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PERFORMANCE OF BROILER CHICKS FED LOW PROTEIN DIETS SUPPLEMENTED WITH THE "PRONIFER" PROBIOTIC

(With 5 Tables and 2 Figures)

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أداء بداري التسمين المغذاة علي علائق منخفضة البروتين مضافا اليها البرونيفير بروبيوتيك

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تم دراسة أثر إضافة البرونيفير إلي العلائق المحتوية علي مستويات منخفضة من البروتين علي أداء بداري التسمين لمدة ٥٥ يوما. تم تقسيم عدد ١٥٠ كتكوت عمر يوم إلي خمس مجموعات بكل منها عدد ٣٠ كتكوت. غذيت المجموعة الأولي علي عليقة ضابطة بها ٢١,٧% بروتين خام بينما غذيت المجموعة الثانية علي عليقة بها ١٩,٧% بروتين خام والمجموعة الثالثة تمت تغذيتها علي نفس العليقة مضافا اليها البرونيفير بنسبة ٢ كجم/طن من عمر يوم حتى عمر ٢١ يوم و بنسبة ١ كجم/طن من عمر ٢٢ حتى عمر ٥٥ يوم. أما المجموعة الرابعة فقد غذيت علي عليقة بها ١٧,٧% بروتين خام و غذيت المجموعة الخامسة علي نفس العليقة مضافا اليها البرونيفير. وقد خلصت الدراسة إلى النتائج الاتية: كمية العلف المستهلك خلال فترة التجربة زاد بمقدار ٤,٢٥% و ٧,٣٨% في المجموعات التي غذيت علي العلائق المنخفضة في البروتين والمضاف اليها البرونيفير مقارنة بالمجموعة الضابطة. عدم وجود أي فروق معنوية في الزيادة في كل من وزن الجسم ومعدل التحويل الغذائي بين المجموعة المغذاة علي العليقة المحتوية علي ١٩,٧% بروتين خام مضافا اليها البرونيفير والمجموعة الضابطة بينما سجلت المجموعة المغذاة علي عليقة بها ١٧,٧% بروتين أقل قيم. سجلت مجموعة الطيور المغذاة علي عليقة محتوية علي ١٩,٧ % بروتين مضافا إليها البرونيفير نقص في كمية المادة الجافة والطاقة والبروتين المستهلك اللازم لكل جرام من الزيادة في الوزن مقارنة بالمجموعات الأخرى ولكنها تساوت تقريبا مع المجموعة الضابطة. تفوق العائد الاقتصادي لمجموعة البداري المغذاة علي العليقة المحتوية علي ١٩,٧% بروتين مضافا اليها البرونيفير مقارنة بالمجموعات الأخرى. من هذه الدراسة نستخلص أن إضافة مركب البرونيفير إلى علائق بداري التسمين المحتوية علي بروتين منخفض (١٩,٧%) أدي إلى تحسن في كل من الزيادة في وزن الجسم ومعدل التحويل الغذائي بالإضافة إلى العائد الاقتصادي.

SUMMARY

The effect of supplementation of broiler diets containing low levels of protein with pronifer on the chick performance was studied for 55 days. 150 one-day old chicks were divided into five groups (30 chicks/each). Chicks in the first group were fed on the control diet (21.7% CP), while the second and third groups were fed on diets containing 19.7% CP. The fourth and fifth groups were fed on diets containing 17.7%. The diet of groups 3 and 5 was supplemented with pronifer at a level of 2 kg/ton from 0 to 21 days of age and 1 kg/ton from 22 to 55 days of age. The amount of the feed consumed during the experimental period was increased by 4.25% and 7.38% in the chick groups fed on diets supplemented with pronifer in comparison with the control group. No significant ($P<0.05$) differences in the body weight gain and feed conversion were recorded between group fed on the diet containing 19.7%CP supplemented with pronifer and control one, while the fourth and fifth groups fed on the diet containing 17.7% CP recorded the lowest values. Broiler chicks fed on the diet containing 19.7%CP supplemented with pronifer recorded lower dry matter, ME and CP intake per unit gain than other groups but nearly similar to control group. Pronifer supplementation to the 19.7% CP diet increased economical efficiency of broilers (34.02%) compared to the control one (28.93%). It could be concluded that supplementation of the 19.7% CP diet with pronifer improved the weight gain, feed efficiency and economical efficiency of the broiler chicks without any adverse effect.

