IMPACT OF THE USE OF A PROBIOTIC (*Enterococcus faecium*) ON ZOOTECHNIC PERFORMANCE AND LIPIDID PROFILE IN BROILER CHICKEN

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Abstract. This study was conducted to determine the effect of probiotic *Enterococcus faecium* DSM 7134 feed supplementation on animal performance of broilers poultry when compared to control animals. The determination of lipid status parameters on day 51 was performed on 5 chicks randomly selected in each group.. Biochemical analyzes included total cholesterol, triglycerides, high density lipoproteins (HDL) and low density lipoproteins (LDL). Individual live weight, consumption index and mortality rate were measured at the end of the rearing phases. The results obtained showed that the addition of *Enterococcus faecium* significantly improved live weight throughout the rearing period without significant charge on FCR and mortality rate. The experimental group had significantly higher cholesterol, triglyceride and HDL levels.

Keywords: *Enterococcus faecium* , probiotic, broiler, lipid profile, animal performance.

INTRODUCTION

In Algeria, poultry farming is a very important sector, providing more than 50% of the food coverage requirements of animal origin. Recently, following industrialization of farms, a new strategy has been proposed through the use of probiotics as a food additive. Probiotics are possible alternative to antibiotics as growth promoters; they are live microorganisms that contribute to health and balance of host intestinal tract [1]. In poultry, recent studies have shown that probiotics have beneficial effects [2,3]. They act on growth and development of breeding animals, exert beneficial effects on flora and health of intestine, thus they improve animal and sanitary performances. These products do not leave residues in animal products and promote animal performance and health [4], because they improve diet digestibility, resulting in better nutrient utilization and consequently, higher productivity [5]. Most of the previous researches on probiotic utilization in poultry focused on the use of multispecies probiotics and various strains of *Lactobacillus*. The present study was planned to investigate the effects of *Enterococcus faecium* on animal performance and lipid profile in broiler chicken

MATERIAL AND METHODS

The study was conducted from February 10 to April 1, 2019 at a private building located in Blida (50 km from Algiers). Out of 400 chicks of Arbor Acres strain were divided in two groups. Each group had 4 replicates (50 birds/pen). The climatic conditions and lightning program were computer-operated and followed the

commercial recommandations. A control group received a drinking water not supplemented with the probiotic, while the experimental group was supplemented from d2 to d50 of the period of breeding with 8.85×10^{10} cfu/kg. Animals from the two groups were vaccinated against *Newcastle (B1) and Infectious Bronchitis (H120) diseases* at d7 and also against Gumboro disease at d14. The both group received meal-type feeds adapted to each age and spring water supplemented with antibiotics, anticoccidial (d21) and polyvitamins. The chemical composition of the feeds is presented in Table 1.

Body weight gain, feed consumption and feed conversion ratio were weekly determined while feed and water consumption were measured daily, as well as bird mortality.

Table 1

Composition of the feeds

Feed	Startup	Growth	Finish
Corn	70.1	76.2	81.4
Bicalcium phosphate	25	20	15
Calcium carbonate	1.5	1	1
Lysine+methionine	0.3	0.4	0.3
salt	0.3	0.2	0.2
MVC	1	1	1
Metabolizable energy (kcal/kg)	2868	2829	2846
Crude protein%	20,9	19,6	18,2
Lysine %	1,15	1,05	0,95
Methionine%	0,49	0,48	0,46
Ashes %	5,25	5,15	4,48

For the biochemical analyzes, 1 to 5 ml blood samples were taken from brachial vein on 5 birds per group randomly selected at d51 to determine trigycerides, total cholesterol and HDL and LDL cholesterol. Samples were collected in dry tubes, then centrifuged at 3000 rpm for 6 minutes and serum removed to be immediately frozen in sterile 5 ml plastic tubes at -20 °C for further analysis.

Statistical analysis: The data were statistically compared using the Student's t-test. All statements of significance were based on the alpha probability level of $p < 0.05$.

RESULTS AND DISCUSSIONS

Table 2 shows animals performance of poultry from the two groups.

