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Effects of Locally-Made Probiotics on Drinking Water on the Performance of Chickens

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Abstract. This study investigated the effects of locally-made probiotics on the performance of Kabir and Starbro broilers. The birds were randomly assigned to four treatments, and their body weight, weight development, feed consumption, feed conversion efficiency, dressing percentage, livability rates, and income over feed and chick cost were measured. The results showed a significant interaction between the breed of chicken and the type of probiotics after 21 days of feeding in terms of body weight, body weight gain, feed consumption, and feed conversion efficiency. However, no significant interaction was observed at 35 days of feeding. The use of locally produced probiotics in drinking water improved the dressing percentage of both breeds of chicken, overall body weight gain, and overall feed consumption compared to the control group. Livability rates were not significantly affected by the inclusion of different locally-made probiotics in drinking water. Net income per chicken was marginally higher for the chickens fed with locally produced probiotics. Further studies are recommended to assess the benefits of locally-produced probiotics in laying chicken and other types of livestock and poultry. These findings provide insights into the potential application of locally-made probiotics as an alternative to commercial products for improving chicken performance.

Keywords: kabir chicken; locally-made probiotics; starbro broiler

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INTRODUCTION

Poultry farming has become a vital component of the global meat industry, providing a significant source of animal protein, with chicken production being the most prominent (Attia et al., 2022). The strain of birds' feed quality, and management practices, including addressing early chick mortality, stress, and disease outbreaks, play a vital role in achieving maximum weight gain in broilers. Antibiotic use has been a common practice to manage diseases affecting the performance of animals. However, there is growing concern over the development of antibiotic resistance, which has prompted researchers to explore alternative measures, such as the use of probiotics. Probiotics are live bacteria that provide health benefits to the host when consumed in suitable quantities (FAO, 2016). They promote gut integrity, maturation, and immune function, and prevent inflammation. Probiotics, including *Aspergillus oryzae, Bifidobacterium bifidum, Lactobacillus bulgaricus, Lactobacillus plantarum, Streptococcus thermophils*, and *Lactobacillus bulgaricus* (Spacova et. al., 2020), have been shown to enhance the health and performance of animals and do not leave residues in animal products (Anee et al., 2021).

The benefits of probiotics on poultry are well documented. Probiotics have been found to improve the balance of bacteria in the gastrointestinal tract, increase the activity of digestive enzymes, decrease the activity of bacterial enzymes, and stimulate immune function (Celi et al., 2017). They also decrease ammonia production, neutralize enterotoxins, and enhance the quality of microbiological meat (Rehman et al. 2020). Probiotics have been shown to increase the immunity sensory characteristics of broiler meat, regulate intestinal microbiota, and reduce pathogens (Krysiak, 2021). The effectiveness of probiotics in colonizing the gut is influenced by various factors, including the availability of fermentation substrate (prebiotics), the strain's specificity with the dose and frequency of supplementation given to the host, the host's age, health, genetics, and nutritional status, intestinal pH, and stress (Markowiak & Slizewska, 2018). Furthermore, the impact of probiotics on the immune system varies, as Al-Shawi et al. (2020) found that probiotics did not improve the immune system, while Raheem et al. (2021) reported that probiotics acted as immunomodulatory agents by activating specific and non-specific host immune responses in chicks, which helped prevent and control various infectious diseases.

The use of probiotics as a replacement for antibiotics has gained attention due to the development of antibiotic resistance. Several studies have reported improved performance with the addition of probiotics to broiler diets (Yu et al. 2022), while Abd El-Hack et al. (2020) found that the tested probiotics did not result in improvements in broiler production efficiency over the control group. Therefore, it is essential to evaluate the effects of administering different locally-made probiotics in drinking water on chicken performance. Overall, probiotics have demonstrated a positive effect on poultry health and performance (Al-Khalaifah, 2018; Ahmad et al., 2022). However, the effectiveness of probiotics in colonizing the gut and improving the immune system is influenced by various factors, including strain specificity, dose and frequency of supplementation, host factors, and stress (Jha et al., 2020; Yousaf et al., 2022). Thus, additional studies are needed to better understand the potential benefits of probiotics in poultry farming. This study investigated the effects of locally-made probiotics on the performance of Kabir and Starbro broilers.

