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Effects of Different Levels of a Locally Made Probiotic (Biolatem™) Administered through Drinking Water on Growth Performance of Broiler Chickens

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ABSTRACT

This study aimed at determining the growth performance of broiler chickens offered varying amounts of a locally made probiotic (Biolatem™) in drinking water. One hundred and ninety-two (192) day-old chicks were bought from a local hatchery and divided into four groups (n = 48). The groups were randomly allocated to four levels of Biolatem™ *via* drinking water (i.e., 0, 5, 8 and 10mL of Biolatem™ per 5L of drinking water). Both the water and feed were offered to the birds in all treatment groups *ad libitum* from 0 – to 42 days of age. Feed and water intake were monitored daily, and body weights were assessed at 0, 7, 14, 21, 28, 35 and 42 days of age. Weight gains and feed conversion ratios were calculated weekly. Generally, birds that received Biolatem™ in water showed higher ($p < 0.05$) total weight gains, daily weight gains and final body weights at 42 days of age than those that consumed water without Biolatem™. Among birds that received Biolatem™, those offered 8mL of Biolatem™ per 5L of drinking water had better performance ($p < 0.05$) in the variables assessed. It was concluded that Biolatem™ positively influenced the growth performance of the broiler chickens, and the best performance was exhibited by birds that were consuming water with 8mL of Biolatem™ per 5L in it.

Keywords: Biolatem™ as a growth promoter, Ross 308 broiler chickens.

INTRODUCTION

Broiler breeding programmes have produced genotypes that impart rapid growth rates and higher feed efficiency characteristics in broiler chickens. However, this successful selection for improved performance has led to lower immunological response to the different stresses that birds are subjected to during their growth. Consequently, their growth performance in weight gains and feed utilisation is poor, leading to huge economic losses for the farmers.

There are many environmental, social, and management stress factors that broilers are subjected to during their growth, which can limit their full genetic potential to perform in terms of productivity. These may include but are not limited to, extreme temperatures, high ammonia concentrations, disease challenges, vaccinations, overcrowding and feed, and water deprivation in terms of quantity and quality. According to Musukwa (2019), birds that are subjected to stress cannot express their full genetic potential for weight gain and feed conversion.

Based on this understanding, poultry nutritionists have been routinely formulating broiler diets with antibiotic feed additives to achieve high economic returns through increased weight gains, feed utilisation, and gut modifications in the gastrointestinal tract of the bird (Torok et al., 2011: Lin et al., 2013). However, widespread and indiscriminate use of these additives in feeds/water for food animals has evoked widespread fears in consumers as these additives contributed to high cases of resistant bacteria found in humans (Okoli et al., 2005; Mehdi et al., 2018) emanating from high cases of residual antibiotics in meats (Ramatla et al., 2017; Ronquillo and Hernandez, 2017) reported. For this reason, antibiotic feed additives have been banned in Europe and America (Patel et al., 2020). Therefore, this has compelled nutritionists to search for cost-effective alternative feed additives that can maintain broilers' health and performance. In Zambia, one of the products with such potential could be Biolatem™, a product manufactured by a local food supplements manufacturing company (JNK Industries Ltd). Although its formulation details have not been disclosed due to copyright protection, this product is purported to be a probiotic with naturally occurring beneficial microorganisms, organic acids, enzymes, and cane molasses. It can potentially promote growth in poultry, pigs, fish and dairy cows (Ndonji, personal communication, October 2020). However, scientific data supporting this assertion is currently unavailable in the literature. Thus, the purpose of this study was to determine the growth performance of broiler chickens feeding on antibiotic-free feed and offered water containing different amounts of Biolatem™ as a growth promoter.

MATERIALS AND METHODS

Three isonitrogenic, isocaloric and antibiotic-free broiler diets (i.e., Starter, Grower and Finisher) were formulated, as shown in Table 1, according to the Zambian feeding standards, bagged and stored till the feeding trial. Water to be mixed with Biolatem™ was first boiled and left to cool for at least, 4 hours before storing it in clean and sealed 20L plastic containers till the commencement of the study. One hundred and ninety-two (192) day-old chicks (Ross 308) were sourced from a local hatchery, and divided into four treatment groups (n = 48). These groups were randomly assigned to water mixed with Biolatem™ at 0, 5, 8 and 10 mL per 5L, and each group was replicated four times (n =12). All birds in all treatment groups had free access to feed and treated water, and all routine management tasks, such as brooding and vaccination, were the same for all the groups and were carried out simultaneously.

Feed intake was monitored daily by first weighing the feed residues from the previous 24 hours of feeding before putting in fresh weighed feed. Body weights of the chickens were taken at 0, 7, 14, 21, 28, 35, and 42 days of age. Weight gains were calculated weekly as the difference between the weight of birds at one weighing age and the next. Feed conversion ratios were also calculated weekly by dividing the total feed consumed in a week (g of feed) by the total weight gained during the same week (g of weight gained).

