**Jurnal Agripet**
p-ISSN: **1411-4623** | e-ISSN: **2460-4534**
*available online at https://jurnal.usk.ac.id/agripet*

**Vol 25 (2): 159-166, October 2025**
*Accredited*: 152/E/KPT/2023

# Utilization of Probiotics, Fermented Beverages, and *Aspergillus niger* in Drinking Water on Performance and Digestive Quality of Broilers (*Gallus domesticus*)

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**ABSTRACT**. Probiotics and *Aspergillus niger* are known to play a role in supporting poultry growth and improving digestive tract health. This study aimed to determine the effectiveness of probiotics in the form of fermented drinks and *A. niger* in improving broiler chicken productivity and digestive tract health. The research was conducted at the LLP (Livestock Field Laboratory) of Syiah Kuala University, while the histological observations of the chicken intestinal villi surface were carried out at the Laboratory of Animal Structure and Development, Faculty of Mathematics and Natural Sciences, Syiah Kuala University. The method used in this study was a Completely Randomized Design (CRD) with 5 treatments (drinking water (control), antibiotic, 5% kefir, 5% Yakult, 2% *A. niger*) and 3 replications. The experimental animals used were broiler chickens from DOC to harvest age, with an initial average body weight of 51–57 g, totalling 75 individuals reared for 4 weeks (30 days). The parameters measured included performance (body weight gain, feed intake, water intake, feed conversion ratio (FCR), defined as the ratio of feed required to produce one unit of body weight, and feed efficiency ratio [FER], defined as the ratio of body weight gain to feed intake), as well as histological features of the intestinal villi (height, apical width, basal width, and total surface area). Data were analysed using ANOVA at a 95% significance level, followed by Duncan's multiple range test ($P<0.05$). The results showed that the 5% kefir group (P2) had the best performance, with feed intake of 1294.25±194.21 g/bird, feed conversion of 0.9033±0.13 g/bird, water intake of 4673.17±69.06 ml/bird, body weight gain of 1792.26±32.34 g/bird, and feed efficiency of 9.4867±0.74%. Histological analysis showed that the intestinal villi size was highest in the 5% kefir group (P2), with an average villi height of 969.96±44.64 µm, apical width of 110.99±12.23 µm, basal width of 106.97±12.41 µm, and total surface area of 1076.93±54.26 µm.

**Keywords**: broiler, growth, probiotics, small intestine histology

## INTRODUCTION

Broiler chicken farming has become one of the most popular businesses in the livestock sector because it is relatively inexpensive and economical. However, broiler chickens are often susceptible to various diseases during their rearing period (Arief, 2019). The main purpose of using probiotics is to increase livestock resistance to pathogens, control diseases, prevent poisoning due to microbial metabolism in the digestive tract, and boost immunity (Putra and Humaidah, 2022). Probiotics are feed additives in the form of live microorganisms that play a role in supporting poultry growth and can produce healthy and nutritious livestock products (Fanani et al., 2023).

The main role of probiotics is to create a balance of microflora in the digestive tract. Several studies show that administering probiotics to livestock can increase livestock growth (Hardiawan et al., 2021). Good digestion will result in an increase in feed conversion efficiency to be converted into meat (Putra and Humaidah, 2022). Sapsuha et al., (2021) reported that the use of probiotics in chickens can maintain health by stimulating certain cells in the intestine, thereby increasing the production of digestive hormones, secretion of enzymes and digestive fluids, local immune protection, and improvement and health of the intestinal wall.

The addition of probiotics in feed can increase weight gain, reduce feed conversion and mortality, and can replace the role of antibiotics in supporting poultry (broiler chicken) growth (Putra and Humaidah, 2022). Various studies have examined the use of probiotics as an alternative to antibiotics. (Zulfan et al., 2021) reported that the administration of probiotics based on a combination of Yakult and tape yeast (YTy) can improve the quality of broiler chicken carcasses, including increasing the percentage of valuable parts such as breasts, thighs, and wings. Fanani et al., (2023) found that adding kefir probiotics to broiler chicken feed had a positive impact on livestock performance, including increased consumption, body weight, FCR, and carcass weight.

A scientific study on the use of kefir probiotics, Yakult, and *Aspergillus niger* in

*Corresponding author: firdus@usk.ac.id
*Received*: 17 December 2024
*Revised*: 18 July 2025
*Accepted*: 17 September 2025
DOI: https://doi.org/10.17969/agripet.v25i2.43233

drinking water for broiler chicken growth and histological description of the intestinal villi surface has never been conducted. Therefore, the results of this study are expected to increase broiler productivity and improve livestock health, especially in the digestive tract, as well as feed efficiency.

