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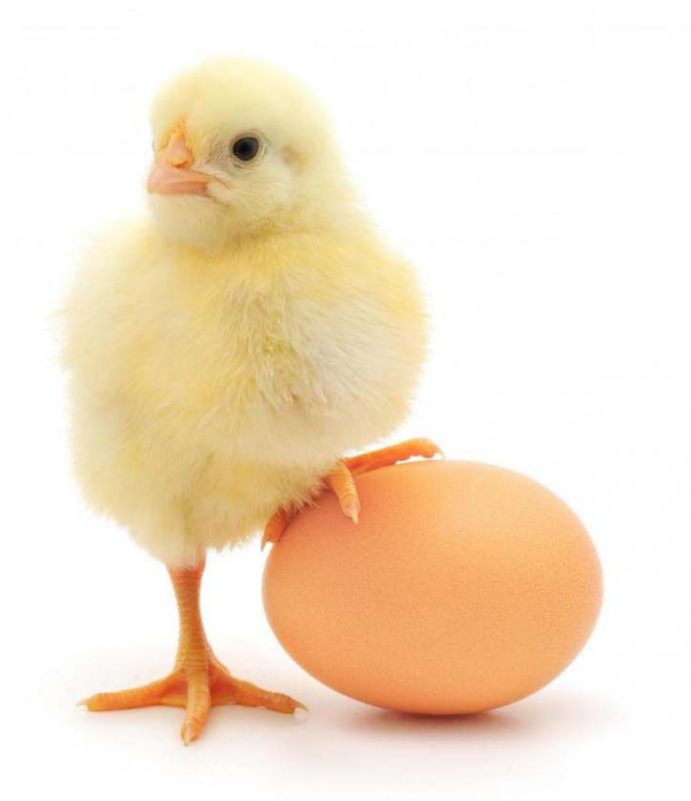

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Effect of Different Levels of Protein and Protexin on Broiler Performance

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Abstract: A feeding trail was conducted to evaluate the effects of different levels of dietary protein and protexin (a commercial probiotic compound) on broiler performance. In a completely randomized design with 2 x 3 factorial arrangement, 360 male broiler chicks were divided into 24 groups, 15 chicks per. Treatments consisted of combination of two levels of protein (NRC and 90% of NRC) and three levels of protexin (without protexin, the recommended level and 120% of recommended level). All of the diets were formulated according to the NRC tables except for protein. Protexin significantly ($P<0.05$) increased weight gain in growing as well as the whole production period. Feeding protexin at 120% of the recommended level caused a significant improvement in feed conversion ratio compared to the control group. Protexin had no significant effect on feed consumption, carcass percentage, abdominal fat and the cost of consumed feed. Decreasing dietary protein caused a significant decrease in feed cost ($P<0.05$). Inclusion of protexin into diet at 120% of the recommended level significantly ($P<0.05$) decreased feed cost per kilogram of live weight gain.

Key words: Probiotic, protexin, protein, broiler

Introduction

Management in a way to make a good balance among nutrition, health and productivity in farm animals is an essential factor in modern animal production systems. The importance of scientific nutrition in maintaining the animal in a healthy and productive condition has an unquestioned place among nutritionists. In order to make a healthy condition, prevention of microbial diseases and growth promotion, "in feed antibiotics" have been recognized to be very useful. Nowadays, appearance of antibiotic resistant microorganisms mainly due to subtherapeutic usage of antibiotics in farm animals nutrition, make it of great importance to find efficient alterative to in feed antibiotics. Using live microbial preparations as "probiotic" in diet to establish a healthy and useful microflora in the gastrointestinal tract, has been suggested as a potential alternative (Fuller, 1973; Fangyan *et al.*, 2000). Administration of useful microorganisms as probiotic into diet usually cause enhancement of organic acids production such as lactic acid that in turn can reduce gastrointestinal pH and subsequent prevention of pathogen microorganisms such as salmonella to colonize the alimentary tract. This process can prevent gastrointestinal disorders such as diarrhea and improve feed efficiency and growth rate in broiler chickens (Dilworth and Day, 1978; Jin *et al.*, 1998). Midilli and Tuncer (2001) reported that addition of probiotic to broiler diets, significantly improved their performance. Kabir *et al.* (2004) reported that administration of protexin into drinking water of broiler chickens caused a significant increase in weight gain during 4, 5 and 6 week of age. Tortuero (1973) concluded that implantation of *Lactobacillus acidophilus* in chicks can enhance their performance. Jin *et al.* (1998) reported that feeding diets containing lactobacillus to broiler chickens caused a significant increase in weight gain related to 21 and 42 d of age.