All the data collected was analysed by the general linear model (GLM) procedure of SAS (2002), with Biolatem™ added to the water as a factor based on the mathematical model;

$$Y_{ij} = \mu + T_i + \varepsilon_{ij}$$

Where: Y_{ij} is the observation; μ is the overall mean, T_i is the fixed effect of Biolatem™, and ε_{ij} is the random error. Means were compared using the Tukey test, and differences among means with $p < 0.05$ were taken as representing statistical differences. However, differences among means with $0.05 < p < 0.10$ were accepted as representing a statistical tendency to differ.

RESULTS AND DISCUSSION

Table 1 shows the composition of the diets formulated. The starter, grower and finishing diets were formulated to contain 23, 21.5 and 19.5% CP, and 2999.5, 3098 and 3198.0 Kcal/Kg of energy. This met the requirements of broiler chickens as outlined in the Zambia feeding standards. Generally, all birds offered experimental diets and water containing Biolatem™ remained healthy from 1-42 days of age. This suggested that the water additive had no deleterious effects on the chickens.

Table 1: Composition of diets fed to broiler chickens offered varying levels of Biolatem™ in drinking water as a growth promoter

Feed ingredient	Diets		
	Starter	**Grower**	**Finisher**
Maize meal	48.0	51.1	56.2
Soybean meal	43.6	39.4	34.6
Soybean oil	3.85	5.69	5.94
Dicalcium phosphate	2.0	1.7	1.54
Limestone flour	1.2	0.9	0.72
Lysine	0.15	0.09	0.07
DL-Methionine	0.33	0.29	0.26
Broiler premix	0.5	0.4	0.3
Salt (Sodium chloride)	0.37	0.37	0.37
Total	**100**	**100**	**100**
Calculated analysis			
Crude protein (%)	23.0	21.5	19.5
Metabolisabe energy (Kcal/Kg)	2999.5	3099.0	3198.2

Results of the growth performance of broiler chickens supplemented with Biolatem™ as a probiotic in drinking are shown in Table 2.

Generally, all birds taking water with Biolatem™ had higher ($p < 0.05$) final body weights, total weight gain and daily weight gain compared to chickens that were offered water without an additive.

Table 2: Body weights and weight gains attained by broiler chickens offered varying levels of Biolatem™ in drinking water as a growth promoter

Variable	Biolatem™ level (mL per 5L of drinking water)			
	0	5	8	10
Initial body weight (g/b)	37.1 ± 2.9	41.0 ± 3.8	38.1 ± 2.2	37.5 ± 2.1
Final body weight (g/b)	2469.3 ± 226.2[a]	2689.0 ± 217.7[b]	2774.8 ± 283.9[b]	2666.4 ± 237.4[ab]
Total weight gained (g/b)	2432.2 ± 225.9[a]	2648.0 ± 218.1[b]	2736.7 ± 282.9[b]	2628.9 ± 237.1[ab]
Daily weight gain (g/b/d)	57.9 ± 6.4[a]	63.0 ± 7.6[b]	65.2 ± 8.1[b]	62.6 ± 7.9[ab]

Values are Means ± STD (n = 48)

[a-b] Means within a raw with different superscripts differ significantly ($p < 0.05$)

Birds receiving 5, 8, and 10mL of Biolatem™ per 5L water weighed significantly heavier at 2689.0, 2774.8, and 2666.4g, respectively, compared to 2469.3g attained by those drinking just ordinary water. This means that chickens receiving Biolatem™ gained 2648.0, 2736.7, and 2628.9g in 42 days of feeding, compared to 2432.2g gained by birds that took only ordinary water over the same period. These weight gains translated into 63.0, 65.2 and 62.6g per bird/day for chickens taking water with 5, 8, and 10mL Biolatem™ per 5L, respectively.

These observations agreed with the findings of Alkhalf et al. (2010), Shabani et al. (2012), and Song et al. (2014), who stated that probiotics administered *via* drinking water had a significant positive effect on weight attained and total weight gained. Various ways have been proposed in which probiotics influence the growth performance of animals. Jadhav et al. 2015) proposed that probiotics increased the area of absorption of the small intestine by increasing the villi height number of goblet cells and decreasing the crypt depth. Bajagai et al. (2016), agreeing with Jadhav et al (2015), added that probiotics increase the digestibility of nutrients in the diet due to increased enzyme activity in the intestine.

Therefore, probiotics mainly influence the

gastrointestinal tract's physiological functions by enhancing digestion, absorption and propulsion.

