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Full Length Research Paper

The effect of novel probiotic on performance and serum concentrations of cholesterol and triglyceride in broiler chickens

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In this experiment, effects of two phosphate solublizing bacteria as a novel probiotic on performance factors and serum concentrations of cholesterol and triglyceride were investigated. The experiment included 320 Ross broilers from 1 to 49 days of age. Birds were randomly allocated to 4 treatments, with 4 replicates of 20 birds. Treatments include (1) basal diet with no additives (control); (2) basal diet + 0.25% probiotic in starter, grower and finisher; (3) basal diet + 0.25% probiotic in grower and finisher; and (4) basal diet + 0.25% probiotic in finisher. The results obtained in this experiment showed that the probiotic significantly increased body weight gain and improved feed conversion ratio ($P < 0.05$). However, the probiotic supplementation did not affect feed intake between treatments ($P > 0.05$). In addition, results showed that probiotic caused significantly decrease on the serum cholesterol and triglyceride ($P < 0.05$).

Key words: Probiotic, phosphate solublizing bacteria, cholesterol, broiler.

INTRODUCTION

The efficiency of a poultry digestion depends on the microorganisms which live naturally in its digestive tract. Dietary feed additives are products which are incorporated into animal feed to create favorable conditions in the animal's intestine for the digestion of feed. Growth promoters have been used extensively in animal feeds and water all over the world especially in the poultry and pig industries (Charles and Duke, 1978). Antibiotics improve the production results of meat producing chicks, and the utilization of energy particular is improved. However the use of growth-promoting antibiotics is being placed under more and more pressure as consumers increasingly fear that their use in feed rations of productive live stocks leads to the formation of resistance against bacteria which are pathogenic to humans (Langhout, 2000).

Some probiotic microorganisms are alternative to an tibiotic and can be used exclusively as a growth stimulant and for improvement of the feed conversion rate in farm animals (Esteive et al., 1997). Probiotics are organisms and substances which help to improve the environment of the intestinal tract. It may be defined as living microorganism which, given to animals, assist in the establishment of an intestinal population which is beneficial to the animal and antagonistic to harmful microbes (Green and Sainbury, 2001). By producing acids (such as acetic acid and lactic acid) and other compounds which inhibit the growth of "bad" bacteria which produce toxins, lactic acid and other useful bacteria have demonstrated probiotic effects (Honma et al., 1987). Studies with broiler chicks showed a positive response to dietary supplementation of probiotic (Midilli and Tuncer, 2001; Mohan et al., 1996). Yeo and Kim (1997) observed significant improvements in daily gain and feed intake for broiler chicks fed probiotic. Probiotics reduce production of toxic components by bacteria and a chance in the morphology of the intestinal wall and reduces colonization of pathogens on the intestinal wall, thus preventing damage to the epithelial cells (Langhout, 2000). The review of literature

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Table 1. Diet composition.

Ingredient (%)	Grower		Starter		Grower	
	Diet with probiotic	Diet without probiotic	Diet with probiotic	Diet without probiotic	Diet without probiotic	Diet with probiotic
Corn	58/55	58/55	58/55	58/55	61/45	61/45
Soybean	35/3	35/30	35/3	35/30	31/48	31/48
Fat	2/2	2/2	2/2	2/2	3/17	3/17
DCP	1/3	1/3	1/3	1/3	1/15	1/15
$CaCO_3$	1/24	1/24	1/24	1/24	1/09	1/09
Salt	0/2	0/25	0/2	0/25	0/32	0/32
Methionine	0/25	0/25	0/25	0/25	0/3	0/3
Lyzine	0/07	0/07	0/07	0/07	0/07	0/07
Additive	0/54	0/67	0/54	0/67	0/73	0/64
Sodium bi carbonate	0/1	0/15	0/1	0/15	0/24	0/15
Probiotic	0/25	0	0/25	0	0	0/25
Calculated analysis						
ME (kcal/kg)	2950	2950	2900	2900	3050	3050
CP %	20/5	20/5	21	21	19	19
CA %	0/87	0/87	0/94	0/94	0/78	0/78
AP%	0/38	0/38	0/42	0/42	0/34	0/34
MET%	0/5	0/5	0/52	0/52	0/48	0/48

showed that some probiotics are alternative for broiler growth performance; thus they take over the role of antibiotics. In the present study, we used two micro-organisms (Pseudomonas putida and Pantoea agglomerans) as new probiotic and studied their effect on the performance and serum concentration of cholesterol and triglyceride in broiler chickens.

MATERIALS AND METHODS

In this study, 320 day-old Ross 308 chicks were used. The chicks were divided into 4 groups; 3 treatment groups and a control group, with 20 chicks in each. Each group was housed separately in individual. The chicks were fed standard starter (from 1 to 21 d), grower (from 22 to 35 d) and finisher (from 36 to 49) diets according to NRC (1994) (Table 1). Groups were randomly assigned to following treatment groups, (1) Basal diet with no additives (control), (2) Basal diet + 0.25% probiotic in starter, grower and finisher, (3) Basal diet + 0.25% probiotic in grower and finisher, (4) Basal diet + 0.25% probiotic in finisher. Each experimental group was fed ad libitum with its own diet for 49 days. The temperature of the room with continuous lighting was maintained at 33°C initially, and reduced by 3°C/wk until it reached 21°C, at which the room temperature was maintained till the end of experiment. Light was provided 24 h a day. Body weight gain, feed consumption and feed efficiency (feed: gain) were checked weekly. At the end of the study period (day 49), 16 broilers were randomly selected from each replicate of each treatment group and blood samples were collected from the bronchial vein during slaughter. The collected blood samples were centrifuged at 3000 rpm for 10 min and the sera were decanted into aseptically treated vials and stored at –20°C until further analysis. Serum samples were analyzed for total cholesterol and triglycerides using enzymatic colorimetric method by kit.The data obtained were analyzed by SAS (1990) with a General Linear Models procedure for ANOVA, for each experiment. Differences between means were analyzed with Duncan's multiple gaps test. The significant difference statements were based on the possibility $p < 0.05$, unless explained in another way.