Since feed is the major cost for meat and egg production and protein sources are of the most expensive ingredients of the diet, growth and production at the highest rate would not be always representative of the maximum economical output. Based on this, low protein diets may be more economic in some situations (Rezaei *et al.*, 2004). In fact, true protein requirements is consisted of need to essential amino acids and good nitrogen sources for making non-essential amino acids. Use of low protein diets in broilers nutrition has been investigated. Isshiki (1979) reported that administration of *Lactobacillus casei* into diet of broiler chickens could reduce the blood non-protein nitrogen including uric acid, urea and ammonia. Mikulec *et al.* (1999) found no improvement in weight gain of male and female broiler chickens that were fed balanced protein diets containing probiotic; however, addition of probiotic to the low protein diets significantly improved the weight gain on 21 and 42 d of age. In addition to having beneficial effects on the gut microflora, lactobacillus can reduce protein degradation and ammonia formation (Fuller, 1973). Protexin is a probiotic compound containing seven species of beneficial bacteria (*Lactobacillus acidophilus, Lactobacillus plantarum, Bifidobacterium bifidum,*

Table 1: Composition of the basal diets

	Starter (0 to 21d of age)		Grower (21 to 42d of age)	
Ingredients	Appropriate protein	Low protein	Appropriate protein	Low protein
	%			
Corn	48.50	55.50	59.30	65.27
Soybean meal	40.37	34.24	32.08	26.77
Soybean oil	6.95	5.95	5.07	4.24
Dicalcium phosphate	1.62	1.67	1.15	1.21
Limestone	1.36	1.37	1.42	1.43
Salt	0.47	0.47	0.34	0.34
Broiler premix[1]	0.5	0.5	0.5	0.5
Lysine	-	-	-	0.05
DL-Methionine	0.17	0.23	0.06	0.12
Antioxidant	0.03	0.03	0.03	0.03
Nutrient Composition				
ME (kcal/kg)	3200	3200	3200	3200
Protein (%)	23	20.7	20	18
Ca (%)	1	1	0.9	0.9
Available P (%)	0.45	0.45	0.35	0.35
Sodium	0.2	0.2	0.15	0.15
Lysine	1.32	1.16	1.1	1
Methionine	0.52	0.55	0.38	0.41
Methionine + cyctein	0.9	0.9	0.72	0.72

[1]Broiler premix contained 50%vitamin premix and 50% mineral premix. Each kg of vitamin premix contained: vitamin A, 3,600,000 IU; vitamin D3, 800,000 IU; vitamin E, 7,200 IU; vitamin K3, 800 mg; vitamin B1, 720 mg; vitamin B2, 2,640 mg; vitamin B3, 4,000 mg; vitamin B5, 12,000 mg; vitamin B6, 1,200 mg; vitamin B9, 400 mg; vitamin B12, 6 mg; vitamin H2, 40 mg; choline chloride, 200,000 mg; and each kg of mineral premix contained: Mn, 40,000 mg; Fe, 20,000 mg; Zn, 40,000 mg; Cu, 4,000 mg; I, 400 mg, Se, 80 mg.

Enterococcus faecium and *Lactobacillus rhamnosus*) and two species of fungi (*Aspergillus oryzae* and *Candida pintolopesii*). This study was conducted to evaluate effects of using protexin in diets containing different levels of protein, on broiler performance.

Materials and Methods

Three hundred and sixty day-old male broiler chicks were purchased from a local hatchery. Chicks were divided into 24 groups, 15 chicks per, housed in floor pens and had free access to feed and water. Six dietary treatments were used as follow: 1) with protein at the NRC recommended level, without protexin; 2) with protein at 90% of the NRC recommended level, without protexin; 3) with protein at the NRC recommended level + protexin at the recommended level; 4) with protein at 90% of the NRC recommended level + protexin at the recommended level; 5) with protein at the NRC recommended level + protexin at 120% of the recommended level; and 6) with protein at 90% of the NRC recommended level + protexin at 120% of the recommended level.