Key words: *Broiler chicks, Low probiotic, Probiotic.*

INTRODUCTION

Probiotic supplementation to the diet of broiler is gaining attention as growth promoter after the ban on antibiotics because of presence of antibiotic residues in animal products and the development of drug resistant microorganisms in humans (Jin *et al.*, 1997). Probiotics act as growth promoters, feed savers, nutritional bio-regulator and help in improving performance and health. Traditional probiotics are lactic acid bacteria such as lactobacillus casei, lactobacillus acidophilus and streptococci. Several studies with broiler chicks have indicated that probiotics preparations improve live weight gain and feed conversion and markedly reduce mortality (Han *et al.*, 1984; Meluzzi *et al.*, 1986; Kim *et al.*, 1988; Tortuero *et al.*, 1989; Owings *et al.*, 1990; Jin *et al.*,

1996a, 1997a,b,c; Mohan *et al.*, 1996; Shoeib *et al.*, 1996; Yeo&Kim,1997; Cavazzoni *et al.*, 1998 and Shoeib& Madian, 2002). The nutritional effect of probiotic is characterized by an improvement of the utilization of nutrients. The addition of lactobacilli cultures to broiler diets maintain normal intestinal micro-flora, improve the digestion, absorption and metabolism of dietary nutrients, stimulate appetite and increase fat and nitrogen retention (Nahashon *et al.*, 1992, 1993, 1994b, 1996a,b). Probiotics suppress ammonia in the excreta and litter of broilers and decrease urease activity in small intestine which improve animal health and enhance growth (Chiang & Hsieh, 1995 and Yeo & Kim, 1997). Lactobacillus species have been shown to produce digestive enzyme protease which accelerate the absorption rate of protein in the intestine of poultry through decomposition of protein into soluble peptides and amino acids (Moon & Kim, 1989; Lee & Lee, 1990 and Jin *et al.*, 1996b).

The present experiment is, therefore, undertaken to evaluate the effect of supplementation of low protein diets with commercial probiotic (pronifer) on growth performance of broilers including body weight gain and feed conversion.

MATERIALS and METHODS

Fermentation products, as pronifer, are made by specific lactic acid fermentation of heat-treated soybean meal and malt, using a multiple strain mixture of lactobacilli and pediococcus selected from their natural habitat. It contains a) viable lactic acid bacteria (L.plantarum, L.brevis, L.fermentum, L.casei and pediococcus acidilacticii). b) lactic acid fermentation metabolites and enzymes (organic acids, glucosidase and peptidase enzymes). c) free soluble amino acids and short chain peptides. The chemical composition of pronifer revealed that, it is rich in crude protein (43%) and contains about 89% dry matter.

Chicks and feeding:

150 one-day old broiler chicks (Arbor acres) were weighed and randomly distributed into five groups of 30-chicks each.. The chicks were floor reared in an experimental room bedded by a layer of wood shavings and provided with clean feeders and waterers. All birds were kept under standard hygienic conditions and were subjected to a prophylactic vaccination and pharmacological program against viral and bacterial diseases. Chicks in the first group were placed on diet I

(control) which have 3200 kcal/kg ME and 21.7% crude protein, while birds in the second and third groups were fed on diet II which containing 3200 kcal/kg ME and 19.7% crude protein. Broiler chicks in the fourth and fifth groups received diet III containing 3200 kcal/kg ME and 17.7% crude protein as shown in Table 1. Birds in the second and fourth groups fed on two levels of low protein diets without pronifer addition, however, chicks in the groups 3 & 5 fed on the same diets supplemented with pronifer at the rate of 2 kg/ton from 0 to 21 days of age and 1 kg/ton from 22 to 55 days of age. The control diet was formulated so that to satisfy the requirements for Arbor acres broiler, while diets II & III were formulated to contain two low levels of protein (19.7 & 17.7%).

Table 1: Physical and calculated chemical composition (%) of the experimental diets

Ingredients	Diets		
	Diet I	Diet II	Diet III
Yellow corn	53.00	60.44	68.00
Soybean meal	32.54	26.44	20.50
Fish meal	4.00	4.00	4.00
Dried fat	7.44	6.00	4.38
Limestone, ground	1.70	1.70	1.60
Dicalcium phosphate	0.60	0.70	0.80
Common salt	0.47	0.47	0.47
D-L methionine	0.10	0.10	0.10
Premix*	0.15	0.15	0.15
Chemical composition:			
ME (kcal/kg)	3200	3200	3200
Crude protein (%)	21.7	19.7	17.7
Calorie/protein ratio	147.5	162.4	180.8
Crude fibre (%)	3.47	3.22	2.97
Calcium (%)	0.99	0.99	0.96
Phosphorous (%)	0.53	0.54	0.54
Methionine (%)	0.48	0.46	0.44
Lysine	1.23	1.08	0.95