## MATERIALS AND METHODS

### Research Location and Time

This research was conducted at the LLP (Field Laboratory of Animal Husbandry) of Syiah Kuala University, while histological observations of the surface of chicken intestinal villi were conducted at the Laboratory of Animal Structure and Development, Faculty of Mathematics and Natural Sciences, Syiah Kuala University. This research was conducted from July to October 2024.

### Research Tools and Materials

The equipment used in this study included digital scales, cages, feeding and drinking equipment, a microtome, a tissue bath, a slide warmer, object glasses, cover glasses, staining jars, label paper, an oven, and a light microscope (Olympus CX31®) equipped with a microphotography device (Olympus BX41®), an incubator, an autoclave, LAF (Laminar Air Flow), petri dishes, test tubes, Bunsen burners, and pipettes.

The materials used in this study included male Cobb strain broiler DOC chickens from PT Charoen Pokphand Jaya Farm, drinking water, and commercial starter, grower, and finisher feed. The feed used was sourced from PT Charoen Pokphand Jaya Farm, namely type 511-Vivo for the grower phase and 512-Bravo for the finisher phase. Drinking water was obtained from R.O Mount Raya in Kopelma Darussalam. Other additional materials included goat milk kefir produced by Mutiara Cinta Kefir, Yakult®, and *Aspergillus niger*® mushrooms. In addition, antibiotics (300 g tetracycline), 10% formalin solution, alcohol with concentrations of 70%, 80%, 90%, 96%, and absolute, xylol, paraffin (Merck®), tissue paper, hematoxylin and eosin (HE) stain, 1% acetic acid, distilled water, running water, and Entellan®. For microbiological purposes, Mueller Hinton Agar (MHA) medium and *Staphylococcus aureus* (*S. aureus*) bacteria were used (Hambal et al., 2019).

### Research Design

This study used a completely randomized design (CRD) with 5 (five) treatments and 3 (replications), resulting in 15 experimental units. A total of 75 broiler chickens were used. The treatments given in this study consisted of P0: Regular drinking water (negative control); P1: Drinking water + 300 mg/kg BW/day of antibiotics (Tetracycline) (positive control); P2: Drinking water + kefir (5%) of drinking water requirement, P3: Drinking water + Yakult (5%) of drinking water requirement; and P4: Drinking water + *A. niger* (2%) of drinking water requirement (Prabowo, 2016).

The cage size used was 1x1, with 5 chickens per cage. This study had previously received ethical approval with number 359/KEPH/XI/2024. Maintenance was carried out for 30 days with ad libitum feeding and drinking twice a day (morning and evening). Drinking water was mixed with kefir probiotics (5%), Yakult (5%), and *A. niger* (2%) of the total daily requirement, starting from DOC until 30 days of age.

Observation of broiler chicken performance includes feed consumption, feed conversion, and daily water consumption, as well as measurement of weekly weight gain by calculating the difference between the final and initial weights each week. Histological preparations of the intestine to be observed include villi height, apical villi width, basal villi width, and total villi area in the broiler chicken intestine.

### Statistical Analysis

The data on the growth and intestinal villi measurements of broiler chickens are presented as mean values ($\bar{x}$) ± standard deviation (SD) and analysed using SPSS with ANOVA to test for significant differences between treatments. If there are differences, the analysis is continued with Duncan's test at a 5% confidence level to determine the differences between treatment groups.

## RESULTS AND DISCUSSION

### Broiler Chicken Performance

Based on the results of research on the use of probiotics, fermented beverages, and *A. niger* in drinking water, it can improve the performance of broiler chickens. This can be seen from the results of the analysis of the average increase in broiler chicken performance presented in Table 1.

### Feed Intake

Table 1 shows that P2, which was given drinking water and added kefir probiotics (5%), had the highest feed consumption compared to other treatments. The high feed consumption in P2 is

thought to be due to the role of probiotics in increasing feed palatability and improving the balance of intestinal microflora. The beneficial microorganisms contained in kefir can help balance the intestinal microflora. Healthy microflora supports more efficient digestive function, thereby improving nutrient absorption and stimulating appetite (Prayoga et al., 2021). Additionally, this is due to an increase in the population of beneficial microbes for livestock, thereby preventing the growth of harmful microbes in the digestive tract, which improves digestion and food absorption (Melia et al., 2022). This is in line with the opinion of (Astuti et al., 2015) that probiotics increase digestive enzyme activity, resulting in more complete food breakdown and absorption, so that well-absorbed food can be utilized for tissue growth and weight gain.

