrsikos P, Palamidi I, Arvaniti A, Mohnl M, Schatzmayr G, and Fegeros K (2010). Effects of probiotic inclusion levels in broiler nutrition on growth performance, nutrient digestibility, plasma immunoglobulins, and cecal microflora composition. Poultry Science, 89(1): 58-67. DOI: https://www.doi.org/10.3382/ps.2009-00308

Muck RE, Nadeau EMG, McAllister TA, Contreras-Govea FE, Santos MC, and Kung L (2018). Silage review: Recent advances and future uses of silage additives. Journal of Dairy Science, 101(5): 3980-4000. DOI: https://www.doi.org/10.3168/jds.2017-13839

Nair J, Xu S, Smiley B, Yang HE, McAllister TA, and Wang Y (2019). Effects of inoculation of corn silage with *Lactobacillus* spp. or *Saccharomyces cerevisiae* alone or in combination on silage fermentation characteristics, nutrient digestibility, and growth performance of growing beef cattle. Journal of Animal Science, 97(12): 4974-4986. DOI: https://www.doi.org/10.1093/jas/skz333

Naji SAH, Al-Gharawi JKM, and Al-Zamili IFB (2015). The effect of starting age of feeding wetting fermented feed on the intestinal flora, humoral and cellular immunity of broiler chicks. International Journal of Advanced Research, 3(1): 41-49. Available at: https://www.journalijar.com/uploads/851_IJAR-4590.pdf

Nurhayati, Wirawati CU, and Putri DD (2015). Penggunaan produk fermentasi dan kunyit dalam pakan terhadap performan ayam pedaging dan income over feed and chick cost [The utilization of fermentation product and curcuma in ration on broiler performance, and income over feed and chick cost]. Zootec, 35(2): 379. DOI: https://www.doi.org/10.35792/zot.35.2.2015.9457

Palupi R, Lubis FNL, and Pratama ANT (2022). The effect of the use of cassava tuber (Manihot esculenta) and indigofera zollingeriana leaf flour combination as a source of energy supplemented with citric acid in ration on broiler small intestine characteristics and productivity. Journal of Advanced Veterinary and Animal Research, 9(3): 471-480. DOI: https://www.doi.org/10.5455/javar.2022.i616

Pradikta RW, Sjofjan O, and Djunaidi IH (2018). Evaluasi penambahan probiotik (*Lactobacillus* sp.) cair dan padat dalam pakan terhadap penampilan produksi ayam petelur [Evaluation additional of liquid and powder probiotic (*Lactobacillus* sp.) in feed on production performance of laying Rona]. Jurnal Ilmu-Ilmu Peternakan, 28(3): 203-212. DOI: https://www.doi.org/10.21776/ub.jiip.2018.028.03.03

Rodríguez-Lecompte JC, Brady J, Camelo-Jaimes G, Sharif S, Crow G, Ramirez-Yanez G, Guenter W, and House JD (2010). Intestinal characterization of avian defensins and cytokines after the early administration of probiotic with organic acids in broilers. Avian Immunology Research Group, Budapest, Hungary.

Romero JJ, Zhao Y, Balseca-Paredes MA, Tiezzi F, Gutierrez-Rodriguez E, and Castillo MS (2017). Laboratory silo type and inoculation effects on nutritional composition, fermentation, and bacterial and fungal communities of oat silage. Journal of Dairy Science, 100(3): 1812-1828. DOI: https://www.doi.org/10.3168/jds.2016-11642

Singh M, Lim AJ, Muir WI, and Groves PJ (2021). Comparison of performance and carcass composition of a novel slow-growing crossbred broiler with fast-growing broiler for chicken meat in Australia. Poultry Science, 100(3): 100966. DOI: https://www.doi.org/10.1016/j.psj.2020.12.063

Singracha P, Niamsiri N, Visessanguan W, Lertsiri S, and Assavanig A (2017). Application of lactic acid bacteria and yeasts as starter cultures for reduced-salt soy sauce (moromi) fermentation. LWT, 78: 181-188. DOI: https://www.doi.org/10.1016/j.lwt.2016.12.019

Steel RGD and Torrie JH (1980). Principles and procedures of statistics. McGraw-Hill Inc., New York.

Sugiharto S (2019). A review on fungal fermented cassava pulp as a cheap alternative feedstuff in poultry ration. Journal of World's Poultry Research, 9(1): 1-6. DOI: https://www.doi.org/10.36380/jwpr.2019.0

Sun H, Chen D, Cai H, Chang W, Wang Z, Liu G, Deng X, and Chen Z (2022). Effects of fermenting the plant fraction of a complete feed on the growth performance, nutrient utilization, antioxidant functions, meat quality, and intestinal microbiota of broilers. Animals, 12(20): 2870. DOI: https://www.doi.org/10.3390/ani12202870

Torrey S, Mohammadigheisar M, Santos M, Rothschild D, Dawson LC, Liu Z, Kiarie EG, Edwards AM, Mandell I, Karrow N et al. (2021). In pursuit of a better broiler: Growth, efficiency, and mortality of 16 strains of broiler chickens. Poultry Science, 100(3): 100955. DOI: https://www.doi.org/10.1016/j.psj.2020.12.052

Uguru JO, Amah UJ, Umoren EP, Unigwe CR, Obinna-Echem PC, Onainor ER, Torhemen M, and Ucheji CC (2022). Carcass traits, nutrient composition and sensory properties of broiler chickens fed diets containing graded levels of fermented cassava. Nigerian Journal of Animal Production, 49(1): 268-283. Available at: https://njap.org.ng/index.php/njap/article/download/3426/2647

Uzer F, Iriyanti N, and Roesdiyanto R (2013). The use of functional feed in rations on consumtion and body weight gain broiler. Jurnal Ilmiah Peternakan, 1(1): 282-288.