* Pfizer broiler premix, furnishing the following ingredients per kg premix:- Vit. A 12000 IU; vit. D3 2000 IU; vit. E 10 mg; folic acid 1 mg; niacin 20 mg; pantothenic acid 10 mg; vit K 2 mg; vit. B1 1 mg; vit. B2 4 mg; vit. B6 1.5 mg; vit B12 10 µg; biotin 50µg; iron 30mg; copper 10 mg; zinc 55 mg; Mn 55 mg; iodine 1mg; Se 0.1 mg; choline chloride500 mg..

The diets were fed ad libitum and fresh clean water was continuously available throughout the experimental period which extended for 8weeks. Feed intake and body weight were recorded for each of the different groups at 0, 11, 22, 33, 44 and 55 days of age to calculate weight gain, feed conversion and efficiency of protein and ME utilization.

Economical efficiency of production: Total production cost was calculated including prices of one-day old chicks, feeding, heating, veterinary care, management and housing. Selling price was calculated by multiplying total live body weight of the birds produced by the price per unit weight commonly offered in the market.

Statistical analysis: Data were analyzed by the one-way analysis of variance (ANOVA) technique and Duncan's multiple range test (Snedecor and Cochran, 1989).

RESULTS and DISCUSSION

The results obtained for broiler performance in terms of feed intake, live body weight, weight gain, feed conversion and protein and metabolizable energy (ME) utilization are presented in Tables (2, 3 & 4). Comparing to control group, increase in the feed intake (g/chick) was recorded in the groups fed low protein diets (19.7&17.7%) whether supplemented with pronifer or not. The amount of feed consumed per bird for the whole growing period was increased in groups fed on diets supplemented with pronifer than unsupplemented ones. The feed intake was increased by 4.25 & 7.38% in groups supplemented with pronifer in comparison with the control group. These results are supported by the findings of Nahashon *et al.* (1992, 1993, 1994b and 1996b) who found that, supplementation of lactobacillus cultures stimulate appetite and increased fat and nitrogen retention.

The growth data revealed that, the addition of the pronifer to the low protein diets (19.7 &17.7%) significantly ($p<0.05$) increased the weight gain of chicks by 17.13 & 10.65% in comparison to their relatives fed the same but unsupplemented diets. The addition of lactobacillus cultures to broiler diets increased the weight gain of chickens as reported by (Kim *et al.*, 1988; Cho *et al.* 1992; Jin *et al.* 1996a, 1997a ; Mohan *et al.*, 1996; Shoeib *et al.*, 1996; Yeo and Kim,1997; Cavazzoni *et al.*, 1998; and Shoeib & Madian, 2002). Improvement in the body weight and feed efficiency was also found by Francis *et al.* (1978) when turkey poults were fed on lactobacillus cultures. From table (4), there was no significant differences in both

body weight gain and feed conversion between the group fed on diet containing 19.7% CP supplemented with pronifer and control (21.7% CP). This indicated that, the addition of lactobacillus cultures to low protein diet (19.7%) improve the weight gain and feed conversion and produce weight gain similar to control group. This may be contributed to production of digestive enzymes specially proteolytic enzymes which decompose proteins into soluble peptides and amino acids to accelerate the absorption rate of protein in the intestine of poultry and domestic animals (Moon & Kim, 1989 and Lee & Lee, 1990). Addition of lactobacillus cultures to broiler diets improve digestion, absorption and metabolism of nutrients and increase fat and nitrogen retention (Nahshon *et al.*, 1992, 1993, 1994b, 1996a,b). On the other hand, probiotics suppress ammonia in the excreta and litter of broilers and decrease urease activity in small intestine and consequently improve health of birds and enhance growth (Chiang & Hsieh, 1995 and Yoe & Kim, 1997). Also results in table 4 showed significant decrease ($p<0.05$) in body weight gain and feed conversion in group fed on diet having 17.7% CP supplemented with pronifer compared with control having (21.7% CP).