**Tabel 1**. Average performance of broiler chickens *(Gallus domesticus)*

| Treatment | Parameters | | | | |
|---|---|---|---|---|---|
| | Feed Intake (g/head) | Feed Conversion Ratio (FCR) % | Water Intake (ml/head) | Weight Gain (g/head) | Feed Efficiency (%) |
| P0 | 1086.33±24.37$^{a}$ | 1.2367±0.17$^{b}$ | 3959.33±239.12$^{a}$ | 1481.33±263.96$^{a}$ | 6.8533±1.98$^{a}$ |
| P1 | 1239.83±3.16$^{a}$ | 0.9567±0.09$^{a}$ | 4387.41± 201.12$^{b}$ | 1685.66±228.75$^{a}$ | 8.9067±0.85$^{a}$ |
| P2 | 1294.25±194.21$^{a}$ | 0.9033±0.13$^{a}$ | 4673.17±69.06$^{b}$ | 1792.26±32.34$^{a}$ | 9.4867±0.74$^{a}$ |
| P3 | 1184.33±195.68$^{a}$ | 1.0567 ±0.11$^{ab}$ | 4548.58±94.71$^{b}$ | 1585.86±158.12$^{a}$ | 7.8867±1.56$^{a}$ |
| P4 | 1177.67± 37.9$^{a}$ | 1.0467 ±0.15$^{ab}$ | 4629.00 ±137.56$^{b}$ | 1776.58±114.58$^{a}$ | 8.6233±1.41$^{a}$ |

Note: Numbers followed by superscripts (a, b, c, and d) indicate significant differences at the 5% level of significance (P<0.05). P0= Drinking water; P1= Drinking water + 300 mg/kg BW/day antibiotic; P2= Drinking water + 5% kefir; P3= Drinking water + 5% Yakult; P4= Drinking water + 2% *A. niger*.

Pambudi et al., (2024) probiotics can increase feed consumption by improving food digestion in animals, because intestinal microbes, including lactic acid bacteria and other microorganisms, produce various enzymes that play an important role in the digestion and absorption of nutrients. This is also known based on the results of research conducted Pambudi et al., (2024), namely that the addition of lactic acid bacteria in quail feed can accelerate the emptying of the digestive tract, which ultimately increases feed consumption and feed efficiency.

**Weight Gain**

Based on Table 1, it shows that the negative control (P0) is not significantly different from (P1), (P2), (P3), and (P4). However, there is a tendency for the highest weight gain to be in P2 (1792.26±32.34) with the administration of drinking water + 5% kefir. Kefir yields have better results because it contains a diverse combination of probiotics and yeast, which can improve gut microbiota balance, stimulate digestive enzymes and hormones, and strengthen the immune system. Thus, the growth, health, and feed efficiency of broiler chickens become more optimal compared to antibiotics, Yakult, or *A. niger*.

This increase in ADG is positively correlated with feed intake levels and supported by improved feed efficiency. The high body weight gain in P2 shows that the addition of kefir probiotics can support broiler chicken performance. Body weight gain is also in line with the amount of feed consumed, meaning that the feed consumed is well absorbed as nutrients and successfully utilized by the chickens, thereby increasing the body weight gain of broiler chickens. This is in line with the opinion of Wang et al., (2016), who stated that probiotics can increase digestive enzyme activity and nutrient absorption, which ultimately results in better weight gain. Ardianto (2014), reported that the use of probiotics can increase growth rates associated with the benefits of probiotics, which can increase appetite and produce vitamins and digestive enzymes. Nahak, (2019), reported similar findings. Probiotics act as growth stimulators that can increase body weight and carcass weight in broiler chickens by increasing appetite and nutrient digestion and reducing pathogenic bacteria in the intestine.

**Feed Conversion Ratio**

Based on the results of the analysis in Table 1, it can be seen that P2 has the lowest feed conversion rate compared to P0, P1, P3, and P4. This means that treatment P2 requires the least amount of feed to produce weight gain compared to treatments P0, P1, P3, and P4. The feed conversion rate indicates the efficiency of feed use in producing weight gain. The low feed conversion rate obtained in P2 with the addition of 5% kefir probiotics to drinking water shows that the lower the feed conversion rate, the more efficient the feed is in increasing chicken weight. This indicates that the feed consumed can be digested more efficiently, allowing nutrients to be absorbed

optimally and reducing feed waste, thereby reducing feed production costs (Anggita et al., 2016). Nugraha et al., (2017), who stated that feed conversion ratio (FCR) is an indicator to see performance that explains the level of feed efficiency. The lower the FCR value, the higher the level of feed efficiency.

