NUTRIENT DIGESTIBILITY OF FINISHER BROILER CHICKENS ADMINSTERED *Bacillus subtilis* (PROBIOTICS) IN DRINKING WATER

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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 sex chicks were used in this study. The birds were randomly assigned to four treatment groups, T_1, T_2, T_3, and T_4 with Bacillus subtilis probiotics 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. At the end of the 4 weeks experimental period, three (3) chickens representing the average group weight were selected from each treatment and were housed individually in separate cages for faecal collection. The trial lasted for 7 days; however, there was two days adjustment period before the commencement of the trial. During collection, contaminants were removed from the faeces. Daily feed intake per bird was recorded. Faecal samples were oven-dried at 80^oC for 24 hours and proximate analysis was carried out to determine the nutrient composition. 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. The result of the study showed that, there was significant differences ($P<0.05$) in the dry matter, crude protein and crude fibre digestibility. However, no significant ($P>0.05$) difference was observed in the ash and nitrogen free extract digestibility. Therefore, supplementation of grower-finisher broiler diets with Bacillus subtilis had positive impact.
Key words: Broilers, dry matter, nutrient digestibility Bacillus subtilis, probiotics

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, 2021). 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 helps 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 Spp.* are considered the most beneficial health-boosting bacteria because they are reported to improve the amount of digestive enzyme activity in the intestinal content, suggesting enhancement of feed utilization (Li *et al.,* 2008). Therefore, this study was carried out to investigate the effect of *Bacillus subtilis* supplementation on the nutrient digestibility 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°C, mean monthly relative humidity is 74%. The mean annual rainfall is 1105mm; the mean monthly temperature is 35.06 °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 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 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 feed was formulated according to the nutritional recommendation of NASEM. The treatment groups were designated as T_1 (control), T_2, T_3, and T_4 with *Bacillus subtilis* supplementation at 0, 10, 20, and 30 ml/litre in drinking water, respectively.

Digestibility Trial

At the end of the 4 weeks experimental period, three (3) chickens representing the average group weight were selected from each treatment and were housed individually in separate cages for faecal collection. The trial lasted for 7 days; however, there was two days adjustment period before the commencement of the trial. During collection, contaminants were removed from the faeces. Daily feed intake per bird was recorded. Faecal samples were oven-dried at 80°C for 24 hours and proximate analysis using AOAC (2008) methods was conducted. The apparent nutrient digestibility was calculated using the formula below:

$$\text{Nutrient Digestibility} = \frac{\text{Nutrient supplied in feed} - \text{amount of nutrient in feaces}}{\text{Nutrient supplied in feed}} \times 100$$

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 apparent nutrient digestibility of grower-finisher broilers is shown in table 2. The result showed that, there was significant difference ($P<0.05$) in the dry matter, crude protein and crude fibre digestibility. However, no significant ($P>0.05$) differences were observed in the ash and nitrogen free extract digestibility. This could be that, probiotics stimulate digestion by enhancing secretion of digestive enzyme and balance of microbiota in the gastro intestinal tract (GIT) of the birds. The result of this study collaborates findings of Anggraeni *et al.* (2020) who in a study evaluated the effect of nutrient digestibility of broiler chicken fed diets supplemented with probiotics phytase-producing, and reported increase nutrient digestibility, especially apparent metabolic energy corrected nitrogen, and true metabolic energy corrected nitrogen. Also, Li *et al.* (2008) evaluated the effect of dietary probiotic supplementation on ileal digestibility of nutrients and growth performance in 1- to 42-day-old broilers and reported improved ($P < 0.05$) ileal digestibility of dry matter, energy, calcium and phosphate in 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
Calculated values	
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

Table:2 NUTRIENT DIGESTIBILITY OF FINISHER BROILERS ADMINISTERED *Bacillus subtilis*

	Treatment					
Parameters	T_1	T_2	T_3	T_4	SEM	P-value
Dry Matter	60.31^{c}	65.97^{b}	70.87^{a}	69.00^{ab}	1.30	0.00
Crude Protein	37.18^{c}	50.09^{b}	61.78^{a}	60.08^{ab}	3.09	0.001
Crude Fibre	37.97	43.63	48.28	49.37	1.98	0.15
Ether Extract	60.89^{c}	70.23^{b}	76.12^{ab}	78.54^{a}	2.78	0.00
ASH	47.46	56.76	59.92	56.69	2.27	0.25
Nitrogen Free-Extract	67.46	77.98	78.75	77.30	2.39	0.32

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 was concluded that supplementation of drinking water with *Bacillus subtilis* had a positive impact on the nutrient digestibilities in finisher broilers.

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