Widodo AR, Setiawan H, Sudiyono, Sudibya, and Indreswari R (2013). Kecernaan nutrien dan performan puyuh (*Coturnix coturnix japonica*) jantan yang diberi ampas tahu fermentasi dalam ransum [Digestibility of nutrient and performance of male quail (*Coturnix coturnix japonica*) were given tofu waste fermented in the diet]. Tropical Animal Husbandry, 2(1): 51-57. Available at: https://peternakan.fp.uns.ac.id/wp-content/uploads/2019/08/8-Andrik-et-al-51-57-.pdf

Wikanatsiri, Utama CS, and Suyanto A (2012). Aplikasi proses fermentasi kulit singkong menggunakan stater asal limbah kubis dan sawi pada pembuatan pakan ternak berpotensi probiotik [Application of cassava skin sensitive process using a starter from cabbage and mustard greens in the manufacture of probiotic potential livestock feed]. Seminar Hasil Penelitian LPPM Universitas Muhammadiyah, Semarang, Indonesia, pp. 281-288. Available at: https://jurnal.unimus.ac.id/index.php/psn12012010/article/viewFile/521/570

Zhang X, Roland DA, Mcdaniel GR, and Rao SK (1999). Effect of natuphos® phytase supplementation to feed on performance and ileal digestibility of protein and amino acids of broilers. Poultry Science, 78(11): 1567-1572. DOI: https://www.doi.org/10.1093/ps/78.11.1567

Zulfan Z and Zulfikar Z (2020). Performances of broilers fed the commercial diet partly substituted by fermented feed based onthe mixing of corn, rice bran, and leubim fish (*Canthidermis maculata*) processing by-product meal. Jurnal Ilmiah Ilmu-Ilmu Peternakan, 23(2): 92-103. DOI: https://www.doi.org/10.22437/jiiip.v23i2.10723

JWPR_13_1_,_127-135,_2023_2.pdf

ORIGINALITY REPORT

9%	%	9%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Supriadi, N Lahay, M Nadir, J A Syamsu, S Purwanti. "The effect of soybean meal substitution with Indigofera zollingeriana and addition of turmeric as phythobiotic on performance of native chicken", IOP Conference Series: Earth and Environmental Science, 2021 Publication	2%
2	A Paranita, B S Rahardja, Prayogo. "Effect of probiotics addition on total organic matter and survival rate of catfish (Clarias sp.) maintenance using recirculating aquaculture system (RAS)", IOP Conference Series: Earth and Environmental Science, 2022 Publication	1%
3	Gita Ciptaan, Mirnawati, Ade Djulardi. "Utilization of Fermented Soy-Milk Waste with Aspergillus ficuum in Broiler Ration", IOP Conference Series: Earth and Environmental Science, 2021 Publication	1%

4	Akhmad Endang Zainal Hasan, Ike Agustiani, Olive Wisepti Pratama, Syifa Khaerani et al. "PERFORMANCE OF BROILERS CHICKEN DUE TO THE ADMINISTRATION OF RAW PROPOLIS", Indonesian Journal of Applied Research (IJAR), 2020 Publication	1%
5	S Purwanti, L Agustina, A Siswoyo, I Ahmadi. "Performance and characteristics of digestive tract organs given Indigofera zollingeriana leaf meal and turmeric (Curcuma domestica) on Japanese quail", IOP Conference Series: Earth and Environmental Science, 2020 Publication	1%
6	"Lactic Acid Bacteria", Springer Science and Business Media LLC, 2019 Publication	1%
7	A. M. Fouad, H. K. El-Senousey. "Nutritional Factors Affecting Abdominal Fat Deposition in Poultry: A Review", Asian-Australasian Journal of Animal Sciences, 2014 Publication	1%
8	Nuraini, Astriana Napirah, Harapin Hafid, Firman Nasiu, Restu Libriani, Yamin Yaddi, Elfia, S.H. Ananda. "Feed Consumption, Average Daily Gain and Feed Conversion of Broiler Chicken with Different Feed", IOP	1%

Conference Series: Earth and Environmental Science, 2020

Publication

9	F N L Lubis, R Palupi, L Solihin, M W Syafiqurrahman. "The effectiveness of herbal fermentation into drinking water on the performance of kampung chickens", IOP Conference Series: Earth and Environmental Science, 2021 Publication	1 %
10	D Suprapto, S Purwanti, L Agustina. " Provision of and turmeric ( ) in quail rations on in vitro value of dry matter and protein digestibility ", IOP Conference Series: Earth and Environmental Science, 2020 Publication	1 %

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		