Direct RESEARCH JOURNALS
Vol.5 (8), pp. 302-306, August 2017
ISSN 2354-4147
DOI: https://doi.org/10.26765/DRJAFS.2017.DRJA16284589
Article Number: DRJA16284589

Direct Research Journal of Agriculture and Food Science
http://directresearchpublisher.org/aboutjournal/drjafs

Research Paper

Effects of Probiotic *Lactobacillus Acidophilus* on Performance of Broiler Chickens

Vantsawa P. A.[1]*, Umar T.[1] and Bulus T.[1,2]

[1]Department of Biological Sciences Nigerian Defence Academy Kaduna, Nigeria.
[2]Department of Biochemistry Kaduna State University, Kaduna, Nigeria.
*Corresponding author E-mail: vantsawa@yahoo.com.

Received 3 July 2017; Accepted 17 August, 2017

A study was conducted to determine the effect of probiotics *Lactobacillus acidophilus* (Lactic acid bacteria) on performance of broilers chickens. One hundred and twenty (120), one-day old broiler chicks of Abor Acre Plus strain were divided equally into 4 groups with 3 replicates of 10 birds each. Chickens were housed in double open-sided pens measuring 1.0×1.2 m for 42 days. Feed and water were provided *ad-libitum*. There were four dietary treatments. Dietary treatments were T1-1.45x10^9 CFU probiotic/kg basal feed, T2-1.09×10^9 CFU probiotic/kg basal feed, T3-7.25×10^8 CFU probiotic/kg basal feed and T4-No probiotics supplementation (control). Feed intake and weight gain were recorded weekly. Total body weight gain was significantly higher (P<0.05) in T1 (1621.44±53.91 g) when compared to T2, T3 and T4; 1407.67±10.23 g, 1258.87±21.49g and 1261.38±63.54 g respectively. Feed consumption was higher in T3 (4131.10±264.59g) but differences were not-significant (P>0.05). Serum cholesterol level was significantly (P<0.05) lower in T1 (3.29±0.26 Mmol/dl) and highest in T4-control (4.34±0.24Mmol/dl). Consequently, dietary supplementation of probiotic in broiler chicken feed at 1.45x10^9 CFU/kg for 42 days enhanced weight gain with better feed conversion ratio and reduced serum cholesterol.

Keywords: Lactic acid bacteria; *Lactobacillus acidophilus*; broilers, serum cholesterol.

INTRODUCTION

The global increase in demand from livestock sector for availability of high quality protein for human consumption has prompted the need to explore cost efficient and faster means of increasing poultry performance and yield at the same time reducing feed consumption. Over the years, antibiotics were used in the poultry industry for prophylactic and therapeutic purposes and also as growth enhancers. Nutrition and diseases are part of the challenges of the poultry industry (Vantsawa *et al*., 2007; Aromolaran *et al*., 2013). Antibiotic usage as growth promoters leaves residues in poultry products (meat and eggs) which have deleterious effect on humans as the consumer and also shown to cause bacteria resistance (Donoghue, 2003; Wegener, 2012). Consequently, this steered to the prohibition of sub-therapeutic use of antibiotics as growth promoters.

Poultry gut microflora plays the most vital role in its physiological performance. Feed supplementation is an important aspect of livestock nutrition, since it has been shown to increase the efficiency of feed utilization and significantly affect blood parameters (Vantsawa and Daramola, 2014). Chicks under modern intensive rearing are hatched in incubators and housed where conditions are free or unfavorable for normal bacteria proliferation

and subsequent gut colonization. This condition deprives the chicks from establishing a well-balanced gut microflora unlike chicks under normal conditions in the wild or free range that share contacts with their mothers and thus obtain normal microflora (Fuller, 1989). A promising alternative approach to sub-therapeutic use of antibiotics is the use of probiotics microorganism. The name probiotics has been credited to live microorganisms which when controlled in sufficient measurement presents medical advantage on the host (FAO/WHO, 2001). Although the mechanism of action of probiotics is not yet clarified, they are thought to function by maintaining the presence of beneficial microorganisms in the gastro-intestinal tract (GIT) of healthy animals (Goh and Klaenhammer, 2010).

Dietary supplementation of lactic acid bacteria has been shown in several studies to: improve the performance of broilers in the starter phase (Altaf *et al*., 2009); have positive effect on weight gain, nitrogen retention and metabolizable energy value (Mohan *et al*., 1996); improve growth performance of broilers after 21 days of age (*et al*., 2004); body weight gain after 42 days of treatment (Joy and Samual, 1997).This study was therefore conducted to evaluate the Stanley probiotic effect of *Lactobacillus acidophilus,* a lactic acid bacteria (LAB) isolated from fermented cow milk on growth performance and organ characteristics of broiler chickens.