Diets were formulated according to the NRC (1994) requirement tables (Table 1). Protexin were used in drinking water at the first wk of age and then in diet up to the end of the trial, according to the manufacturer instruction. Based on this, protexin was added to drinking water at 1 g/L for the groups 3 and 4, and at 1.2 g/L for the groups 5 and 6 during 1 to 7 d of age. Also protexin was added to diet at 150 and 100 g/ton for the groups 3 and 4, and 180 and 120 g/ton for the groups 5 and 6 during the growth and finishing periods, respectively.

Feed intake and body weight gain were recorded weekly. Feed conversion ratio and percentages of carcass, breast muscle, thigh muscles, liver, abdominal fat and the cost of consumed feed (totally and per kilogram of body weight gain for periods of 0 to 21, 21 to 42, and 0 to 42 d of age) were calculated. At the end of the experiment (42 d of age), one chicken from each replicate (4 per each treatment) with weight close to the mean of the pen were weighed and killed by cervical dislocation. Carcass, breast muscle, thigh muscles, liver and abdominal fat of each bird were weighed using a digital scale.

A completely randomized design with 2 x 3 factorial arrangement were used. All data were analyzed using General Linear Models procedure in the SAS software. Treatment means were compared by new Duncan multiple range test (SAS, 1985).

Results and Discussion

Feed intake, weight gain and feed conversion data for different growth periods are presented in Table 2. There was no significant dietary protein level protexin interaction regarding weight gain during starter (0 to 21 d of age) period. However, there were significant dietary protein protexin effects for the second growth period (21 to 42 d of age) and the entire period of the experiment (0 to 42 d of age) ($P<0.05$). Birds receiving the appropriate

Table 2: Effect of different levels of protein and protexin on the performance of broiler chickens

		0 to 21 d of age			21 to 42 d of age			0 to 42 d of age		
Protein	Protexin	WG (g)	FI (g)	FCR (g/g)	WG (g)	FI (g)	FCR (g/g)	WG (g)	FI (g)	FCR (g/g)
NRC	0	600^{a}	1048^{a}	1.75^{bc}	1516^{bc}	3456^{a}	2.15^{a}	2215^{bc}	4505^{a}	2.04^{a}
NRC	R	624^{a}	1011^{ab}	1.63^{c}	1699^{b}	3452^{a}	2.04^{ab}	2323^{b}	4464^{a}	1.92^{abc}
NRC	120%R	650^{a}	1056^{a}	1.62^{c}	1820^{a}	3513^{a}	1.93^{ab}	2471^{a}	4570^{a}	1.85^{c}
90%NRC	0	518^{b}	945^{b}	1.82^{ab}	1642^{bc}	3204^{b}	1.95^{ab}	2160^{dc}	4150^{b}	1.92^{abc}
90%NRC	R	488^{b}	947^{b}	1.94^{a}	1557^{d}	3154^{b}	2.03^{ab}	2046^{d}	4102^{b}	2.00^{a}
90%NRC	120%R	529^{b}	931^{b}	1.76^{bc}	1623^{bc}	3116^{b}	1.92^{b}	2153^{dc}	4047^{b}	1.88^{bc}
SEM		16.0	30.4	0.101	38.6	58.4	0.048	37.8	70.9	0.045
Protein										
NRC		625^{a}	1038^{a}	1.66^{b}	1711	3474^{a}	2.04	2336	4513^{a}	1.94
90%NRC		512^{b}	941^{b}	1.84^{a}	1607	3158^{b}	1.96	2119	4100^{b}	1.93
SEM		9.3	17.6	0.032	22.3	33.8	0.039	21.9	41.0	0.026
Protexin										
0		559	996	1.78	1628	3330	2.05	2187	4327	1.98^{a}
R		556	979	1.78	1628	3303	2.03	2184	4283	1.96^{a}
120%R		590	993	1.69	1721	3315	1.93	2312	4308	1.86^{b}
SEM		11.4	21.6	0.039	27.4	41.5	0.048	21.9	50.3	0.031

WG, weight gain; FI, feed intake; FCR, feed conversion ratio; R, the recommended level of protexin by the manufacturer.
$^{a-d}$In each section, means within a column with no common superscript differ significantly (p<0.05).

