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Effect of probiotic microbial culture from maize steep in drinking water of broiler chickens

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Abstract

Effects of probiotic microbial culture isolated from the steep of fermented maize mash on broiler performance, nutrient retention, blood profile, gut microbial profile and carcass characteristics were assessed in a 42-day trial. Drinking water with none or any of three microorganisms isolated from maize steep and included singly or in combinations to give eight treatment groups; Control (C), Lactobacillus fermentum (L), Bacillus substilis (B), Saccharomyces cerevisiae (S), Lactobacillus fermentum and Bacillus substilis (LB), Lactobacillus fermentum and Saccharomyces cerevisiae (LS), Bacillus substilis and Saccharomyces cerevisiae (BS), Lactobacillus fermentum, Bacillus substilis and Saccharomyces cerevisiae (LBS) were administered to 192 day-old broiler chicks in a Completely Randomised Design. The treatments had 3 replicates with 8 birds each. Daily/weekly data were collected from the birds on performance parameters. Experimental diets and excreta droppings were analysed for their chemical constituents and at 42nd day, samples were collected for blood, gut microbial analyses and carcass evaluation. Average daily feed intake values were significantly ($p < 0.05$) higher for birds on experimental treatments with inclusion of various combinations of microbial culture (LS – 73.14 g/bird/day, LBS – 72.40 g/bird/day, LB – 72.23 g/bird/day and BS – 72.02 g/bird/day) compared to birds administered drinking water with inclusion of single microbial culture and control groups (L, B, S and C). Only total protein of all biochemical indices assessed was significantly ($p < 0.05$) influenced with the highest value (36.00 g/l) observed in birds on LB. The experimental treatments significantly ($p < 0.05$) influenced bird RBC, MCH and MCV. The RBC of broilers on the experimental treatments were highest compared to those on the control treatment. The MCH and MCV for birds on S were significantly ($p < 0.05$) lowest compared to the values obtained in other treatment groups. There was significant ($p < 0.05$) effect of treatment groups on wing yield. The yield in groups LB (8.44 %), L (8.33 %), LS (8.25 %) and LBS (8.13 %) were higher ($p < 0.05$) than other treatment groups but similar to control group. In conclusion, there was no adverse effect of the probiotic microbial culture on broiler chickens.

Keywords: Broilers, drinking water, maize steep, microbial culture, probiotic

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Introduction

The long term and extensive use of antibiotics for veterinary purpose in poultry production may eventually result in selection for resistant bacteria species or strain survival (Ohimain and Ofongo, 2012) and the major concerns are related to the presence of antibiotic residues in animal-derived products obtainable for consumption by humans with resultant adverse effects on their health and possible antibiotic resistant bacteria development (Manyi-Loh *et al*., 2018; Kalsum *et al*., 2012). A major strategy for antibiotic replacement in poultry diets is to directly feed microorganisms to the bird. Previous report shows that direct feeding of Lactobacillus strain culture isolated directly from the gut of healthy bird and screened for probiotic properties improved the growth performance of broilers at 1 – 21days of age (Zhu *et al*., 2009). In Tibetian chickens, there was improved growth performance, gut barrier health, intestinal flora balance and immune protection after being fed probiotic strains isolated from Tibetian chicken caecum (Wang *et al*., 2023). At present, information on the effect of microbial culture isolated from steep of fermented grain mash on broilers is limited. This study was therefore designed to evaluate the effect of direct inclusion of probiotic microbial culture isolated from maize steep on their performance, biochemical and haematological parameters.