Table 2

Animal performance of poultry receiving or not *Enterococcus faecium* as probiotic in feed

Parameters	Control group	Experimental group	P>F
Weight	2650±6.7	2930±7.2	0,03
FCR	2.76±0.08	2.38±0.07	0.34
Mortality	1.15	1.05	NS

Final live weight at the end of the experiment was significantly higher in the group that received E. faecium. The difference reached almost 300g. As a consequence, FCR was lower in the supplemented group but, not significantly. The levels of mortality were below 5% in the both groups, and not differences were observed between them.

Similarly results were reported by Vittorio [6] (2005) and showed an improvement in weight gain in chickens that received Pedi*ococcus acidilactici.*

At D 51 a reduction in the feed consumption in favor of the experimental group compared to the control group was observed.

Chafai [7] (2006), Hammami (2009) [8] and (Sahraoui et al., 2015) [9] reported positive effects of *P. acidilactici* supplementation on chicken feed consumption.

The mortality rates in the control group were higher that observed in experimental group in the end of rearing period. According to Pelicano et al. (2004) [10], Vittorio (2005) [6] and Chafai (2006) [7], the addition of *P. acidilactici* had no influence on the mortality rate of chickens during the breeding.

Biochemical parameters of lipid balance are showed in table 2.

Table 2

Biochemical parameters of poultry receiving or not *Enterococcus faecium* as probiotic in feed (g/l)

Parameters	Groups		P value
	Control	Experimental	
Cholesterol	2.15 ± 0.07	1.45 ± 0.05	0.002
Triglyceride	1.48 ± 0.04	0.77 ± 0.03	0.001
Cholesterol HDL	0.77 ± 0.03	1.35 ± 0.08	0.002
Cholesterol LDL	0.53 ± 0.03	0.51 ± 0.02	0.086

The differences between the groups were statistically significant for Cholesterol, triglyceride and cholesterol HDL respectively but not significant for cholesterol LDL.

Probiotic administration lowered plasma cholesterol and triglyceride concentrations compared to control group ($P < 0.002$).

Chafai et al. [7], using the probiotic strain P. acidilactici, reported also a decrease in cholesterol and triglycerides levels in chickens throughout the rearing phase. Similar results were reported by Arun et al. [11] who found that serum total cholesterol and triglycerides were reduced significantly by dietary supplementation with probiotic containing L. Sporogene at 100 mg per kg diet. Chicken fed a diet containing various levels of probiotic also showed a significant decrease in plasma cholesterol concentration compared to control group [12]. Finally, Kalavathy et al. [13] showed that *Lactobacillus sp.* probiotic supplementation increased serum HDL and decreases serum LDL [14]. The lowering of cholesterol by some microorganisms, is well documented, though mecanisms that remain to be clarified [15, 16]. There is uncertainty regarding probiotics competing for some nutrients, especially folic acid, within the host animal [17]. The reduction in serum cholesterol of broiler chickens fed probiotic supplemented diet also could be attributed to higher excretion of biliary acids in gastro-intestinal tract by probiotic supplementation [15]. It was speculated that *L. acidophillus* could reduce blood cholesterol by deconjugating bile salts in intestine and

increasing its excretion, reducing thus entero-hepatic recycling. Cholesterol is a precursor of bile acids into which it is converted, replacing the amount lost due to probiotic effect and leading to a reduction in serum cholesterol [18]. Downregulation of cholesterol synthesis by deconjugated bile acids have be also evocated [19].

CONCLUSIONS

It is concluded that supplementation with Enterococcus faecium strains feed enhanced growth performance and reduced plasma total cholesterol and triglycerides in broiler chicken. The results support previous data reporting positive effects of probiotic supplementation on poultry performance

REFERENCES

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

2. Vandeplas S. Dubois Dauphin R. Thiry C. Beckers Y. Welling G. W. Thonart. Efficiency of a Lactobacillus plantarum-xylanase combination on growth performances, microflora populations, and nutrient digestibilities of broilers infected with Salmonella Typhimurium. Poultry Science.88,8p. 1643-165412 p

3. Higgins J. P., Higgins S. E., A. D. Wolfenden, S. N. Henderson, A. Torres-Rodriguez, J. L. Vicente, B. M. Hargis, G. Tellez. Effect of lactic acid bacteria probiotic culture treatment timing onSalmonella Enteritidis in neonatal broilers. Poultry Science, 89, 2, 2010; 243–247