Abdurrahman and Soepranianondo (2022), reported that probiotics act as growth promoters and increase livestock productivity. In addition, probiotic administration can improve growth, reduce feed conversion rates, and increase the availability of vitamins and other essential nutrients. In other words, the lower the feed conversion ratio, the more feed is saved and the more efficient the animal's growth. This is in line with the results of weight gain and feed consumption values because the feed conversion ratio is calculated by dividing the amount of feed consumed by body weight (Abrori et al., 2022).

**Water Intake**

Based on the results of the study, it was found that all treatments given probiotics, namely P2, P3, and P4, showed an increase in broiler chicken water consumption. The high water consumption value obtained in P2 was balanced with the amount of feed consumption and weight gain produced in this study. This increase in water consumption was influenced by several factors, including the content of each probiotic. Probiotics administered through drinking water can affect metabolism, increase digestive enzyme activity, and balance microflora in the digestive tract, which indirectly affects the water requirements and consumption of livestock (Sudartama et al., 2019). Kefir contains lactic acid bacteria and yeast that play a role in the fermentation process, producing lactic acid that gives kefir its sour taste. This sour taste can affect water consumption levels in broiler chickens (Nurjannah, 2014). Similar findings was also reported by Liang et al., (2014), revealed that drinking water with a slightly acidic pH (6.0-6.5) improves palatability because it provides a fresher taste, reduces any metallic taste that may be present in the water, and has the same natural pH as the digestive tract of chickens.

**Feed Efficiency**

Based on the results of the analysis of the average feed efficiency values in Table 1.1, it can be seen that the highest feed efficiency value was obtained in treatment P2, which was drinking water with 5% kefir added. This feed efficiency value shows how well animals are able to utilize the feed given to increase their body weight. The higher the feed efficiency value, the more effectively the feed is converted into weight gain.

This is in line with the opinion of *Nugraha* et al. (2017), who explain that feed conversion ratio (FCR) is a performance indicator used to assess feed efficiency. The lower the FCR value, the higher the feed efficiency. When feed efficiency is high (P2 with drinking water + 5% kefir has the highest efficiency value), it means that broiler chickens are most efficient at converting feed into body weight. In line with this, the feed conversion ratio (FCR) value is certainly low in the most efficient treatment, because the less feed needed to gain weight means that the feed is used more efficiently. Thus, a low feed conversion ratio indicates high feed efficiency. Conversely, a high conversion ratio indicates that the feed provided is less efficiently used.

The addition of kefir probiotics to livestock feed has a positive effect on feed consumption and utilization efficiency. Probiotics work through various mechanisms that support the digestive and metabolic functions of livestock, such as improving digestibility and nutrient utilization.

The findings of Fanani et al. (2023) support this by stating that the use of kefir probiotics effectively increases livestock productivity by optimizing feed utilization. The presence of probiotics in feed helps optimize enzyme activity and the digestive process, thereby minimizing nutrients lost through feces. Thus, farmers benefit from reduced production costs and increased feed efficiency. Rahmaniar et al. (2021) added that feed consumption and weight gain are the main factors that determine feed utilization efficiency.

Based on the overall average performance data obtained, it can be seen that P2 with drinking water + 5% kefir can have an impact on improving broiler chicken performance. This shows that kefir, which is better known as one of the main probiotic drinks because it contains several types of bacteria that are beneficial to humans, is also good for broiler chickens, so that giving kefir as a feed additive can trigger an increase in broiler chicken performance. However, in this study, all treatments had no significant effect ($P>0.05$).

**Histomorphometry of the Small Intestine**

Small intestine histomorphometry is a method of quantitatively measuring the microscopic structure of the small intestine, including measurements of various morphological parameters such as villi height, apical villi width, basal villi width, and total villi area. The results of

the villi histomorphometry study are presented in Table 2.

**Tabel 2**. Average measurements of small intestine histomorphometry

| Treatment | Parameters | | | |
|---|---|---|---|---|
| | Villus Height | Villus Apical Width | Villus Basal Width | Total Villus Surface |
| P0 | 790.92±37.50[a] | 78.70±2.00[a] | 79.43±1.26[a] | 870.34±36.57[a] |
| P1 | 824.77±11.44[a] | 84.03±0.50[a] | 84.14±0.37[a] | 908.90±11.21[a] |
| P2 | 969.96±44.64[b] | 110.99±12.2[b] | 106.97±12.4[b] | 1076.93±54.26[b] |
| P3 | 836.43±5.25[a] | 87.65±1.36[a] | 87.93±1.51[a] | 924.36±5.46[a] |
| P4 | 798.38±39.49[a] | 84.66±2.89[a] | 85.30±1.35[a] | 883.67±40.10[a] |

Note: Numbers followed by superscripts (a, b, c, and d) indicate significant differences at the 5% level of significance (P<0.05). P0= Drinking water; P1= Drinking water + 300 mg/kg BW/day antibiotic; P2= Drinking water + 5% kefir; P3= Drinking water + 5% Yakult; P4= Drinking water + 2% *A. niger*.