Materials and methods

The bacterial and fungal isolates possessing probiotic properties according to previous report (Ohimain and Ofongo, 2012) and were isolated and characterized from fermented maize mash steep in this experiment include: *Bacillus substilis, Lactobacillus fermentum* and *Saccharomyces cereviseae.* They were each applied singly and in various combinations directly into drinking water for broilers as a source of probiotic. This resulted into 8 experimental treatments designated thus: O; Ordinary drinking water (Control), L; water with *Lactobacillus fermentum*, B; water with *Bacillus substilis*, S; water with *Saccharomyces cereviseae*, LB; water with mixture of *Lactobacillus fermentum* and *Bacillus substilis*, LS; water with mixture of *Lactobacillus fermentum* and *Saccharomyces cereviseae*, BS; water with mixture of *Bacillus substilis* and *Saccharomyces cereviseae*, LBS; water with mixture of *Lactobacillus fermentum*, *Bacillus substilis*, and *Saccharomyces cerevisiae*. Experiment was laid out in a completely randomized design with 192 day-old broiler chicks (mixed sex) of Arbor Acre strain randomly divided into eight experimental treatments consisting of three replicates. Water and feed were administered *ad-libitum* for 42 days. Composition of diet is presented in Table 2. Performance parameters were measured and at trial's end, blood samples were collected from two randomly selected birds per replicate through the jugular vein into properly labeled and sterilized tubes without anticoagulant for blood biochemistry and with Ethylene Diamine Tetra Acetic acid for blood haematology. All data collected were subjected to one way analysis of variance (ANOVA) using the General Linear Model of SAS (2003) at 5% level of significance. All significantly different means were separated using the Duncan's Multiple Range Test of the same software package.

Results and Discussions

The lack of significant ($p<0.05$) effect of experimental treatments on the performance parameters supports previous reports by Ergun *et al.* (2000), Rehman *et al*. (2020) that probiotics have no effect on broiler performance. For blood biochemistry, there was a significant ($p<0.05$) effect only on blood total protein of broilers with the highest value (36.00g/l) observed in birds on treatment LB. It was however comparable with the birds on control treatment. According to Hewida *et al*. (2011), blood biochemistry parameters in broiler chickens were not significantly affected by microbial culture with probiotic properties. The effect on blood haematology in broiler chickens resulted in a significant ($p<0.05$) influence on RBC, MCH and MCV. While Dimcho *et al*. (2005) reported that probiotic supplementation did not affect blood constituents comprising of haemoglobin concentrations in ducklings, Cetin *et al.,* (2005) observed that probiotic supplementation caused statistically significant increase in the erythrocyte count, haemoglobin concentration and haematocrit values of Turkeys. MCH and MCV values for birds on drinking water with *Saccharomyces cerevisiae* (S) alone were significantly ($p<0.05$) lowest compared to other experimental treatments. Muhammad and Oloyede (2009) reported that reduction in MCV occurs when iron deficiency becomes severe thus the presence of *Saccharomyces cereviseae* in this study was probably not adequate enough to alleviate the deficiency of iron in the broiler red blood cells. Wing yield in groups LB (8.44%), L (8.33%), LS (8.25%) and LBS (8.13%) were higher ($P<0.05$) than other treatment groups but similar to

control group. This may be explained by the active constituents of probiotics in those groups containing *Lactobacillus fermentum* which played an important role in improving quantitative carcass traits (Mgunda, 2011).

Table 1: **Effect of probiotic microbial culture from maize steep in drinking water of broiler chickens**

Parameters	O	L	B	S	LB	LS	BS	LBS	±SEM
ADFI (g/ bird/day)	70.80^{b}	70.68^{b}	70.48^{b}	70.49^{b}	72.23^{a}	73.14^{a}	72.02^{ab}	72.40^{a}	0.88
Total protein (g/l)	31.00^{ab}	30.50^{ab}	23.00^{c}	28.00^{bc}	36.00^{a}	23.50^{c}	31.00^{ab}	24.50^{c}	2.38
RBC ($x10^{6}$/ µl)	1.75^{b}	2.75^{ab}	2.25^{ab}	4.05^{a}	2.85^{ab}	3.00^{ab}	2.75^{ab}	3.20^{ab}	0.55
MCH (pg)	44.28^{a}	37.48^{ab}	35.14^{ab}	24.70^{b}	34.76^{ab}	29.82^{ab}	29.32^{ab}	28.29^{ab}	5.07
MCV (fl)	132.57^{a}	112.27^{ab}	105.88^{ab}	74.09^{b}	104.22^{ab}	89.60^{ab}	87.88^{ab}	84.90^{ab}	15.15
Wing	8.04^{ab}	8.33^{a}	7.52^{bc}	7.29^{c}	8.44^{a}	8.25^{a}	7.54^{bc}	8.13^{ab}	0.43

ADFI - Average daily feed intake, RBC - Red Blood Cell, MCH -

Conclusion

The results obtained in this study show that probiotic microbial culture from maize steep in drinking water of broiler chickens had significant effect on average daily feed intake (ADFI), blood total protein, RBC, MCH, MCV and yield of wing as percentage of live weight of the experimental broiler chickens. There seemed to be a synergism when the microorganisms were combined compared to including them singly in broiler diets and this resulted in a positive influence on ADFI, blood total protein, RBC and wing yield of experimental birds. The non- significant influence of the experimental diets in this study on other parameters evaluated show absence of antinutritional factors hence no adverse inhibition on broiler performance. Further studies will assess the effect of probiotic microbial culture from maize steep in drinking water on broilers when stress is introduced or the health of birds is compromised.

