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The Role of Probiotic and Source of Lactose as Feed Additives on Performance and Gut Improvement in Broilers

[1]Mahmoud Radfar and [2]Parviz Farhoomand
[1]Department of Young Researcher Club of Tabriz, Islamic Azad University, Iran
[2]Department of Animal Science, University of Uromia, Iran

Abstract: This study was conducted to determine the effect of whey powder (Lactose: 75%) and Pediococcus Acidilactici bacteria (probiotic) on growth performance and gut improvement of broiler chickens. Day-old male commercial broiler chicks (Arbor Acres) were randomly assigned to treatments. During the experimental period (0-28 days), all chickens were fed the basal diet and different levels of whey powder, Probiotic and whey powder plus Probiotic: (control, W = 1%, P = 0.01%, W+P = 1+0.01% and W+P = 0.5+0.005%). Each diet was offered ad libitum to a group of 40 (4 replication, 10 birds per replication). Throughout the study, body weight, feed intake and Feed Conversion Ratio (FCR) were calculated and at the end of experiment, two birds of each replicate were selected. All birds weighted, then decapitated and viscera were collected immediately, then number of intestinal E. coli, number of cecal oocyste, cecal pH and rate of intestinal lactic acid were detected. Supplementation of whey powder plus Probiotic (1+0.01% and 0.5+0.005%) and whey powder (1%) improved body weight, feed intake and FCR at the end of experimental period ($p<0.05$). likewise, all treatments except control caused to significant decrease in number of E. coli, number of oocyste and cecal pH ($p<0.05$). Also the highest and lowest intestinal lactic acid belonged to diet containing whey powder plus Probiotic (1+0.01%) and control, respectively.

Key words: Broiler, probitic, whey powder, gut improvement

INTRODUCTION

Probiotics are often used in feeding of poultry in intensive rearing systems. Beneficial effects of probiotics were observed in toxin neutralisation, prevention of development and multiplication of specific bacteria, change in microbial metabolism and immunity stimulation (Fuller, 1989).The purpose of using probiotic in diet, is that, its population prevails against adverse population of digestive system (Mohan and Andjames, 1988). The prevailence of useful micro-organism over harmful ones, cause to increase and improvement of feed conversion (Bilgili and Moran, 1995). Lactic acid-producing bacteria are represented among the members of the normal micro flora and inhabit the digestive tract of many animal species (Tannock *et al*., 1990). Adding whey to diet, contributes to digestibility and absorption of nutrients in diet. This is because of the fact that whey produces an acidic condition that is suitable for growth lactobacillus and causes to increase of digestibility and absorption of nutrients (Bilgili and Moran, 1995). Adding lactose to broilers diet, increases length and height of cecum folds and decrease intestinal pH and thickness of mucosa memberance (Tellez *et al*., 1993). Orban *et al*., (1997) showed that intestinal pH contents are in opposite relation to cecum weight. The aim of this trial was study of effect of whey powder and Pediococcus Acidilactici bacteria (Probiotic) on broilers performance and intestinal microbial flora factors.

Corresponding Author: Mahmoud Radfar, Centeral Post Office (Restant Section), Tabriz, Iran

Table 1: The composition of experimental diets (%)

Ingredients	0 to 14 days	15 to 28 days
Corn	56.5	61.5
Vegetable oil	3.7	4
Soybean meal	32.3	28
Fish meal	3.2	2.2
Zeolit	0.98	1.26
Probiotic	0, 0.01, 0.005	0, 0.01, 0.005
Whey powder	0, 0.5, 1	0, 0.5, 1
Dicalcium phosphate	1.3	1.1
Oyster shell	1	1
DL-Methionine	0.15	0.1
Lysine HCl	0.17	0.12
Vitamins Permix	0.3	0.3
Minerals Permix	0.3	0.3
Salt	0.1	0.12
Chemical analysis		
ME (kcal kg^{-1})	3000	3060
Crude protein (%)	21.2	19
Calcium (%)	0.92	0.87
Available phosphore (%)	0.43	0.42
Sodium (%)	0.06	0.06
Lysine (%)	1.3	1.1
Methionine (%)	0.53	0.45

MATERIALS AND METHODS

Two hundred day old broiler chicks as a male from commercial strain (Arbor Acres) were utilized for 28 days experimental period in Iran. The chicks were randomly allocated to 20 pens containing 10 chicks each with 4 replicates and assigned to receive one the following dietary treatments: (1) basal diet (control), (2) basal diet + 0.01% Pediococus Acidilactici bacteria (Probiotic), (3) basal diet + 1% whey powder that contained 9% Cp and 75% lactose, (4) basal diet + 0.01% Probiotic and 1% whey powder, (5) basal diet + 0.005% Probiotic and 0.5% whey powder. The chicks were fed a starter diet from day 0 to 14 (Men = 3000 kcal kg^{-1}, CP = 21.2%) then switched to a grower diet from day 15 to 28 (MEn = 3060 kcal kg^{-1}, CP = 19%) of the experimental period (Table 1). Birds were fed *ad libitum* and water was available all times during the experimental period. Feed intake, body weight, feed conversion rate were measured weekly. At the end of experiment, two birds of each replicate were selected. All birds weighted, then decapitated and viscera were collected immediately. One gram of intestinal contents sampled and cultured on Violet Red Bile Agar (VRBA) medium for coli-form counting. Also rate of intestinal lactic acid were detected. Another sample from cecal obtained for pH measurement and number of oocyst counting. Effects of treatments on response variables were determined by Two-way ANOVA using commercially available statistical software SPSS. Significance of difference among source of variance was determined using the Dancan method. Difference among experimental groups were declared to be significant if probability was less than 0.05 throughout the study.