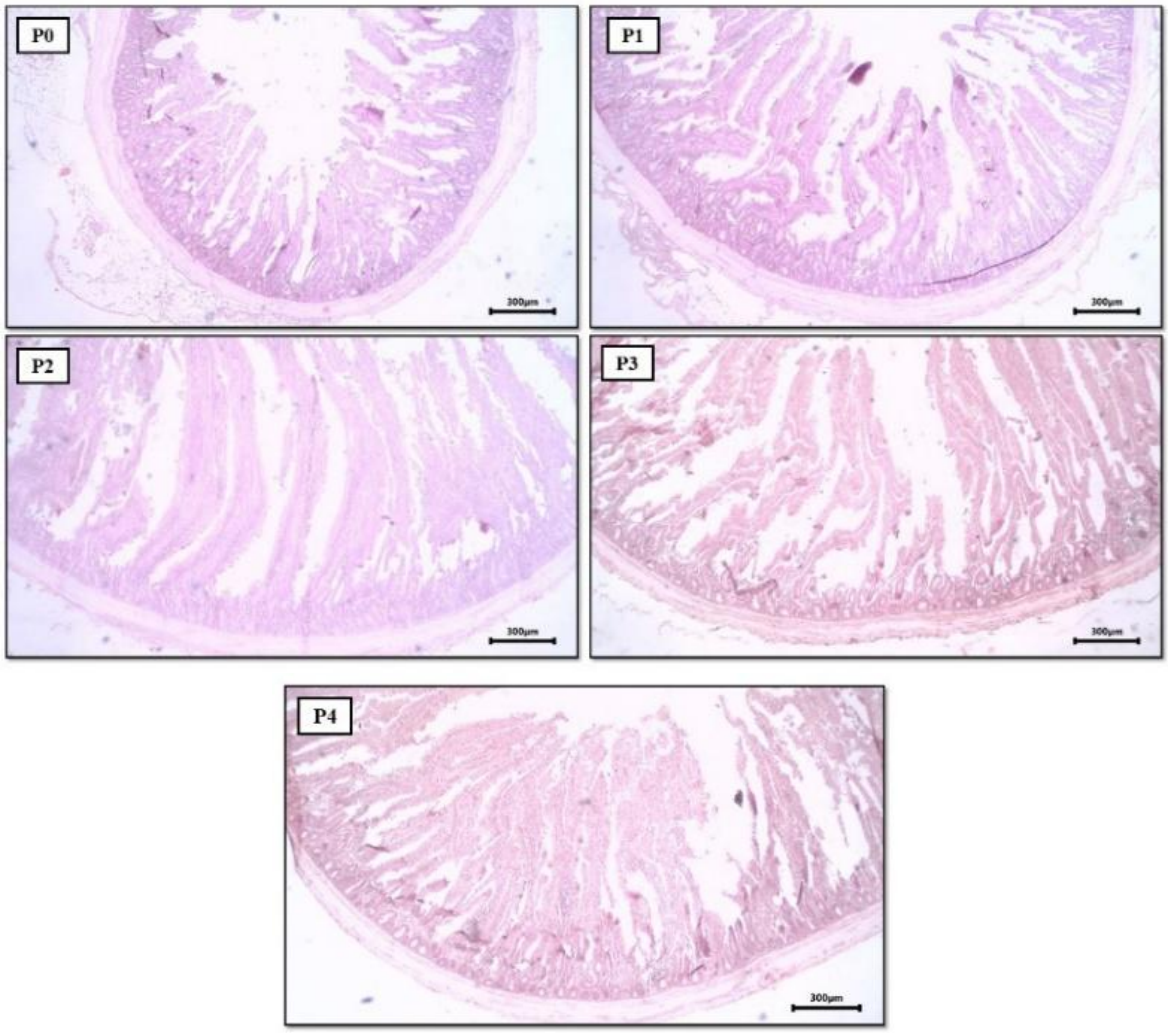


**Figure 1**. Histological features of broiler chicken (Gallus domesticus) small intestinal villi (HE 4×10).

**Villus Height**

Based on the results of the analysis of the average villi height in Table 2, it can be seen that group P2, which was given drinking water + 5% kefir probiotics, had the highest villi height (969.96±44.64 µm) compared to the other treatment groups. The administration of kefir probiotics through drinking water was proven to significantly increase the villi height of the small intestine. The microbial content in kefir probiotics can help increase the population of beneficial bacteria and suppress pathogenic bacteria in the intestine, so that the increase in villi height indicates that nutrient absorption in the small intestine becomes more effective., that probiotic administration can increase the population of lactic

acid bacteria, thereby improving the morphology of the small intestine by increasing the height and width of the villi and expanding the surface area for nutrient absorption.