References

1. Cetin, N., Guclu, B.K. and Cetin, E. (2005) The effects of probiotic and mannanoligosaccharide on some haematological parameters in turkeys. *Journal of Veterinary Medicine Physiology Pathology and Clinical Medicine,* 2(6), 263-267.
2. Dimcho, D., Svetlana, B., Tsvetomira, S. and Tatiana, V. (2005) Effect of feeding Lactina® probiotic on performance, some blood parameters and caecal microflora of mule ducklings. *Trakia Journal of Sciences*, 3: 22–28.
3. Ergun, A., Yalcin, S. and Sacakli, P. (2000) The usage of probiotic and zinc bacitracin in broiler rations. *Ankara Universitesi Veteriner Fakultesi Dergisi*, 47: 271-280.
4. Hewida, H.M.A., El-Allawy, M.H. and El-Ghamry, A.A. (2011) The effect of yeast (*Saccharomyces cerevisiae*) culture versus Flaovomycin supplementation on laying hen diets and their comparative influence on the late stage production performance. *Iranian Journal of Applied Animal Science*, 1(3), 149-153.
5. Kalsum, U., Soetanto H, Achamanu and Sjofjan .O. (2012) Effect of probiotic containing *Lactobacillus salivarius* on the laying performance and egg quality of Japanese quails. *Livestock Research for Rural Development*, 24 (217). Accessed on April 13 2014, http:// www.Irrd.org/Irrd24/12/Kals24217.htm.

6. Manyi-Loh, C., Mamphweli, S., Meyer, E. and Okoh, A. 2018. Antibiotic use in agriculture and its consequential resistance in environmental sources: potential public health implications. *Molecules.* 23(4): 795. doi:10.3390/molecules23040795.
7. Mgunda H.D. (2011) *Assessment of effects of effective microorganisms on broiler chicken performance and malodour reduction in poultry*. Ph.D Thesis. Sokoine University of Agriculture.
8. Muhammad, N.O. and Oloyede, O.B. (2009) Haematological Parameters of Broiler Chicks Fed *Aspergillus niger* - Fermented Terminalia catappa Seed Meal-Based Diet. *Global Journal of Biotechnology & Biochemistry,* 4(2), 179-183.
9. Ohimain, E.I and Ofongo, R.T.S. (2012) The effect of probiotic and prebiotic feed supplementation on chicken health and gut microflora: A Review. *International Journal of Animal and Veterinary Advances,* 4(2): 135-143.
10. Rehman A., Arif, M., Sajjad, N.,Al-Ghadi M..Q., Alagawany, M., Abd El-Hack, M.E., Alhimaidi, A.R., Elnesr, S.S., Almutairi, B.O., Amran, R.A., Hussein, E.O.S. and Swelum, A.A. 2020. Dietary effect of probiotics and prebiotics on broiler performance, carcass, and immunity. Poultry Science. 99: 6946-6953.
11. SAS (Statistical Analysis Systems), 2003.SAS Institute Inc. User's guide, Version 9.1 Cary, North Carolina, USA.
12. Wang, L., Lin, Z., Ali, M., Zhu, X., Zhang, Y., Li, S., Li, K., Kebzhai, F. and Li, J. 2023. Effects of lactic acid bacteria isolated from Tibetian chickens on the growth performance and gut microbiota of broiler. Front. Microbiol. Sec. Microorganisms in vertebrate digestive systems. Vol 14. https://doi.org/10.33889/fmicb.2023.1171074
13. Zhu, N.H., Zhang, R.J., Wu, H. and Zhang, B. (2009) Effect of *Lactobacillus* cultures on growth performance, xanthophylls deposition and color of the meat and skin of broilers. *The Journal of Applied Poultry Research*, 18(3): 570- 588. doi: 10.3382/japr.2009-00012.