4. Zulkifli, I. Growth performance and immune response of two commercial broiler strains fed diets containing Lactobacillus cultures and oxytetracycline under heat stress conditions. British Poultry Science, v.41, p.593-597, 2000

5. Mountzouris, K.C.; Tsirtisikos, P.; Palamidi, I. et al. Effects of probiotic inclusion levels in broiler nutrition on growth performance, nutrient digestibility, plasma immunoglobunis, and cecal microflora composition. Poultry Science, v.89, p.58-67, 2010

6. Vittorio, S. A., F. Mauro, B. Carla, D. D. Giovanna, S. Giovanni, and E. Horses. 2005. Effets de l'addition de Pediococcus acidilactici dans la ration de poulets de chair sur les performances zootechniques et la microflore intestinale. P 208–211 in Proc. 6th Poultry Research Days, St. Malo, France.

7. Chafai S. 2006. Effect of the addition of probiotics in diets on the zootechnical performance of broilers. Memory of magister. El Hadj University Lakhdar of Batna

8. Hammami N., Temim S., Bedrani L., Sahraoui L., Kaddour R., Boudina H., KHelaf D., Adjou K., Ain Baziz H. 2009. Evaluation of the Efficacy of the Probiotic Pediococcus Acidilactici on Growth Performance Morphometry and Lactobacillary Flora of the broiler gut. European journal of animal science 17: 401-109.

9. Sahraoui N. O. Dotreppe , M. Brahim-Errahmani , JL. Hornick , D. Guetarni1 2015. Effet du probiotique Pediococcus acidilactici sur le profil en acides gras de viande de poulet de chair en Algérie Pratiques en nutrition, 42 p 43-45

10. Pelicano ERL, De Souzaa P. A., Souzaa HBA, Leonel FR, Zeola NMBL, Boiago, MM 2004. Productive traits of broiler chikens fed diets containing different growth promoters. Rev. Arms. Cienc., 6 (03): 177-182.

11. Arun, K. Panda, Rama Rao, Savaram, V., Mantena, V.L.N. Raju, Sita, R. Sharma, 2006 Dietary supplementation of Lactobacillus Sporogenes on performance and serum biochemico-lipid profile of broiler chickens. Journal of Poultry Science 43, 235–240

12. Alkhalf A, Alhaj M and Al-homidan I (2010). Influence of probiotic supplementation on blood parameters and growth performance in broiler chickens. Saudi J. Biol. Sci., 17: 219-225. A

13. Kalavathy R., Abdullah N, Jalaludin S, Wong MC, HO YW 2006. Effects of Lactobacillus feed supplementation on cholesterol, fat content and fatty acid composition of the liver, muscle and carcass of broiler chikens. Anim. Res. 55: 77-82.

14. Pietras M. 2001.The effect of probiotics on selected blood and meat parameters of broiler chickens. J. Anim. Feed Sci. 2001;10 (Suppl. 2):297–302

15. [15] Mohan, B, Kadirvel, R, Natarajan, A and Bhaskaran, M. 1996. Effect of probiotic supplementation on growth, nitrogen utilization and serum cholesterol in broilers. British Poultry Science, 37: 395–401.

16. Sahraoui N, R Djezzar, L Kisarli, M Brahim Errahmani, JL Hornick, D Guetarni Effet du Pediococcus acidilactici sur le bilan lipidique sanguin du poulet de chair 2014. Bulletin of Animal Health and Production in Africa. Vol 62, N°1 (2014)

17. Karimi Torshizi M.A., A.R. Moghaddam,Sh. Rahimi&N. Mojgani 2010. Assessing the effect of administering probiotics in water or as a feed supplement on broiler performance and immune response. Poult Sci. 2010 Apr;51(2):178-84.

18. Kumar, M., R. Nagpal, R. Kumar, R. Hemalatha, V. Verma, A. Kumar, C. Chakraborty, B. Singh, F. Marotta, and S. Jain. 2012. Cholesterol-lowering probiotics as potential biotherapeutics for metabolic diseases. Exp. Diabetes Res. 2012:902917

19. Ishimwe, N., Daliri, E. B., Lee, B. H., Fang, F., & Du, G. (2015). The perspective on cholesterol-lowering mechanisms of probiotics. Molecular nutrition & food research, 59(1), 94-105.