An increase in the length of the small intestine villi can cause the absorption surface area to become wider so that nutrient absorption can occur optimally, which will automatically increase growth. Hartono and Iriyanti (2016), that *Lactobacillus sp.* as a probiotic will work by expanding the absorption process because it can influence the anatomy of the intestinal villi to be taller and have a dense density so that nutrient absorption is more optimal.

**Villus Apical Width**

The results of the apical villi width analysis showed significant results between treatments. P2, which was given drinking water + 5% kefir, showed optimal villi width (110.99±12.23 µm) and the lowest was P0 (78.70±1.99 µm), thus supporting an increase in absorptive surface area. (Chen et al., 2017) stated that proportional villi width contributes to nutrient absorption efficiency.

Kusuma et al. (2021), feed with high digestibility slows down the feed flow rate, allowing more time for digestive enzymes to degrade nutrients. This enables the activation of intestinal villi cells, which increase in size. Yao et al. (2006) added that the smoother the feed is digested in the small intestine, the greater the villi width, because the surface area of the villi is influenced by intestinal activity, which expands the villi to optimize nutrient absorption. Wider intestinal villi indicate a higher ability of the intestine to absorb consumed feed. conversely, if the villi size decreases, the intestine's ability to absorb feed also decreases, which will affect livestock performance. Lisnahan et al. (2019) also stated that an increase in villi width is proportional to chicken growth.

**Villus Basal Width**

Histomorphometric measurements showed significant differences in villus base width among the treatment groups (Table 2). Treatment P2, which involved administering drinking water + 5% kefir probiotics, resulted in the highest villus base width (106.97±12.41 µm) compared to the other treatment groups.

Factors affecting the basal width of villi can be reviewed in terms of nutrition, including increased feed protein quality, amino acid balance, fiber content, and feed additive supplements. Probiotics from fermented beverages such as kefir and Yakult show the effect of kefir as a probiotic containing a complex of microorganisms capable of colonizing the digestive tract through the production of lactic acid, acetic acid, and other products, thereby helping to suppress the growth of pathogenic bacteria through competition that results in intestinal microflora homeostasis (Anhar et al., 2016).

**Total Villus Surface**

The total villi area was obtained by calculating the total area of the villi height, apical villi width, and basal villi width. The histomorphometric measurement results showed a significant difference ($P<0.05$) in the total villi area between treatment groups (Table 2). Treatment P2, which involved giving drinking water + 5% kefir probiotics, produced the highest villi area (1076.93±54.26 µm) compared to other treatment groups. Ramadhan et al. (2022) a large villi surface area is an indication of efficient nutrient absorption because the intestinal villi contain microvilli that function as an absorption site.

Intestinal villi growth can be associated with an increase in the number of goblet cells. Goblet cells secrete mucus throughout the gastrointestinal tract, forming a gel that adheres to the mucosal surface and can play an important role in repairing epithelial cells, leading to improved intestinal digestive function (Matty and Hassan, 2020). The rate of feed nutrient digestion is influenced by the surface area of intestinal villi. A larger surface area of intestinal villi indicates a higher ability of the intestine to digest consumed feed (Kusuma et al., 2021).

These excellent results are due to the fact that livestock at P2 receive nutrition that meets their needs and are also able to digest their feed well. Nutrition that meets the needs of livestock can stimulate and optimize the growth of cells in the intestinal villi. According to Agustono et al. (2020), nutrients absorbed by the intestine are predominantly used to maintain the function and regeneration of the intestinal cells themselves. Feed nutrients in the form of protein and fat digested by the small intestine, which play a role in tissue formation and stimulate cell proliferation. The use of kefir as a probiotic source for livestock is known to have a positive effect. Kefir probiotics are known to improve the population of lactic acid bacteria in young dairy cattle within 14 days of life (Satik and Gunal, 2017).