METHODS

Preparation of the Treatment

Before the start of the study, fermented rice wash, fermented kangkong juice, and golden kuhol amino acid were prepared. The kangkong plant and golden kuhol were purchased from M.R. Espinosa in Milagros, Masbate, while the rice wash was collected from the neighborhood in Panique, Aroroy, Masbate. The different stored probiotics were used as supplements in drinking water after the experimental birds reached seven days of age and were continued throughout the study. Kangkong plants were collected early in the morning while they were still fresh, and the microorganisms were still present. The plants were chopped into small pieces. For every three kilograms of chopped kangkong, one kilogram of molasses was added, mixed thoroughly, and put in a pail. The pail was covered with a clean, white cloth and secured with a string or rubber band. The container was stored in a cool, dry, shady place for ten days. After 10 days, the fermented kangkong juice was collected, placed in a plastic bottle, and stored in a cool place until it was used.

The initial rice washes were collected from the neighborhood. For the initial rice wash, a cup of rice and a half cup of water were combined, and the mixture was collected for fermentation. For every liter of newly washed rice, one kilogram of molasses was added, mixed thoroughly, and put in a pail. The pail was covered with a clean, white cloth and secured with a string or rubber band. The container was stored in a cool, dry, shady place for ten days. After 10 days, the fermented rice wash juice was collected, placed in a plastic bottle, and stored in a cool place until it was used. The raw golden kuhol was collected from a swampy area in M.R. Espinosa and crushed into small pieces. For every kilogram of crushed golden kuhol, one kilogram of molasses was added, mixed thoroughly, and put in a pail. The pail was covered with a clean, white cloth and secured with a string or rubber band. The container was stored in a cool, dry, shady place for twenty days. After 20 days, the fermented golden kuhol was collected, placed in a plastic bottle, and stored in a cool place until it was used.

Research Design

In this study, a Completely Randomized Design (CRD) with a two-factor experiment was used. As test animals, one hundred (100) day-old straight-run broiler chicks and one hundred (100) kabir chicks were employed. Five birds were assigned randomly to each cage to represent a replication of the eight (8) treatment combinations that were replicated five times.

Data Collection and Analysis

Throughout the experiment, data were collected on various parameters including body weight, body weight gain, feed intake, feed conversion efficiency, dressing percentages, livability, and income over feed and chick costs. The initial data was obtained by weighing the chicks seven days after the brooding period. Further data were collected at 21 and 35 days of feeding. The data was analyzed using a Completely Randomized Design and a two-factor factorial experiment and analyzed using analysis of variance.

RESULTS AND DISCUSSIONS

Body Weight of Chickens

This study investigated the effects of locally-made probiotics on the body weight of two breeds of chickens, namely broiler and Kabir. Drinking water with different locally-made probiotics (Fermented kangkong juice, Fermented rice wash, and Kuhol amino acid) at a 5% level was given to the treated groups, while the control groups were given plain drinking water. The study results indicated that the treated groups had higher average body weights than the control groups, indicating that the locally-made probiotics significantly increased body weights after 21 days of feeding (F=34.63, P<0.01) and after 35 days of feeding (F=3.86, P<0.05) of both broilers and Kabir chickens, compared to the control group in both breeds.

The findings further revealed a significant interaction (F=3.87, P<0.05) between the breed of chicken and the type of probiotics after 21 days of feeding, suggesting that the locally-made probiotics had a substantial influence on the breed of chicken tested and that the effects differed considerably depending on the breed of chicken examined. Moreover, the increased body weight of chickens on locally-made probiotics can be attributed to the fact that probiotics promoted the metabolic processes and digestion of nutrients and their utilization. These findings are consistent with the study of Arsene et al. (2021), where probiotics have been shown to promote growth, improve the efficiency of feed utilization, protect the host from an intestinal infection, and stimulate responses in farm animals. Analysis of variance for average body weight (grams) of chickens given drinking with different locally-made probiotics were shown in Table 1.

Table 1. Analysis of variance for average body weight (grams) of chickens given drinking with different locally-made probiotics

Source of Variation	**Feeding Period**		
	Initial	**21 days**	**35 days**
Factor A (Breeds of Chicken)	16,402.50**	640,090**	6,231,128.91**
Factor B (Kinds of Probiotic)	69.17^{ns}	17,530**	40,433.07*
Interaction	29.17^{ns}	1,956.67*	25,333.91^{ns}
Experimental Error	37.50	506.25	10,462.50

Means squares in columns having a ** are significantly different at the 1% and * at the 5% level of significance using F-Value of comparison.