Microorganisms found in probiotics change the activity of digestive enzymes in the gastrointestinal tract of the birds, thereby creating a large surface area for absorption. The Biolatem™ used in this study also contains digestive enzymes, microorganisms, and organic acids. It was, therefore, postulated that the enzymes and microorganisms present in Biolatem could also have influenced the physiological functions of the gastrointestinal tract, thereby enhancing feed digestibility. Additionally, the presence of organic acids in Biolatem could have reduced the pH in the crop and gizzard, thus, providing a conducive environment for nutrient absorption from the gastrointestinal tract, leading to higher weight gains.

Among the birds that received Biolatem™, there were no significant differences among the treatments of 5, 8 and 10mL in final body weight, total weight gain and daily weight gain ($p > 0.05$). However, birds that received 8mLs Biolatem™ tended to be higher ($p = 0.07$) in final body weight, total weight gain and daily weight. According to Huang et al. (2004), higher inclusion levels of probiotics did not always result in better performance in broiler chickens. Jadhav et al. (2015), emphasised that the dose was a key factor for a probiotic's effectiveness in broiler chickens. Therefore, five and 10mL treatments with the probiotic were ineffective because one was on a lower side, while the other was on a higher side. This suggests that 8mL Biolatem™ per 5L of water may be the optimal inclusion level of this product.

Table 3 shows the total feed and water intakes and feed conversion ratios of broiler chickens offered water mixed with Biolatem™. The addition of Biolatem™ in drinking water at 5, 8 and 10mL per 5L of water did not have any significant effect on total feed and water intake, daily feed intake and feed conversion ratios when compared to 0mL Biolatem™ per 5L water treatment.

The feed and water intake for broiler chickens receiving Biolatem™ via water at 5, 8 and 10mL in 5L of water consumed 3952.9, 4109.2, and 3943.2g of feed, respectively, during the 42 days of trial, while those drinking ordinary water consumed 3791.1g during the same period. This means that daily feed consumption was 90.3, 94.1, 97.8, and 93.9g for birds that received 0, 5, 8, and 10mL Biolatem™ per 5L of water. Total water consumed from 1-42 days of age was 7961.3, 7905.8, 8629.3, and 7886.4mL/bird in 0, 5, 8, and 10mL Biolatem™ per 5L of drinking water treatment groups, respectively. Feed conversion ratios were 1.68, 1.51, 1.50, and 1.55 for chickens that consumed 0, 5, 8, and 10mL Biolatem™ per 5L drinking water, respectively. Statistically, there were no significant differences in feed and water intakes and feed conversion ratios.

Table 3: Feed intake, water intake, and feed conversion ratios of broiler chickens offered varying levels of Biolatem™ in drinking water as a growth promoter

Variable	Biolatem™ level (ml per 5L of drinking water)			
	0	5	8	10
Total feed intake (g/b)	3791.1 ± 322.9	3952.9 ± 378.8	4109.2 ± 410.2	3943.2 ± 362.1
Total Water intake (ml/ bird)	7961.3 ± 648.1	7905.8 ± 698.3	8629.3 ± 623.1	7886.4 ± 649.8
Daily feed intake (g/b/d)	90.3± 53.2	94.1 ± 55.7	97.8 ± 53.9	93.9 ± 54.4
Feed Conversion Ratio	1.6 ± 0.3	1.5 ± 0.2	1.5 ± 0.2	1.5±0.3

Values are Means ± STD (n = 48)

The lack of statistical differences in the water intake may indicate that the additive did not change the taste quality of the water after mixing it with Biolatem™. However, birds in 8mL Biolatem™ per 5L drinking water treatment tended to consume more feed ($p = 0.058$) and water ($p = 0.063$) than the rest. Similarly, broiler chickens that were offered 8mL Biolatem™ per 5L of water exhibited a statistical tendency to have a lower ($p = 0.0.74$) feed conversion ratio than the rest of the treatment groups.

Panda et al. (2000), Ahmad (2004), Anjum et al. (2005), Altaher et al. (2015), and Patil (2015) found no differences in the feed intake and feed conversion ratios when they supplemented the birds with different probiotics. Shokryazdan et al. (2017), reported that differences in strains, sources, viability and concentration of bacteria, and methods of administration were the reasons for the lack of differences in total feed intake, daily feed intake and feed conversion ratios in most probiotic trials in broilers. Probably, the bacterial strain in Biolatem™ did not have much influence on the rate at which feed was digested to affect feed intake. The presence of organic acids in this product could have exerted much influence by providing an enabling environment for nutrient absorption by lowering the pH in the gizzard and small intestines.

CONCLUSION

The results of this study have shown that administering Biolatem™ as a probiotic *via* drinking water generally, had significant positive effects ($p < 0.05$) on final body weights attained at the end of the rearing period, total weight gained and the daily weight gain. Among birds consuming Biolatem™, those supplied with 8mL Biolatem™ per 5L of water tended to outperform birds that received 0, 5 and 10mL Biolatem™.

CONFLICT OF INTEREST

The authors certify no conflict of interest with any financial organisation regarding the material discussed in this manuscript.

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