## CONCLUSION

Probiotics in fermented beverages (Kefir, Yakult) and *A. niger* administered in drinking water have the potential to act as growth promoters and improve broiler chicken performance. The digestive health of broiler chickens administered probiotics in fermented beverages and *A. niger* had a significant and consistent effect on the growth process of broiler chickens, which showed improvement.

## REFERENCES


Arief, I. I., Taufik, E., 2019. Analisis residu antibiotik serta kualitas daging dan hati ayam broiler di kabupaten pidie jaya Provinsi Aceh. Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan, 7(3), 102-110.

Abrori, A. S., Ali, U., Rozi, A. F., 2022. Peningkatan pertumbuhan, efisiensi pakan, dan pendapatan dalam penggemukan domba menggunakan pakan debu sawit terfermentasi. Indonesian Journal of Animal Science, 24(3), 270-280.

Abdurrahman, F., Soepranianondo, K., 2022. Studi indeks performa dan analisis usaha pada ayam pedaging yang diinfeks *Escherichia coli* dengan pemberian probiotik bakteri asam laktat. J. Med. Vet. 5.

Agustono, B., Yunita, M. N., Warsito, S. H., Lokapirnasari, W. P., Al Arif, M. A., Prastiya, R. A., Saputro, A.L., 2020. Pengaruh substitusi tepung ikan dengan tepung barnacle terhadap berat organ pencernaan dan lemak abdominal kelinci pedaging jantan (*Oryctolagus cuniculus*). J. Nutr. Ternak Trop. 3, 41–47.

Anhar, F.F., Suthama, N., Sukamto, B., 2016. Efek penambahan umbi bunga dahlia sebagai sumber inulin terhadap kecernaan protein dan produktivitas ayam lokal persilangan. J. Kedokt. Hewan 10, 58–62.

Anggitasari, S., Sjofjan, O., Djunaidi, I. H., 2016. Effect of some kinds of commercial feed on quantitative and qualitative production performance of broiler chicken. Buletin Peternakan, 40 (3), 187-196.

Ardianto, E., 2014. Pengaruh penambahan probiotik "Probiss" dalam air minum terhadap penampilan produksi ayam pedaging. Universitas Brawijaya.

Astuti, F. K., Busono, W., Sjofjan, O., 2015. Pengaruh penambahan probiotik cair dalam pakan terhadap penampilan produksi pada ayam pedaging. Indones. J. Environ. Sustain. Dev. 6.

Chen, F., Zhu, L., Qiu, H., 2017. Isolation and probiotic potential of *Lactobacillus salivarius* and *Pediococcus pentosaceus* in specific pathogen free chickens. Brazilian J. Poult. Sci. 19, 325–332.

Fanani, A. F., Fajrih, N., Anjani, F. M., Ardiansyah, A., Qulubi, M.H., 2023. Performans ayam broiler dengan penambahan kefir sebagai probiotik. J. Galung Trop. 12, 25–34.

Hardiawan, N. D. I. G., Mahardika, Sudiastra, I. W., 2021. Produktivitas ayam broiler yang diberikan additive probiotik dalam air minum. Maj. Ilm. Peternak. 24, 91–95.

Hartono, E.F., Iriyanti N., Suhermiyati, S., 2016. Efek penggunaan sinbiotik terhadap kondisi miklofora dan histologi usus ayam sentul jantan. J Agripet 16, 97–105.

Jannah, S. L., Lamid, M., Sukmanadi, M., Al Arif, M. A., Chusniati, S., Hamid, I. S., Solfaine, R., 2022. Potensi pemberian probiotik terhadap peningkatan berat badan, konsumsi, dan konversi pakan ayam petelur fase pre layer. MKH 96–104.

Kusuma, A. Y., Sjofjan, O., Djunaidi, I.H., 2021. Pengaruh fermentasi campuran bungkil inti sawit dan onggok (FBISO) sebagai pengganti jagung dalam pakan terhadap karakteristik vili usus ayam pedaging. J. Ilmu Ternak Univ. Padjadjaran 20, 126–137.

Liang, Y., Tabler, G. T., Costello, T. A., Berry, I. L., Watkins, S. E., Thaxton, Y. V., 2014. Cooling broiler chickens by surface wetting: indoor thermal environment, water usage, and bird performance. Appl. Eng. Agric. 30, 249–258.

Lisnahan, C. V., Wihandoyo, W., Zuprizal, Z., Harimurti, S., 2019. Intestinal morphology of native chickens at 20 weeks-old supplemented by dl-methionine and l-lysine hcl into feed. J. Trop. Anim. Sci. Technol. 1, 14–21.

Melia, U., Nafiu, L. O., Badaruddin, R., 2022. Performans produksi ayam broiler yang diberi probiotik berbeda. Jurnal Ilmiah Peternakan Halu Oleo, 4(1), 57–60.