The study findings suggest that different locally-made probiotics at a 5% level can be used as a supplement to the drinking water of chickens to improve their body weight.

Body Weight Gains of Chickens

The results of the study showed that the supplementation of locally-made probiotics in the drinking water of chickens significantly increased the body weight gain of both breeds (Tabel 2). The use of different locally-made probiotics in drinking water significantly influenced the overall body weight gain at the end of the study compared to the control group (F=5.88, P<0.01). The significantly higher level of body weight gains after 21 days of feeding (F=45.94, P<0.01) and overall body weight gains of chickens given drinking water with different locally-made probiotics can be attributed to their significantly higher body weight compared to those in the control groups without probiotics. Furthermore, the study revealed a significant interaction between the breed and the type of probiotics after 21 days of feeding (F=5.17, P<0.01) but not in overall body weight gain (F=1.94, P>0.05). The findings of this study are consistent with previous research by Rahman et al. (2021), who reported that the average daily weight gain of chickens fed probiotics was significantly increased during the first 21 days of growth but not during the 28-42 days of growth.

Moreover, the improvement in weight gain might be associated with the capability of probiotics to secrete enzymes such as amylase, protease, and lipase, which might improve the digestion rate of feed nutrients, leading to the improved live weight gain of broilers. This is consistent with the findings of Fesseha et al. (2021) and Napirah et al. (2021), who reported that the addition of probiotics improved the final weight and weight gain of chickens.

Table 2. Analysis of variance for average body weight gain (grams) of chickens given drinking water with different locally-made probiotics

Source of Variation	Feeding Period		
	21 days	35 days	Overall
Factor A (Breeds of Chicken)	451,562.50**	2,920,051.41**	5,668,207.66**
Factor B (Kinds of Probiotic)	18,549.17**	11,315.57ns	53,902.66**
Interaction	2,089.17**	8,436.41ns	17,829.32ns
Experimental Error	403.75	7,644.69	9,172.81

Means squares in columns having a ** are significantly different at the 1% and * at the 5% level of significance using F-Value of comparison.

The study conformed to the results found by Hrnčár et al. (2014) that the inclusion of locally-made probiotics in drinking water significantly increased the body weight gain of broiler and Kabir chickens. The results suggest that the use of probiotics in the poultry industry can be a viable strategy to improve production efficiency and reduce feed costs. Further studies on the use of probiotics on other types of livestock and poultry are recommended to better understand the benefits of probiotics in animal production.

Feed Consumption of Chickens

The results showed that the inclusion of different locally-made probiotics in drinking water had a significant effect on the average feed consumption (F=3.10, P<0.05). Despite receiving the same feed ratio in all treatments, chickens with different locally-made probiotics had higher feed consumption than the control group, resulting in overall higher feed consumption throughout the feeding period. However, the treated group exhibited higher average body weights than the control group, indicating that the treated group was more effective in converting feed into meat.

The analysis of the data on means square cumulative feed intake suggested that there was no significant (F=0.53, P>0.05) interaction between chicken breeds and kinds of locally-made probiotics, as an overall feed consumption (Table 2). This could be attributed to the probiotics-producing enzymes that improve feed intake and digestion in the broiler. This finding is consistent with the results of Toluwase (2016) study, which indicated that dietary probiotics suppressed the growth of bacteria and produced an enzyme that increased feed intake and weight gain in birds fed with probiotics.

Table 3. Analysis of variance for average feed consumption (grams) of chickens given drinking water with different locally-made probiotics

Source of Variation	Feeding Period		
	21 days	35 days	Overall
Factor A (Breeds of Chicken)	1,100,248.90**	23,435,017.23**	34,690,925.03**
Factor B (Kinds of Probiotic)	25,897.97**	34,682.56ns	113,699.03*
Interaction	3,433.70*	16,363.89ns	19,503.96ns
Experimental Error	870.85	22,505.48	36,651.55

Means squares in columns having a ** are significantly different at the 1% and * at the 5% level of significance using F-Value of comparison.

The results suggest that locally-made probiotics can be an effective way to increase feed consumption and improve body weight in chickens. Further studies are recommended to determine the optimal inclusion level of locally-made probiotics in chicken feed.

