GROWTH PERFORMANCE OF FINISHER BROILER CHICKEN ADMINSTERED *Bacillus subtilis* (PROBIOTICS) IN DRINKING WATER

Adagi, J.M.[1]*, Uza, O. [2], Ate, M.E.[3] and Utoo, E.G.[4]
[1]Department of Animal Nutrition, Joseph Sarwuan Tarka University, P.M.B. 2373 Makurdi, Benue State, Nigeria
[2]Department of Animal Production. Joseph Sarwuan Tarka University, P.M.B. 2373 Makurdi, Benue State, Nigeria
[3]Department of Animal Breeding and Physiology. Joseph Sarwuan Tarka University, P.M.B. 2373 Makurdi, Benue State, Nigeria
[4]Department of Agricultural Technology, Federal Polytechnic, Wannune, Benue State.
***Corresponding author:** adagi.myom@uam.edu.ng; 08054511156*

ABSTRACT
A 28-day feeding trial study was conducted to evaluate the effect of Bacillus subtilis (probiotics) supplementation on the growth performance of finisher broiler chickens. One hundred and twenty (120), three (3) weeks old mixed sexes chicks were used in this study. The birds were randomly assigned to four dietary treatment groups; T_1, T_2, T_3, and T_4 with Bacillus subtilis supplementation at 0ml/litre, 10ml/litre, 20ml/litre and 30ml/litre in drinking water respectively. The treatment groups were replicated three times with ten (10) birds per replicate in a Complete Randomized Design. The birds were housed in deep litter pens and all necessary routine management practices were observed. The growth performance data were collected for parameters such as initial weight, final weight, weight gain, feed intake and feed conversion ratio (FCR). The data collected were statistically analysed using one-way analysis of variance (ANOVA) with SPSS version 16.0 and significance of differences among treatments was determined using Duncan multiple range test. There were no significant differences ($P>0.05$) across the treatment groups for Initial weight. However, significant ($P<0.05$) differences were observed for feed intake, final body weights and feed conversion ratio (FCR). Therefore, supplementation of broiler finisher diet with 20ml/litre in drinking water is recommended for optimal performance.
Keywords: **Broiler performance, Feed intake, Weight gain, Feed conversion ratio, Bacillus subtilis**

INTRODUCTION

Poultry is considered the cheapest source of animal protein, contributing significantly to supply the growing demand for animal protein around the world (Ogundipe and Sanni, 2005). The consumption and trade in poultry products have increased rapidly as the human population increases, making it the second largest source of meat after pork (FAO, 2022). The improvement in poultry production is often achieved by the use antibiotics which help in increasing feed conversion, growth rate promotion and disease prevention ((Mehdi *et al.*,2018).

Despite the importance of antibiotics, there is prohibition/restriction of its usage especially in developed countries like USA and the European Union, due to its negative impacts such as the development of antibiotic resistance and dangerous residues in animal products. Considering the severe restriction or total ban on the usage of antibiotics as growth promoters in poultry production, probiotics, organic acids and enzymes have been suggested as alternatives (He *et al.,* 2020; Larsson and Flach, 2022). Probiotics are a culture of living microorganisms that are used as functional ingredients to manipulate and maintain gut health by controlling gut microflora and increasing digestive enzyme activity (Chandrasekaran *et al.,* 2024). Bacillus species, including *Bacillus subtilis, Bacillus cereus, Bacillus clausii, and Bacillus coagulans,* have been identified as effective probiotics that promote animal growth, maintain intestinal barrier function, and promote meat quality of broilers (Gaggia, 2010). Therefore, this study was carried out to investigate the effect of *Bacillus subtilis* supplementation on the growth performance of finisher broiler chickens.

MATERIAL AND METHODS

Experimental site

The feeding trial was carried out at the Poultry Unit of the Teaching and Research Farm of the College of Animal Science, Joseph Sarwuan Tarka University, Benue State, Nigeria. Makurdi is located in the Guinea Savannah Zone of Nigeria on latitude $7^0$43'N and longitude $8^0$53'E. The average minimum temperature is 23^0C and maximum temperature is 36.9^{o}C, mean monthly relative humidity is 74%. The mean annual rainfall is 1105mm; the mean monthly temperature is 35.06 ^{o}C (TAC, 2022).

Experimental design and management of birds

One hundred and twenty (120), three (3) weeks old mixed sexes, broilers were used for this study. The birds were purchased from a vendor in Makurdi, Benue State. They were randomly allotted to four dietary treatment groups;

T_1 (control), T_2, T_3, and T_4. The treatment groups were replicated three times with ten (10) birds per replicate in a Complete Randomized Design.
The birds were housed in deep litter pens and all necessary routine management practices were observed. Clean/fresh water and feed were provided *ad libitum* for the 28 days of the experimental period. The diets were formulated to meet the nutrient requirements of the finisher birds (Table 1) according to the National Academy of Sciences, Engineering and Medicine (NASEM) Research requirements (2024).

Bacteria Preparation
Bacillus subtilis (BS) was isolated and cultured in Pathology Laboratory, Department of Veterinary Medicine, Joseph Sarwuan Tarka University, Makurdi. The *B. subtilis* solution was prepared at a concentration of 2.0 × 108 cfu/ml.

Experimental diets
A 21% CP diet was formulated according to the nutritional recommendation of NASEM (Table 1). The water administered to the birds are designated as T_1 (control), T_2, T_3, and T_4 with *Bacillus subtilis* supplementation at 0, 10, 20, and 30 ml/litre of drinking water, respectively.

Measurement of performance parameters: The weights of the experimental animals were taken weekly using a sensitive electronic kitchen scale (e.g. 0.1g, 0.01g etc). Body weight gain was calculated at the end of the experiment by subtracting the initial weight from the final weight. The feed conversion ratio was determined by dividing the feed intake by the weight gain. Feed intake was taken every day, by subtracting the left over from the daily feed given.