Broiler chicks fed on diet containing 19.7% CP (group 3) supplemented with pronifer showed lower dry matter, ME and crude protein intake per unit gain than those of groups 2, 4 &, although no difference was observed among this group and control. Similar results were reported by Jin *et al.* (1996a, 1997a,b) who found that addition of lactobacillus cultures to broiler diets improved significantly weight gain and feed to gain ratio. Tortuero *et al.* (1989) and Mohan *et al.* (1996) reported that body weight and feed efficiency increased significantly when chicken were fed on diets containing a mixture of L. acidophilus, L. casei. In contrast, Watkin & Kratzer (1984), Mudalgi *et al.* (1993), and Panda *et al.* (1999, 2001) reported no significant effect of probiotics on body weight gain and feed conversion.

Data for feeding cost, total production cost, net revenue (L.E/bird) and economical efficiency of the different groups are shown in Table (5). The results revealed that, addition of pronifer to 19.7% CP diet increased economical efficiency (34.02%) in comparison with control (28.93%), while other groups showed poor economical efficiencies. Priority of economical efficiency in the third group of broiler may be due to better feed utilization and conversion.

From previous results, it could be concluded that, pronifer supplementation of chick fed on low protein diet (19.7%) improved weight gain and feed efficiency without any physiological disorders.

Table 2: Feed intake (g) of chicks during the experimental period

Age period (day)	Groups				
	1	2	3	4	5
0-11	407.0	403.0	428.0	430.0	417.0
11-22	525.0	540.0	577.0	561.0	551.0
22-33	1015.0	995.0	1053.0	1070.0	1134.0
33-44	1422.0	1546.0	1542.0	1529.0	1662.0
44-55	1980.0	1965.0	1980.0	2010.0	2005.0
Total	5343.0	5429.0	5580.0	5650.0	5769.0

Table 3: Body weight development (g) of chicks during the experimental period

Age (day)	groups				
	1	2	3	4	5
0	44.0 ±4.0	45.0 ±2.6	45.0 ±3.8	44.0 ±3.6	43.0 ±2.9
11	195.71 ±5.99	177.14 ±6.50	187.14 ±4.74	179.29 ±4.96	187.14 ±7.22
22	591.07 ±20.23 [a]	550.0 ±15.50 [b]	590.30 ±22.79 [a]	471.43 ±27.22 [c]	492.86 ±17.47 [e]
33	1203.0 ±43.14 [a]	1042.86 ±41.56 [b]	1248.57 ±39.12 [a]	953.57 ±48.24 [c]	963.71 ±38.31 [e]
44	1814.28 ±44.91 [a]	1517.44 ±62.21 [b]	1812.19 ±61.93 [a]	1300.0 ±74.68 [d]	1390.0 ±63.33 [e]
55	2453.57 ±58.48 [a]	2051.71 ±78.48 [b]	2466.43 ±64.05 [a]	1769.28 ±96.53 [d]	1975.0 ±62.18 [e]

*Figures in the same row having the same superscripts are not significantly different ($P<0.05$)

Table 4: Feed efficiency utilization of chicks during the experimental period

Item	groups				
	1	2	3	4	5
Total feed intake (g)	5343.0	5429.0	5580.0	5650.0	5769.0
ME intake (Mcal)	17.47	17.37	7.86	18.08	18.46
CP intake (g)	1159.4	1069.5	1099.3	1000.1	1021.1
Weight gain (g)	2409.57 ±55.13[a*]	2006.71 ±72.32[b]	2421.43 ±66.08[a]	1725.28 ±89.56[d]	1931.0 ±71.60[e]
Feed conversion (g/g gain)	2.22 ±0.33[e]	2.71 ±0.40[b]	2.30 ±0.28[e]	3.27 ±0.35[a]	2.99 ±0.41[a]
ME efficiency (kcal/g gain)	7.25 ±0.89[e]	8.66 1.45[b]	7.38 ±1.12[e]	10.48 ±0.96[a]	9.56 ±1.22[a]
CP efficiency (g/g gain)	0.48	0.53	0.45	0.58	0.53

*Figures in the same row having the same superscripts are not significantly different ($P<0.05$)

Table 5: Economical evaluation of broiler performance as probiotics supplementation to low protein diets*

Item	groups				
	1	2	3	4	5
Feeding cost	6.42	6.03	6.20	5.88	6.00
Total production cost	8.42	8.03	8.20	7.88	8.00
Net revenue/chick	2.43	1.00	2.79	0.12	0.69
Economical efficiency	28.93	12.46	34.02	1.52	8.61

*Calculated by LE.

