ECONOMICS OF PRODUCTION OF FINISHER BROILER CHICKENS ADMINISTERED *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 sexes, 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 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 economics of production data was collected for parameters such as feed intake, cost feed per kg, total cost of feed consumed, total weight gain, feed cost/ kg weight gain, revenue and cost of saving percentage. The result showed that, the cost of the feed increased as the level of the probiotics increased. Though, there was improvement in the feed intake, feed gain ratio and total weight gain. There was also increase in revenue and the cost of saving percentage in the Bacillus subtilis supplemented groups compared with the control group, T2 (12.94%), T3(17.79%) and T4 (6.29%).
Key words: Broilers, Weight gain, Bacillus subtilis, Revenue and Economics of production

INTRODUCTION

Poultry is considered the cheapest source of animal protein, contributing significantly to supplying 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 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 (Larsson and Flach). 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 cost implication 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. The treatments 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.

TABLE 1: Ingredients and Nutrient Composition Of#o 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

Measurement of performance parameters: The weights of the experimental animals were taken weekly using sensitive electronic kitchen scale. 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.

Economics of production
The costs per kilogram of each experimental diet were calculated based on the prevailing market prices of feed ingredients in Makurdi. To calculate the cost per kilogram of feed, the price/kg of each ingredient were multiplied by the quantity in Kg of that ingredient in the diet. The cost of feed of feed consumed per each bird was calculated as the product of the cost of 1 kg of feed and amount of total feed intake. Feed cost per kg weight gain was calculated as, feed cost x FI / WG (where FI= feed intake and WG = weight gain). Revenue obtained from the sales of the birds was realized by the multiplying the weight gain by the cost live body weight (₦4,500/kg). The cost of saving percentage was expressed in relative to the revenue of the control treatment.

RESULTS AND DISCUSSION
The results for the effect of *Bacillus subtilis* probiotics supplementation on the economics of production of finisher broilers is shown in table 2. The result showed that, *Bacillus subtilis* supplementation increased the feed cost per

kg (₦/kg) and was noticed to be highest (₦814.00) in treatment 4 (30ml/litre) while the control T1 (control) (0ml/litre) The weight gain was observed to increase with probiotics supplementation compared with the control group with treatment 3 having the highest total weight gain of (1.63kg) and treatment 1 (control) having the lowest (1.34kg). The accruable revenue was observed to be highest in treatment 3 (₦8,150) which had the highest weight gain, and lowest in the control group (₦6,700). The percentage cost of saving was observed to be highest in treatment 3 (17.79%) compared with the T1(control group).

The improvement in feed intake, total weight gain, revenue and percentage cost of saving as a result of *Bacillus subtilis* supplementation in grower-finisher diets depicts the improvement weight gain which imply improved health status and better utilization of feed. The result of this study agrees with findings of Reis *et al*. (2017). Who conducted a study on the Effect of *Bacillus subtilis* (DSM 17299) on performance, digestibility, intestine morphology, and pH in broiler chickens and reported that, *B. subtilis* DSM 17299 resulted in an improvement in performance and a decrease in production costs when fed to broiler chickens. Also, Mekala *et al*. (2024). Reported increase in revenue as a result of *Bacillus subtilis* inclusion in broiler diets.

Table 2: Growth Performance of Finisher Broilers

Parameter	T1	T2	T3	T4
Total Feed intake	2.63	2.70	2.92	2.68
Feed cost/kg (₦)	735.00	758.00	786.00	814.00
Cost of total feed consumed (₦)	1,933.05	2,046.60	2,279.40	2181.00
Total weight gain (kg)	1.34	1.54	1.63	1.43
Feed cost/kg gain	548.51	492.21	482.21	569.23
Revenue (₦)	6,700	7,700	8,150	7150
Cost of saving%	--	12.98	17.79	6.29

Revenue-weight gain x 4500/1kg LBW (Live body weight), FCR-Feed conversion ratio

CONCLUSION

Based on the findings of the study, it was concluded that finisher broiler supplemented with *Bacillus subtilis in drinking water*, improved total weight gain, revenue and cost of saving percentage. Therefore, supplementation of broiler drinking water with 20ml/litre of *Bacillus subtilis* is recommended for optimal performance.

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