Matty, H. N., Hassan, A.A., 2020. Effect of supplementation of encapsulated organic acid and essential oil gallant+® on some physiological parameters of japanese quails. Iraqi J. Vet. Sci. 34, 181–188.

Nurjanah, H. (2014). Penambahan kefir dalam air minum untuk meningkatkan efisiensi pakan dan performans pada usaha broiler (Doctoral dissertation, Politeknik Negeri Jember).

Nugraha, Y. A., Nissa, K., Nurbaeti, N., Amrullah, F. M., Harjanti, D.W., 2017. Pertambahan bobot badan dan feed conversion rate ayam broiler yang dipelihara menggunakan desinfektan herbal. J. Ilmu-Ilmu Peternak. 27, 19–24.

Nahak, A. T., 2019. Pengaruh penambahan probio dalam pakan terhadap bobot hidup, berat karkas, berat dada, berat paha atas dan paha bawah ayam broiler. JAS, 4 (2), 18-20.

Pambudi, S. T., Wadjdi, M. F., Suryanto, D., 2024. Pengaruh penambahan probiotik *Lactobacillus salivarius* plus bio enzim terhadap konsumsi pakan dan quail day production pada burung puyuh. Din. Rekasatwa J. Ilm. 7.

Prabowo, M.R., 2016. Pengaruh variasi dosis probiotik cair dengan interval waktu pemberian satu hari sekali pada air minum ternak terhadap pertumbuhan ayam broiler (*Gallus Gallus domesticus*). Universitas Airlangga Surabaya.

Prayoga, A.P., Ramona, Y., Suaskara, I,B., 2021. Bakteri asam laktat bermanfaat dalam kefir dan perannya dalam meningkatkan kesehatan saluran pencernaan. Jurnal Simbiosis Ix (2): 115-130

Putra, D. C., Humaidah, N., 2022. Efektivitas probiotik sebagai pengganti antibiotic growth promotor (AGP) pada unggas (Artikel Review). Din. Rekasatwa J. Ilm. 5.

Rahmaniar, A., Kurniawan, W., Sandiah, N., 2021. Kinerja produksi ayam broiler yang diberi probiotik bioboost dalam air minum. JIPHO (Jurnal Ilm. Peternak. Halu Oleo) 3.

Ramadhan, R. A., Widodo, E., Sjofjan, O., 2022. Pengaruh penambahan ekstrak kunyit (*Curcuma longa* Linn) pada perkembangan dan histopatologi usus halus pada puyuh petelur. J. Nutrisi. Ternak Trop. 5.

Sapsuha, Y., Suprijatna, E., Kismiati, S., Sugiharto, S., 2021. Combination of probiotic and phythobiotic as an alternative for antibiotic growth promoter for broilers chickens-a review. Livest. Res. Rural. Dev 33, 49.

Satik, S., Gunal, M., 2017. Effects of kefir as a probiotic source on the performance and health of young dairy calves. Turkish J. Agric. 5, 139–143.

Satimah, S., Yunianto, V. D., Wahyono, F., 2019. Bobot relatif dan panjang usus halus ayam broiler yang diberi ransum menggunakan cangkang telur mikropartikel dengan suplementasi probiotik *Lactobacillus* sp. J. Sain Peternak. Indones. 14, 396–403.

Wang, X., Farnell, Y. Z., Peebles, E. D., Kiess, A. S., Wamsley, K. G. S., Zhai, W., 2016. Effects of prebiotics, probiotics, and their combination on growth performance, small intestine morphology, and resident *Lactobacillus* of Male Broilers. Poult. Sci. 95, 1332–1340.

Yao, J., Tian, X., Xi, H., Han, J., Xu, M., Wu, X., 2006. Effect of choice feeding on performance, gastrointestinal development and feed utilization of broilers. Asian-australasian J. Anim. Sci. 19, 91–96.

Zulfan, Z., Latif, H., Yaman, M. A., Fitri, C. A., Munandar, M.H., 2021. Administering probiotic yakult+ tape yeast into the mixture of rice and corn bran as partial replacement of commercial diet affects the carcass yield of broiler chickens. Indonesian J. Anim. Sci. 31, 42.

## HOW TO CITE

Rahmatillah, Z., Firdus, F., Allaily, A. 2025. Utilization of probiotics, fermented beverages, and Aspergillus niger in drinking water on performance and digestive quality of broilers *(Gallus domesticus)*. Jurnal Agripet, 25(2), 159–166. https://doi.org/10.17969/agripet.v25i2.43233