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Immune Response and Performance of Broiler Chicks Fed Protexin and Propionic Acid

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Abstract: This study was conducted to evaluate the effects of dietary protexin, propionic acid and a blend of protexin and propionic acid on the immune response and the performance of broiler chicks. In a completely randomized design, three hundred and twenty broiler chicks were divided into 4 groups (each group consisting of 16 unsexed 1-d-old chicks) and reared on floor pens for 42 days. Dietary treatments consisted of a control diet without any additives, the control diet + 0.1 g/kg protexin, the control diet +2 g/kg propionic acid, and the control diet + 0.1 g/kg protexin + 2 g/kg propionic acid. On the 42 day, body weight gain and feed intake of chicks were calculated. On the same day, one male chick from each pen, which was the nearest to mean weight, was bled to determine blood parameters. Feed conversion ratio for birds fed a diet of propionic acid and a protexin + propionic acid differed ($p < 0.05$) from control birds. Although body weight gain was numerically higher in the birds fed feed additives than the control diet, body weight gain for these birds did not differ ($p > 0.05$) from control birds. There were no significant differences for feed intake and blood parameters among the dietary treatments. In conclusion, based on the results of the experiment, propionic acid and protexin have the potential to be used as feed additives in broiler diets.

Key words: Broiler chicks, protexin, propionic acid, immune response, performance

INTRODUCTION

Natural immune system in newly hatched poultry is incompetent (Lowry *et al*., 1997; Genovese *et al*., 1998; Beal *et al*., 2004; Lowry *et al*., 2005) and pathogenic bacteria such as Enterobacteriaceae and Enterococci can predominate in their gastrointestinal tract and through damaging effects on cell wall of intestine, decrease performance at the whole period of poultry life (Fuller, 1989; Vander Wielen *et al*., 2000; Parks *et al*., 2001). Because feed additives can affect microbial population in the gastrointestinal tract (Hume *et al*., 2006; Oviedo-Rondo´n *et al*., 2006), they are of great interest in the poultry industry. Therefore, animal researchers and animal food producers are looking for suitable feed additives to improve poultry natural immune system and hereby increase poultry performance.

Several scientific reports demonstrated that probiotics and organic acids could stimulate the natural immune response of poultry, reduce the activity of pathogenic bacteria and balance bacteria population in poultry (Cross, 2002; Patterson and Burkholder, 2003; Dalloul *et al*., 2003). It seems that the positive effects of these feed additives are mainly include: reducing colonization of pathogenic microorganisms, reducing production and releasing toxic components from bacteria and their antifungal and antibacterial activities that are totally due to an increase in broiler performance (Kishi *et al*., 1999; Chaveerach *et al*., 2004; Martins *et al*., 2005).

However, evaluation of these feed additives efficiency on immune response and performance of broiler chicks requires studies that are more comprehensive. Therefore, this experiment was designed to 1) determine the effects of protexin, propionic acid as feed additive on immune response and performance of broiler chicks 2) determine whether there is any synergism between protexin and propionic acid.

MATERIALS AND METHODS

A total number of three hundred and twenty chicks Cobb 500 were divided into 4 groups, each consisting of 16 unsexed 1-d-old chicks. Then, these chicks were randomly housed in 20 equivalent pens and reared on floor pens for 42 days. Each of these groups received one of the following experimental diets randomly: a control corn-soybean diet that was prepared based on NRC (1994) recommendations, the control diet + 0.1 g/kg protexin, the control diet + 2 g/kg propionic acid and the control diet + 0.1 g/kg protexin + 2 g/kg propionic acid. The temperature of the room with continuous lighting was maintained at 34°C at first and then reduced by 3°C/wk until it reached to18°C and this temperature was maintained to the end of the experiment.

At the end of the experiment (42 days), Body Weight Gain (BWG) and Feed Intake (FI) were recorded. Feed Conversion Ratio (FCR) was also calculated through dividing feed intake (g) into body weight gain (g). On the same day, one male chick from each pen, which was the nearest to mean weight of the same pen, was selected

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Table 1: Mean (± S.E.) of protexin, propionic acid and protexin + propionic acid on performance of 6-wk old broiler chicks

Treatment	BWG[1] (g)	FI[2] (g)	FCR[3] (g/g)
Control	2273.24±39.40	4861.3±163.55	2.17502[a]±0.10
Protexin	2339.16±37.17	4734.9±108.82	2.02751[ab]±0.06
Propionic acid	2400.79±45.45	4511.0±85.41	1.88015[b]±0.03
Protexin + Propionic acid	2400.79±41.89	4618.9±59.31	1.94722[b]±0.03