MATERIALS AND METHODS

One hundred and twenty (120) one-day old broiler chicks (Arbor Acre Plus breed) procured from Yammfy farms-Offa were used for this study. Birds were housed in an open-sided deep litter system with wood shavings as bed. All experimental pens were provided with 200W bulbs for warmth and lighting. The chicks were allowed to acclimatize for two (2) days then randomly divided into four experimental groups (T1- T4) of 30 chicks having three (3) replicates of 10 chicks each. All recommended environmental health conditions for poultry rearing (NVRI poultry manual) were maintained throughout this study.

Lactobacillus acidophilus isolated from fermented cow milk (nono) was obtained from the Department of Microbiology Laboratory, Kaduna State University. The isolate was sub-cultured by inoculating in 1000 ml of reconstituted MRS (Mans Rogosa & Sharpe) broth for 72 h before use.T1, T2 and T3 were the treatment groups, while T4 was control group. Table 1 shows the diet composition with LAB for each treatment group. Feed and clean fresh water were provided *ad-libitum* throughout the six (6) weeks period. All experimental birds were routinely vaccinated against avian infections such as Newcastle and infectious bursal disease (Gumboro). Mortality was recorded at necropsy level as it occurs.

Sampling methods

Birds in each experimental pen (replicates) were weighed in group using a mechanical weighing scale at weekly interval in the morning before feeding till the 6-weeks of age. Average individual body weight was recorded for each of the experimental groups. Feed consumption was measured and recorded by feed “weigh-back” method at the end of each week. Using the average feed intake, Feed to Gain ratio (FGR) was calculated. At the end of the experiment (6-weeks of age), six birds per experimental group (2 from each replicate) of same average weight were kept fasted for 6 hours then sacrificed. Blood samples were collected with the aid of a 5ml sterilized plastic syringe from the wing vein for *in vitro* quantitative determination of serum cholesterol based on CHOD-PAP method (AGAPPE Diagnostics Switzerland GmbH). After bleeding, birds were scalded and eviscerated to obtain carcass weight for the calculation of the dressing percentage. The gizzard, heart and liver percentage in relation to the body weight were also calculated. Body weight gain and performance index were determined according to Zar, (2010). Percentage mortality was calculated using the ratio of death to the remaining birds.

Statistical analysis

All the recorded data and calculated results were subjected to analysis using StatistiXL (MS Excel add-in, version 1.11). P-value of <0.05 was considered a significant difference among groups and the post-hoc comparison between means using Duncan Multiple Range Test.

RESULTS

The performance of the experimental birds is presented in (Table 2). The live body weight gain (g) for experimental groups was significantly higher ($P<0.05$) in treatment group T1 which were fed 1.45×10^9 CFU/kg when compared to other treatments. A lesser weight gain was observed in treatment T3. There was significant difference in feed to gain ratio among the treatment groups. The control group (T4) gained considerably higher weight than birds in treatment T3 which were fed diet containing 7.25×10^8 probiotics. Total feed intake shows no significant ($P>0.05$) difference at the end of the6-weeks experiment. Feed consumed by T1, T2, T3 and T4 was 3896.74 g, 3971.04 g, 4131.10 g and 4072.17g respectively. Scalded weight of birds in all the experimental groups was significantly ($P<0.05$) different. While control group and treatment T3 showed similar scalded weight (1239.83 g and 1239.07 g respectively). Serum cholesterol level of blood taken from broilers fed

Table 1. Composition and calculated nutrient contents of experimental broilers diet.

Ingredients	T1	T2	T3	T4 (Control)
Maize (kg)	50.00	50.00	50.00	50.00
Soya (kg)	20.00	20.00	20.00	20.00
GNC (kg)	19.00	19.00	19.00	19.00
Bone meal (kg)	3.00	3.00	3.00	3.00
BDG (kg)	5.00	5.00	5.00	5.00
Limestone (kg)	2.10	2.10	2.10	2.10
Lysine (kg)	0.15	0.15	0.15	0.15
Methionine (kg)	0.15	0.15	0.15	0.15
Common salt (kg)	0.35	0.35	0.35	0.35
Vit./ Mineral Premix*	0.25	0.25	0.25	0.25
TOTAL (kg)	100	100	100	100
L. acidophilus	1.45×10^{9}	1.09×10^{9}	7.25×10^{8}	-
Calculated Nutrient Contents				
M. E. Kcal/kg	2980	2980	2980	2980
Crude Protein %	21.5	21.5	21.5	21.5
Crude Fibre %	4.00	4.00	4.00	4.00
Fat	3.8	3.8	3.8	3.8
Calcium %	0.48	0.48	0.48	0.48
Phosphorus %	0.45	0.45	0.45	0.45