RESULTS AND DISCUSSION

Feed Intake

Results from variance analysis showed that diets used in starter and grower period was significant and mean of results obtained from different treatments are displayed in Table 2. At starter period, all treatments in comparison with control improved feed intake and these treatments as compared with each others did not have any significant difference ($p<0.05$). During the whole experiment period (0-28 day) broilers receiving Probiotic plus whey powder (0.01+1% and 0.005+0.5%) and also whey powder (1%), showed greatest amount of feed intake ($p<0.05$).

Table 2: Effect of Probiotic and Whey powder on performance and gut micro flora of broilers

	T 1	T 2	T 3	T 4	T 5	
	Control	Probiotic 0.01%	Whey powder 1%	P+W 0.01+1%	P+W 0.005+0.5%	Diet effect
Starter (0-14 days)						
Body weight (g)	350.63^{c}	369.74^{b}	412.37^{a}	420^{a}	417.87^{a}	**
Feed intake (g)	412.48^{b}	421.51^{ab}	496.59^{a}	498.58^{a}	471.47^{ab}	*
Feed conversion	1.17^{a}	1.14^{a}	1.20^{a}	1.18^{a}	1.13^{a}	NS
Grower (0-28 days)						
Body weight (g)	1011.92^{b}	1054.79^{b}	1244.94^{a}	1320.43^{a}	1319.06^{a}	**
Feed intake (g)	1960.08^{b}	1975.05^{b}	2025^{ab}	2115.5^{a}	2104.9^{a}	*
Feed conversion	1.93^{a}	1.87^{a}	1.62^{b}	1.60^{b}	1.63^{b}	*
E. coli bacteria	13575000^{a}	1790000^{b}	1270975^{b}	175^{b}	81750^{b}	**
Oocyst (per gram of fecal)	15.5^{a}	0^{b}	0^{b}	0^{b}	0^{b}	*
Cecal pH	7.59^{a}	6.25^{b}	6.15^{b}	6.12^{b}	6.32^{b}	*
Lactic acid (mg dL^{-1})	118^{c}	120.75^{c}	182.5^{b}	250.5^{a}	181.5^{b}	*

Mean in the same line with different superscripts are significantly different ($p<0.05$); *: Significant; **: Highly significant; NS: Non-Significant

Body Weight

Effect of treatments on body weight were significant at the end of starter and grower period. Average comparison (Table 2) showed that either at starter period or grower period, highest body weight belonged to broilers fed Probiotic plus whey powder (0.01+1% and 0.005+0.5%) and also whey powder (1%). These results disagrees with results of Jin *et al*. (2000) that expressed that adding lactobacillus to broilers diet caused to significant improvement in their weight and feed conversion. In this survey adding only probiotics dose not have any effect on broilers weight gain and it only caused to increase body weight when probiotics were used with whey powder.

Feed Conversion Ratio (FCR)

Feed conversion ratio was not affected significantly by treatment groups at starter period but was affected significantly at the end of grower period. All treatments except probiotic in comparison with control demonstrated best FCR ($p<0.05$). The obtained results are in accordance with the finding of Jin *et al*. (2000). In this research, probiotic caused to FC improvement when used with whey powder. Probiotics cause to useful microbes in digestive system overcome harmful microbes and this mechanism brings growth increase and FCR improvement and along with this, whey powder provides suitable condition for probiotic activity.

Escherichia coli

Number of *E. coli* was affected significantly by treatment ($p<0.01$). All treatments except control caused a significant decrease in number intestinal e-coli and these treatments as compared with each other did not have any significant difference ($p<0.05$). We can conclude that using Probiotic plus whey powder together or separately cause to decrease intestinal *E. coli* bacteria. Jin *et al*. (2000) announced that using lactobacillus decrease e-coli bacteria in broilers cecum. Lactose of diets contents is in opposite relation to intestinal pH. Increasing lactic acid caused a decrease in *E. coli* (Chambers *et al*., 1997). May be probiotic mechanism in decreasing pathogenic micro-organism is because of competitive exclusion or inhibitor production such as organic acid, Bacteriosin and Lactolin (Gardiner *et al*., 2004).

Lactic Acid

Effect of treatments on intestinal lactic acid were significant ($p<0.01$). The highest of intestinal lactic acid belonged to broilers that fed Probiotic plus whey powder (0.01+1%) and on the next rank belonged to treatment including Probiotic plus whey powder (0.005+0.5%) and also whey powder (1%). The results of recent research are completely in accordance with Jin *et al*. (2000) result which expressed adding lactobacillus to broilers diet caused a significant increase in total of cecal volity fatty acid.

Cecal Oocyst

Results from variation analysis indicate significant difference between diets in amount of oocyst in faeces of broilers cecum (Table 2). All treatments except control caused to significant decrease in number of cecal oocyst ($p<0.05$). Broilers which receive probiotic have much more lymphocyte and less oocyst than control treatment and these results show clearly that probiotic nutrition lead to development of digestive system and increase immunity against coccidosis (Dalloul *et al*., 2003). So we can conclude that, number of oocyst used as inner parasite in each treatment, has reduced by using of Probiotic and whey powder separately or together.

Cecal pH

Means of data obtained from different treatments are displayed in Table 2. All treatments except control caused a significant decrease in cecal pH ($p<0.05$). Lowering digestive system pH, because of whey powder intake and lactic acid producing bacteria, reduce activity of harmful organism like *E. coli* which activate in 8-9 pH (Glusen *et al*., 2002).

CONCLUSIONS

Using Probiotic plus whey powder show Synergetic effects in improving of broiler performance and decreasing of pathogenic micro-organism in digestive system and we reached to our final objective that it was eliminating antibiotic from poultry diet and producing safety meet.

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