[a,b]Row means with different superscripts differ significantly at p<0.05,
[1]BWG = Body Weight Gain [2]FI = Feed Intake [3]FCR = Feed Conversion Ratio

Table 2: Mean (± S.E.) of protexin, propionic acid and protexin + propionic acid on leukocyte, erythrocyte, eosinophil and basophile of 6-wk-old broiler chicks

Treatment	Leukocyte	Erythrocyte	Eosinophil	Basophile
Control	26.64±1.96	2.93±0.21	0.14±0.02	0.06±0.02
Protexin	27.32±0.49	2.87±0.16	0.18±0.02	0.06±0.04
Propionic acid	26.52±0.96	2.66±0.21	0.14±0.02	0.04±0.02
Protexin + Propionic acid	28.10±2.29	2.54±0.14	0.14±0.04	0.04±0.04

Table 3: Mean (± S.E.) of protexin, propionic acid and protexin + propionic acid on heterophil, lymphocyte and heterophil to lymphocyte ratio (H/L) of 6-wk-old broiler chicks

Treatment	Heterophil	Lymphocyte	H/L
Control	3.52±0.11	5.62±0.08	0.62±0.02
Protexin	3.32±0.08	5.72±0.03	0.58±0.01
Propionic acid	3.36±0.12	5.62±0.05	0.59±0.02
Protexin + Propionic acid	3.46±0.06	5.80±0.10	0.59±0.02

for collection of blood samples. Then, these blood samples were centrifuged at 3000 rpm for 15 min and serum was obtained and stored at -20°C. Finally, these samples were analyzed to determine leukocyte, erythrocyte, eosinophil, basophile, heterophil and lymphocyte using enzymatic diagnostic kits.

All the data were analyzed using one-way ANOVA procedure of SAS software (1985). Differences among treatments were separated by Duncan Multiple Range Test at 0.05 probability level.

RESULTS AND DISCUSSION

The effects of feed additives on BWG: The results of dietary treatments on performance of broiler chicks are shown in Table 1. Although BWG was numerically higher in the birds fed feed additives than the control diet, BWG for these birds did not differ (p>0.05) from control birds. Similar effects were found by Engberg *et al.* (2000) and Izat *et al.* (1990), who reported that organic acids and probiotics have no significant effect on BWG of broiler chicks. However, other researchers reported beneficial effects of these additives on BWG (Skinner *et al.*, 1991).

The effects of feed additives on FI: It is noteworthy that the results indicated that the control group had numerically higher FI than others groups. Because pattern of FI in birds is based on energy level (NRC, 1994), it is likely that the birds which have better FCR have a lower FI. Therefore, this effect may be related to this effect. In accordance with this experiment, observations of other researchers indicated that the addition of probiotics and organic acids to the broilers diet either numerically or significantly improves FI (Patterson and Burkholder, 2003).

The effects of feed additives on FCR: All of the birds fed feed additives had numerically better FCR than the control birds; However, this parameter only for birds fed diets that were supplemented with propionic acid and protexin + propionic acid differed (p<0.05) from the control birds. These effects may be due to higher BWG and lower FI in the birds fed feed additives. In addition, it is reported that decreasing of pH of digestive organs using organic acids and probiotics could lead to better digestion, absorption and utilization of nutrients (Panda *et al.*, 2000; Boling *et al.*, 2001; Arslan, 2004).

The effects of feed additives on the immune response: The results of Table 2 and 3 showed that there was no significant difference among the dietary treatments. No significant effect of feed additives on the immune response of broilers may be associated with the environmental condition, because this experiment was performed in an almost entirely aseptic condition. It is reported that (Patterson and Burkholder, 2003; Sarica *et al.*, 2005) the mode of action of feed additives is mainly related to competitive exclusion and prevention of growth and reproduction of pathogens. Accordingly, because growth and reproduction of pathogens will increase in the unsuitable the rearing condition such as non-aseptic condition, high density of the birds and emergence of environmental stress, it is believed that positive effects of these feed additives may be revealed when the broilers are reared in such unsuitable conditions. However, other researcher reported that organic acids (Ricke, 2003) and probiotics (Patterson and Burkholder, 2003) improve the immune response. These researchers indicated that probiotic and organic acid

could stimulate immune response and increase resistance to microbial pathogens as they are utilized in broilers diet.

Conclusion: In conclusion, based on the results of this experiment, protexin and propionic acid have the potential to be used as feed additives in broiler diets. The results also showed no synergism between probiotic and organic acid. However, further studies are needed to amplify the results of this experiment and to determine whether these results are likely to be applicable for other rearing conditions.

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