*Vitamin/mineral premix from Bio-mix starter supplied per kg of diet: Vit. A, 10,000 i.u; Vit.D3, 2000 i.u; Vit. E 23mg; Vit. K, 2mg; Vit. B1 (Thiamine), 1.8mg; Vit B2 (Riboflavin), 5.5mg; Vit. B6 (Pyridoxine), 3 mg; Vit. B12 0.015mg; Pantothenic acid 7.5mg; Folic acid 0.75mg; Niacin 27.5mg; Biotin 0.6mg; Choline chloride 300mg; Cobalt 0.2mg; Copper 3mg; Iodine 1mg; Iron 20mg; Manganese 40mg; Selenium 0.2mg; Zinc 30mg; Antioxidant 1.25mg;
ME= Metabolizable Energy. T1, T2, T3, T4: Treatment groups assigned identity.

Table 2. Mean live weight gain, feed intake (g) and feed to gain ratio per bird fed different levels of probiotics.

Parameters	T1 ($1.45x10^{9}$)	T2 (1.09×10^{9})	T3 (7.25×10^{8})	T4 (Control)
Final Weight (g)	1694.46±51.27	1480.28 ± 11.12^{a}	1330.74 ± 19.93^{ab}	1333.16 ± 63.98^{ab}
Total Weight Gain (g)	1621.44 ± 53.91^{a}	1407.67 ± 10.23^{ab}	1258.87 ± 21.49^{ab}	1261.38 ± 63.54^{ab}
Total Feed Intake (g)	3896.74±70.90	3971.04±46.91	4131.10±264.59	4072.17±95.28
Feed to Gain Ratio	2.41 ± 0.04^{a}	2.82 ± 0.02^{ab}	3.28 ± 0.15^{ab}	3.25 ± 0.23^{ab}

Means±S.E in the same row with different superscripts are significantly different (P< 0.05).

L. acidophilus supplemented diet significantly (P<0.05) decreased when compared to control group that had no probiotics. Post-hoc comparison showed no significant (P>0.05) difference in serum cholesterol level among birds in groups T3 and T4. The mean values for carcass characteristics (eviscerated and dressed weight) and organ weight (%) relative to body weight of broilers have been presented in (Table 3). The average dressed weight for group T1, T2, T3 and T4 was 1230.83, 1069.60, 955.15 and 957.91 respectively.

Higher gizzard to body weight percentage was observed in T4 followed by T3, T2 and T1. While significant difference was observed amongst the treatment groups, a non-significant difference (P>0.05) was observed for heart weight. There was no significant difference (P>0.05) in the percentage mortality across the treatments.

DISCUSSION

Total gain in body weight (weight gain) which was higher in probiotics fed groups than the control group even though the feed consumed was lower in the probiotics treated groups could be attributed to the presence of beneficial microbes in probiotics producing energy nutrients digesting enzymes (amylase, protease, and lipase), which would augment the catalytic activities of the endogenous enzymes to liberate more energy from hydrolyzing feed ingredients making it highly efficient in improving live weight of experimental birds (Altaf *et al*., 2009). The result in this present study was in agreement with the results of many authors (Kabir *et al*., 2009; Hosseini *et al*., 2013).

Improved feed to gain ratio was recorded in treatment groups T1 and T2 than the control group. The results in

Table 3. Carcass characteristics, organ weight (%) relative to body weight and mortality rate per bird fed different levels of probiotics.

Parameters	T1 ($1.45x10^9$)	T2 ($1.09×10^9$)	T3 ($7.25×10^8$)	T4 (Control)
Scalded Weight (g)	1584.47±61.35	1391.94±4.82^a	1239.07±30.00^{ab}	1239.83±57.68^{ab}
Eviscerated Wt. (g)	1329.16±44.51^b	1172.10±2.68^a	1053.65±12.95^{ab}	1069.58±49.68^a
Head & Shank (g)	98.33±5.83^a	102.50±2.50	105.83±3.63	111.67±0.83^a
Dressed Weight (g)	1230.83±41.80	1069.60±1.75^a	955.15±10.78^{ab}	957.91±50.45^{ab}
Gizzard (%BW)	1.55±0.80	2.10±0.35^a	2.43±0.04^{ab}	2.50±0.13^{ab}
Heart (%BW)	0.29±0.17	0.34±0.01	0.34±0.01	0.26±0.01
Liver (%BW)	1.19±0.04^c	1.15±0.03^b	1.15±0.46^a	0.95±0.07^{abc}
Cholesterol (Mmol/dl)	3.29±0.26^a	3.75±0.10	3.74±0.09	4.34±0.24^a
Percentage Mortality	11.11	3.45	7.14	7.14

Means±S.E in the same row with different superscripts (^{abcd}) are significantly different (P<0.05).