Statistical Analysis
Data collected was subjected to analysis of variance (ANOVA) according to the procedure of SAS (2003). Statistically significantly different treatments were separated using Duncan Multiple Range Test.

RESULTS AND DISCUSSION
Table 1 shows the gross composition of the experimental diets fed to the finisher broilers, which were isonitrogenous and isocaloric. The results for the effect of *Bacillus subtilis* supplementation on the growth performance of finisher broilers is shown in Table 2. The result showed that, there was no significant difference ($P>0.05$) in the initial weight. However, significant differences were observed for average feed intake, daily weight gain, final body weights and feed conversion ratio (FCR). The improved feed intake, weight gain and feed conversion ratio could be as a result of the action of the *Bacillus subtilis* that caused secretion of digestive enzymes which helped in the release of nutrients in the feeds and the enhanced immune status of the birds.

TABLE 1: INGREDIENTS AND NUTRIENT COMPOSITION OF EXPERIMENTAL BROILER FINISHER DIET

Maize	44.00
Full- Fat Soybean	48.40
BDG	2.00
Rice offal	2.00
Bone ash	2.00
Dicalciumphosphate	0.50
L-Lysine	0.20
DL-Methionine	0.20
Salt	0.20
V/M Premix	0.20
ME (Kcal/kg)	2950.00
Crude protein (%)	21.00
Crude fibre (%)	5.00
Ether extract (%)	10.58
Calcium (%)	1.08
Phosphorous (%)	0.79
L-Lysine (%)	1.39
DL-Methionine (%)	0.51

The result of this study agrees with findings Mohamed *et al.* (2022) who conducted a study on effect of dietary supplementation of *Bacillus subtilis* on the growth performance, organ weight, digestive enzyme activities and serum biochemical indices of broilers and reported improved (P<0.05) weight gains. Also, Zhang *et al.* (2013) reported an increase in the average daily gain of broilers when feed was supplemented with *Bacillus spp*. (105 and 108 cfu/kg).

TABLE 2: GROWTH PERFORMANCE OF FINISHER BROILERS

Parameter	T1	T2	T3	T4	SEM	P.Value
Initial body Weight(g)	947.52	921.08	950.43	910.77	27.62	0.461
Daily weight gain(g)	38.02[b]	52.10[a]	56.88[a]	46.87[b]	2.74	0.046
Total weight gain (g)	1064.82[b]	1458.12[a]	1592.90[a]	1312.57[b]	76.76	0.041
Final weight (g)	2135.33	2380.00	2548.33	2223.33	59.72	0.151
Average daily Intake (g)	87.65[b]	96.43[a]	99.40[a]	102.38[a]	2.75	0.021
Total Feed Intake (g)	2314.67[b]	2700.00[a]	2783.33[a]	2866.67[a]	77.00	0.011
FCR	2.17	1.78	1.78	1.94	0.07	0.192

Superscripts are read row wise for comparison of means. Means in the same row with different superscripts a, b is significantly different (P< 0.05), (P> 0.05) NS= non-Significant, *SEM: Standard error of Mean and P-Value: Probability Values*

CONCLUSION

Based on the findings of the study, it is concluded that finisher broiler diets supplemented with *Bacillus subtilis* significantly improved feed intake, weight gain the feed gain ratio. Therefore, supplementation of broiler finisher diet with 20ml/litre in drinking water is recommended for optimal performance.

REFERENCES

Chandrasekaran, p., Weiskirchen, S and Weiskirchen, R. (2024). Effects of Probiotics on Gut Microbiota: An Overview *International Journal of Molecular Sciences, 25(11), 6022.*

FAO. (2022). *The State of Food and Agriculture 2022: Leveraging Food Systems for Inclusive Rural Transformation*. Food and Agriculture Organization of the United Nations.

Gaggia, F., Mattarelli, P., and Biavati, B. (2010). Probiotics and prebiotics in animal feeding for safe food production. *International Journal of Food Microbiology*, *141*(S1), S15-S28.

He Y., Yuan Q., Mathieu J., Stadler L., Senehi N., Sun R., et al. (2020). Antibiotic resistance genes from livestock waste: occurrence, dissemination, and treatment. NPJ Clean Water 4:1–11.

Larsson D. G. J. and Flach C.F. (2022). Antibiotic resistance in the environment. National Review Microbiology 20,257-269. 10.1038/s41579-021-00649-x

Mohamed, T.M, Sun, W., Bumbie, G.Z., Dosoky, W.M., Rao, Z., Hu, P., Wu, L., and Tong, Z. (2022). Effect of dietary supplementation of *Bacillus subtilis* on the growth performance, organ weight, digestive enzyme activities and serum biochemical indices of broilers. *Animal (Basel), 12(12):1558*.

NASEM (2024). Assessing NASA Science Activation 2.0: Progress, Achievements, and Strategic Recommendations. Washington, DC: The National Academies Press. https://doi.org/10.17226/27989

Ogundipe S. O. and Sanni, S.A. (2021). Some modules of poultry production in Kaduna State, Nigerian Journal of Animal Production Nigeria. 32(1):102-107

SAS (2003). User's Guide statistics version, 10th edition, SAS statistical package Inc., Carry, North Carolina, USA

TAC (2022). Tactical Air command Makurdi. Annual weather Report Bulletin.

Zhang Z.F., Cho J.H., Kim I.H. (2013). Effects of Bacillus subtilis UBT-MO2 on growth performance, relative immune organ weight, gas concentration in excreta, and intestinal microbial shedding in broiler chickens. *Livest. Sci. 155:343–347*. doi: 10.1016/j.livsci.2013.05.021.