Feed Conversion Efficiency of Chickens

The data in this study showed that the inclusion of different locally-made probiotics in drinking water significantly improved the feed conversion efficiency (FCE) after 21 days in both breeds (F=24.99, P<0.01) but not after 35 days of feeding. The significantly better feed conversion efficiency of chickens at 21 days with the inclusion of locally-made probiotics in drinking water at 21 days of age compared to those fed control diets as shown in Table 4, was attributable to their significantly higher body weight gains as shown in Table 2. Additionally, there was a significant (F=4.51, P<0.01) interaction between the breed of chicken and the kinds of probiotics used during this period.

Table 4. Analysis of variance for average feed conversion efficiency of chickens given drinking water with different locally-made probiotics

Source of Variation	Feeding Period		
	21 days	35 days	Overall
Factor A (Breeds of Chicken)	0.44^{**}	0.17^{ns}	0.28^{*}
Factor B (Kinds of Probiotic)	0.28^{**}	0.05^{ns}	0.09^{ns}
Interaction	0.05^{**}	0.71^{ns}	0.10^{ns}
Experimental Error	0.01	0.25	0.06

Means squares in columns having a ** are significantly different at the 1% and * at the 5% level of significance using F-Value of comparison.

However, after 35 days of feeding, there was no significant (F=2.80, P>0.05) effect on FCE, and there was no significant (F=1.58, P>0.05) interaction between the breed of chicken and the kinds of locally-made probiotics employed as treatment in the research. The data indicate that chickens given drinking water with locally-made probiotics efficiently converted nutrients at 21 days of age. This finding is in agreement with the study of Rahman et al. (2021), who reported that the average daily weight gain of chickens fed probiotics was significantly increased during the first 21 days of growth but not during the 28 - 42 days of growth.

The findings presented in Table 5 indicated that the inclusion of various locally-made probiotics in drinking water significantly increased the dressing percentage of both Kabir and day-old straight-run broilers in comparison to the control groups. Chickens given drinking water with locally-made probiotics exhibited significantly higher dressing percentages (with or without giblets) than those in the control treatment (F=8.98 & 9.11, P<0.01). However, no significant interaction was observed between the breeds of chicken and the types of probiotics in terms of dressing percentage (with and without giblets) (F=0.40 & 2.67, P>0.05). This increase in dressing percentage can be attributed to the higher body weight of chickens given drinking water with locally-made probiotics, as presented in Table 1.

Dressing Percentage

Table 5. Analysis of variance for average dressing percentage (%) of chickens with and without giblets given drinking water with locally-made probiotics

Source of Variation	Dressing Percentage	
	With Giblets	Without Giblets
Factor A (Breeds of Chicken)	90.54^{*}	477.76^{**}
Factor B (Kinds of Probiotic)	138.27^{**}	225.84^{**}
Interaction	5.89^{ns}	9.83^{ns}
Experimental Error	15.40	24.80

Means squares in columns having a ** are significantly different at the 1% and * at the 5% level of significance using F-Value of comparison.

These results are consistent with previous studies that reported an increase in dressing percentage following the addition of symbiotics (Abdel-Hafeez et al., 2017). The improved carcass characteristics resulting from the addition of probiotics to the broiler diet might be related to the inhibition of intestinal pathogen colonization and enhanced utilization of nutrients, such as protein and energy, in the diet (Pourakbari et al., 2016).

Livability Rate

The study found that the inclusion of different locally-made probiotics in drinking water did not significantly affect the livability rates of the chickens. Mortality occurred only in the control group (Kabir), but this could not be attributed to the supplementation of locally-made probiotics. Statistical analysis of the data showed no significant difference among treatment means.

Table 6. Analysis of variance for average livability rate (%) of chickens given drinking water with different locally-made probiotics

Source of Variation	Livability Rate
Factor A (Breeds of Chicken)	40.00[ns]
Factor B (Kinds of Probiotics)	40.00[ns]
Interaction	40.00[ns]
Experimental Error	15.00

The observed 100% livability rates of chickens given drinking water with locally-made probiotics could be attributed to the continuous use of probiotics, which may have suppressed undesirable microorganisms and improved the chickens' health status and overall performance by building up resistance. This observation is consistent with previous studies that demonstrated the efficacy of mannan oligosaccharides (extracted from the cell wall of *S. cerevisiae)* in controlling pathogenic scours caused by *Salmonella*, *Escherichia coli*, and other organisms in livestock (Teng & Kim, 2018). Therefore, the inclusion of locally-made probiotics in drinking water may prevent the entry of harmful organisms, resulting in a 100% livability rate for chickens. These findings suggest the potential benefits of locally-made probiotics as an alternative to commercial products for improving chicken health and performance.