this study are in conformity with the findings of Jin *et al*. (1997) who reported that administration of Lactobacilli through feed had a positive effect on feed intake and feed conversion efficiency. It was hypothesized that using probiotic at a dosage not above the lethal dose ($>1×10^{11}$ CFU/kg) in diets would increase the nutrient retention and decrease their passage rate as undigested feed through maintaining balanced natural microbiota which would reduce the feed intake (Ishibashi and Yamazaki, 2001; Altaf *et al*., 2009). Heart weight showed no significant effect of *L. acidophilus* supplemented feed. Panda *et al*. (2000) made similar discovery when they reported that inclusion of probiotics in feed has no effect on weight of internal organs. Gizzard weight increase following reduction in dosage of probiotic could be as a result of the particle size of the mashed diet and the survivability to low pH of *Lactobacillus*. This could increase the absorption of nutrients and reduced gizzard size to accommodate fat pads. Broilers liver weight was significantly affected by the Lactobacilli supplemented diet. *Lactobacillus acidophilus* is capable of de-conjugating glycolcholic and taurocholic acids produced by hepatocytes under anaerobic condition (Gilliland and Speck, 1977). These acids enter the small intestine where they are absorbed and directed to the liver. As a result, decrease in the bile acid recycling by the liver would eventually result in an increase in the organ size and lowering of serum cholesterol concentrations. In this study, consequential reduction in blood serum cholesterol as per dosage level of probiotic in dietary feed increases is in conformity with Alkhalf *et al*. (2010) and Jouybari *et al*. (2009) when they reported reduced cholesterol and triglycerides in broiler fed diet containing *Pediococcus acidilactici*. One of the purported mechanism through which probiotic culture may exert its hypercholoestrolemic lowering action is by means of bile acid synthesis of cholesterol (St-Onge *et al*., 2000).

Conclusion

Conclusively, feed supplementation with probiotic (*Lactobacillus acidophilus*) improves growth performance and reduces serum cholesterol in broiler chickens. Addition of probiotic to ration at dosage level of $1.45×10^9$ CFU/kg was found to yield better effects than control group with birds reaching table size of 1.6 kg in six weeks. This also point toward effectiveness of *Lactobacillus acidophilus* in improving broiler chickens performance is dose-dependent.

REFERENCES

Alkhalf A, Alhaj M, Al-Homidan I (2010). Influence of probiotic supplementation on blood parameters and growth performance in broiler chickens. Saudi journal of biological sciences,17(3), 219-225.

Altaf UR, Sarzamin K, Daulat K, Munib H, Sohail A, Syed MS, Ishtiaq A, Ikram H, Zahir S (2009). Use of Probiotics in Broilers Feed at Starter Phase. Sarhad J. Agric. 25(2):471-474.

Aromolaran AK, Ademiluyi IO, Itebu OJ (2013). Challenges of Small Poultry Farms in Layer Production in Ibadan Oyo State Nigeria. Global Journal of Science Frontier Research,13(2).

Donoghue DJ (2003). Antibiotic residues in poultry tissues and eggs: human health concerns? *Poultry Science*, *82*(4), 618-621.

FAO/WHO (2001). Health and nutritional properties of probiotics in food including powder milk with live lactic acid bacteria. *Report of a Joint FAO/WHO Expert Consultation on Evaluation of Health and Nutritional Properties of Probiotics in Food Including Powder Milk with Live Lactic Acid Bacteria*; Argentina, pp. 1-34.

Fuller R (1989). Probiotics in man and animals. Journal of Applied Bacteriology 66:365–378.

Gilliland SE, Speck ML (1977). Deconjugation of bile acids by intestinal lactobacilli. Applied and Environmental Microbiology, 33(1):15-18.

Goh YJ, Klaenhammer TR (2010). Functional roles of aggregation-promoting-like factor in stress tolerance and adherence of *Lactobacillus acidophilus NCFM*. Appl. Environ. Microbiol. 76:5005–5012.

Hosseini Z, Hasan NM, Hasan K (2013). Effect of probiotic supplementation on broiler performance at starter phase. IJASC journal, 5(11):1221-1223.

Ishibashi N, Yamazaki S (2001). Probiotics and safety. *Am. J. Clin. Nutr*. 73, 465S-470S.

Jin L Z, Ho YW, Abdullah N, Jalaludin S (1997). Probiotics in poultry: modes of action. *World's Poultry Science Journal*, *53*(04), 351-368.

Jouybari MG, Malbobi MA, Irani M, Pour VR (2009). The effect of novel probiotic on performance and serum concentration of cholesterol and triglycerides in broiler chicken. *Afr. J. Biotechnol*. 9(45):7771-7774.

Joy AD, Samual JJ (1997). Effect of probiotic supplementation on the performance of broiler. Journal of Veterinary and Animal Sciences, 28(1): 10-14.