Fig .1.Weight gain of the chick (g) during the experimental period

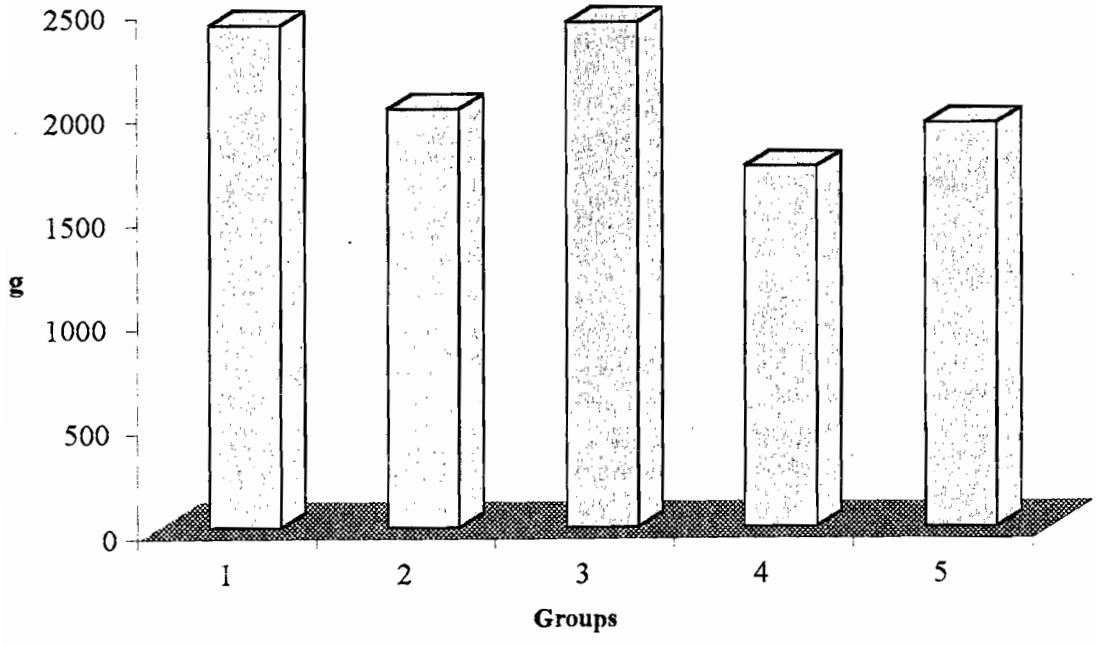
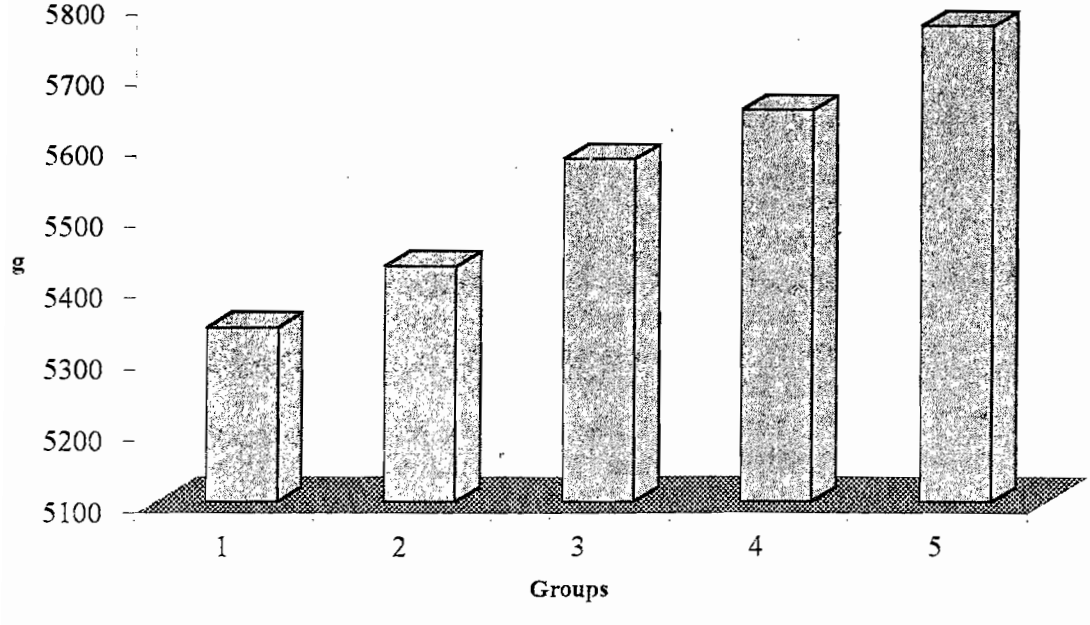


Fig .2.Feed intake of the chicks (g) during the experimental period



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