Income over Feed and Chicks Costs

The results of this study showed that the supplementation of probiotics in drinking water led to slightly higher income in broilers compared to the control group. Meanwhile, the income of treated Kabir chickens was almost the same as the control group, except for those treated with fermented plant juice, which had a higher income. The higher income of both breeds supplemented with probiotics was associated with their higher body weight and body weight gain Krysiak et al. (2021) as shown in Fig. 1. The slower growth of Kabir chickens compared to broiler breeds, as demonstrated in Table 1, may explain the minimal net income from Kabir chickens supplemented with probiotics in drinking water. The lower net income of treated groups in Kabir does not necessarily indicate that probiotics did not improve performance since birds without probiotics experienced mortality, as shown in Table 6. These findings suggest that the use of probiotics in drinking water can improve the performance of both broilers and Kabir chickens (Fesseha et al., 2021) and may lead to higher income in certain cases. Further studies are needed to assess the optimal inclusion rate of probiotics in the diets of different chicken breeds.

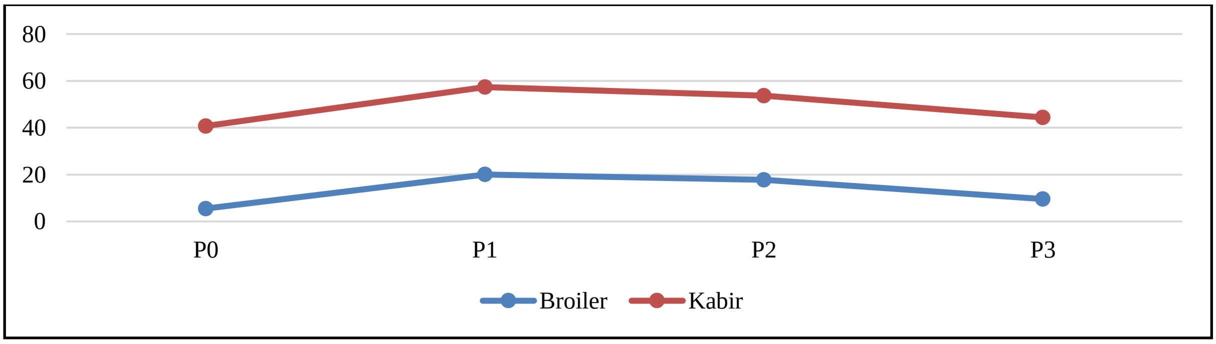

Figure 1. Net profit (₱) from chickens given drinking water with different locally-made probiotics

This study was novel in its use of locally-made probiotics, administration in drinking water, focus on the performance of chickens, consideration of the geographic context, and practical implications for the poultry industry. By combining these unique aspects, the research provided valuable insights into the potential benefits of locally-made probiotics in improving chicken productivity and offered practical implications for sustainable poultry production.

The study showed several potential benefits for society. It offered insights into using locally-made probiotics to improve poultry production, enhancing growth rate and feed conversion efficiency. This contributed to a more sustainable and efficient poultry industry, ensuring a stable supply of affordable poultry products. Also, the study promoted sustainable agriculture by reducing reliance on commercial probiotic products and encouraging local farmers to utilize available resources within their communities. This minimized environmental impact and fostered self-sufficiency. Additionally, the use of locally-made probiotics could lower production costs for farmers, making poultry farming more economically viable, especially for small-scale and resource-constrained farmers. The study's findings also contributed to healthier poultry populations, potentially reducing the need for antibiotics and ensuring safer and more sustainable food for consumers. Lastly, by emphasizing local empowerment and community development, the research encouraged farmers and researchers to tailor probiotic solutions to their specific contexts, promoting knowledge sharing, innovation, and strengthening the agricultural sector at the local level.

CONCLUSIONS

The inclusion of locally-made probiotics in chicken drinking water was concluded to have had positive effects on various performance indicators. Specifically, it improved body weight, weight gains, feed consumption, feed conversion efficiency, dressing percentage, and income. These findings addressed the objective of this study, which was to evaluate the effects of administering different locally-made probiotics in drinking water on chicken performance. Further studies should be conducted to determine the optimal inclusion rate of probiotics, analyze changes in gut microbiota, evaluate immune response, conduct economic analysis, and assess environmental impacts. This will help us to have a clear understanding of probiotic supplementation in poultry production and optimize its application in terms of performance, health, economics, and sustainability.

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