RESULTS AND DISCUSSION

Performance results from 1 to 21 days of age are presented in Table 2. There were no feed intake differences among treatment groups and the control group ($P > 0.05$), nor in weight gain of broilers fed the different diets. As a result, the best feed conversion ratios were found for the groups in which the broilers were fed the diet containing probiotic in starter, grower and finisher. From 22 to 35 days of age, feed intake was higher in broilers fed the basal diet (negative control) as compared with those fed the diet with probiotic (Table 2). Also in this period, treatments affected weight gain, and treatments that consumed the feed containing probiotic in total period and in grower and finisher presented better feed conversion ratios as compared to other treatments. In the finisher phase (36 - 49 days), only birds fed the diets without probiotic (control) presented different feed intake as compared to the other treatments. When the entire rearing period was evaluated, feed intake of broilers fed probiotic in finisher was significantly lower than in the other treatments. It is also evidenced that the best feed conversion ratio in this period was presented by the broilers fed the diet with probiotic in starter, grower and finisher. At the end of experiment, results about blood cholesterol and triglyceride shown that treatments

Table 2. Feed intake (FI), weight gain (WG), feed conversion ratio (FCR), cholesterol and triglyceride of broilers fed probiotic from 1 to 49 days of age.

Factor		Treatment				SEM
		1	2	3	4	
FI	Starter	0.891ab	0.858ab	0.873b	0.891a	0.007
	Grower	1.440b	1.418a	1.360a	1.462a	0.015
	Finisher	1.911	2.008	1.982	1.844	0.011
WG	Starter	0.519b	0.543a	0.522b	0.543b	0.007
	Grower	0.698 c	0.798a	0.740b	0.714b	0.007
	Finisher	0.854a	1.094b	0.988a	0.968ab	0.015
FCR	Starter	1.68a	1.53b	1.66b	1.60a	0.027
	Grower	2.08a	1.85c	1.86b	2.09ab	0.033
	Finisher	2.53a	1.82b	2.02a	2.16a	0.063
Cholesterol (mg/dl)		127.00a	106.87c	117.62b	123.50ab	3.268
Triglyceride (mg/dl)		93.25	61.85	83.37	88.75	2.557

significantly affected serum cholesterol and triglyceride ($P > 0.05$). The lowest cholesterol and triglyceride were observed in treatment that consumed the feed containing probiotic in starter, grower and finisher ($P < 0.05$).The addition of probiotic to diets may influence broiler weight gain (Jones and Ricke, 2005). However, the main objective of using these compounds in broiler diets is to improve their feed conversion ratio (Dibner and Richards, 2005), as was observed in this study. The mechanism that explains the action of probiotics is focused on gastrointestinal tract, as most of these products are not absorbed, and are not efficient as growth promoters in germ-free animals (Coates et al., 1955; Coates et al., 1963). Therefore, it maybe speculated that there is a strong interaction between probiotics and the intestinal micro flora. This improvement in performance due to the action of probiotics on the micro flora can be interpreted in two ways: the first is related to the reduction in the utilization of nutrients by microorganisms, and the second is the decrease of microbial metabolites that interfere with host growth (Visek, 1978; Anderson et al., 1999). In addition, maintaining the integrity of the intestinal mucosa results in high energy requirements, and the decrease of pathogens and intestinal metabolites can also decrease intestinal cell turnover, resulting in more energy available for production. Finally, the reduction of opportunistic pathogens and sub-clinical infections can also be associated with the use of probiotics (Dibener and Richards, 2005). At this time, however, the use of these products is being debated due to a possible relation with the resistance to antibiotics used in human antibiotic therapy (Maiorka et al., 2001). The improvement in performance (feed conversion ratio) of birds fed with diets containing the tested probiotic shows that the use of these products is a feasible alternative to antibiotics used as growth promoters. Similar results were also found by Maiorka et al. (2001), Pelicano et al. (2004) and Pelícia et al. (2004). Edens (2003) reported that the addition of a probiotic, did not affect weight gain of broilers at 42 days of age; however, it improved feed conversion ratio. There was also a significant reduction in carcass contamination by enteric bacteria, potentially pathogenic for humans (Marutta et al., 1996; Fritts et al., 2000), as they are present in smaller numbers in broilers feces. The inclusion of desirable microorganisms (probiotics) in the diet allows the rapid development of beneficial bacteria in the digestive tract of the host, improving its performance (Edens, 2003). As a consequence, there is an improvement in the intestinal environment, increasing the efficiency of digestion and nutrient absorption processes (Pelicano et al., 2004), which may explain the improvement in feed conversion ratio observed in the present study. The efficiency of probiotics, however, will depend on the quantitative and qualitative characteristics of microorganisms used in the production (Tournut, 1998), making it difficult to conduct comparative studies between different products.

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