Table 3: Effect of different levels of protein and protexin on the live weight and percentage of the carcass components (g/100g) of the broiler chickens at the end of the experiment (42 d of age)

Protein	Protexin	Live weight (g)	Carcass weight (g)	Carcass[1]	Thigh	Breast	Abdominal fat	liver
NRC	0	2137^{dc}	1551^{bc}	72.6	30.6	27.7^{bc}	3.2^{a}	3.6^{a}
NRC	R	2365^{b}	1655^{b}	69.9	31.4	30.1^{ab}	2.8^{ab}	2.9^{b}
NRC	120%R	2512^{a}	1882^{a}	74.9	29.9	31.0^{a}	2.2^{b}	2.7^{bc}
90%NRC	0	2202^{dc}	1623^{bc}	73.8	31.8	26.9^{c}	2.5^{ab}	2.6^{bc}
90%NRC	R	2085^{d}	1503^{c}	72.1	31.0	28.9^{abc}	2.1^{b}	2.1^{c}
90%NRC	120%R	2222^{c}	1630^{bc}	73.4	31.2	28.3^{abc}	2.8^{b}	2.3^{c}
SEM		38.4	43.3	2.1	0.59	0.86	0.28	0.17
Protein								
NRC		2338	1696	73.1	31.4	29.6^{a}	2.8	3.1^{a}
90%NRC		2170	1585	72.5	30.7	28.0^{b}	2.5	2.4^{b}
SEM		22.2	25.0	1.24	0.34	0.49	0.16	0.09
Protexin								
0		2170	1587	73.2	31.2	27.3^{b}	2.9	3.1^{a}
R		2225	1579	71.1	31.2	29.5^{a}	2.5	2.7^{b}
120%R		2367	1756	74.2	30.6	29.7^{a}	2.5	2.5^{b}
SEM		27.2	30.7	1.52	0.42	0.60	0.16	0.12

[1]Carcass percentage was calculated by dividing carcass weight to live weight and percentages of the other carcass components were calculated by dividing the weight of the compartment to the carcass weight; R, the recommended level of protexin by the manufacturer. $^{a-d}$In each section, means within a column with no common superscript differ significantly (p<0.05).

protein diet (NRC recommended) had a greater weight gain than chicks receiving low protein diet, during the first period of the experiment (P<0.05). Protexin had no significant effect on none of the measured parameters during the first period. Fangyan *et al.* (2000) and Ferguson *et al.* (1998) reported a significant decrease in weight gain of broilers when dietary protein level was reduced. Also, Rahman *et al.* (2002) using diets containing 23, 21, 19, and 17 percent crud protein, reported a significant reduction in weight gain of broilers with decreasing dietary protein.

In this experiment, protexin coused a significant (P<0.05) increase in body weight gain during the second period (21 to 42 d of age) and the entire period of the experiment (0 to 42 d of age). Kabir *et al.* (2004) added protexin into the drinking water of broiler chickens up to the six wk of age and reported a significant improvement in body weight gain related to weeks 4, 5 and 6.

There was no significant dietary protein level protexin effect in relation with feed intake during all the experiment period (Table 2). Birds had a greater feed intake when fed appropriate protein diet compared to those fed low protein diet (P<0.05). Protexin had no significant effect on feed intake. Rezaei *et al.* (2004) reported a significant reduction in feed intake due to decrease in dietary protein level. Decrease in feed intake resulting from reduction in dietary protein level has also been reported by Fangyan *et al.* (2000). Homma and Shinohara (2004) reported that inclusion of *Bacillus cereus* to the broiler chicks diet had no effect on feed intake.

Feed conversion ratio for different growth periods are

Table 4: Effect of different levels of protein and protexin on the feed cost and the meat production cost in different growth periods

	Feed cost (toman[1]/kg)			Meat production cost[2] (toman/kg)		
	0 to 21d of age	21 to 42d of age	0 to 42d of age	0 to 21d of age	21 to 42 d of age	0 to 42 d of age
Protein						
NRC	216.8[a]	677.7[a]	894.5[a]	347.7[b]	398.2	383.9
90%NRC	196.4[b]	616.2[b]	812.6[b]	384.4[a]	383.7	383.7
SEM	3.67	8.09	8.14	6.63	7.71	5.18
Protexin						
0	208.00	649.00	857.00	372.00	400.00	392[a]
R	204.00	644.00	848.00	372.00	396.00	389[a]
120%R	207.00	646.00	854.00	375.00	375.00	369[b]
SEM	4.5	9.9	9.9	8.1	9.4	6.4[1]

[1]The local currency, each dollar nearly equals 980 toman. [2]Meat production cost was calculated by dividing feed cost to weight gain (kg) in different growth period. [a-b]In each section, means within a column with no common superscript differ significantly ($p<0.05$).

shown in Table 2. Feed conversion ratio in the first period of the experiment (0 to 21 d of age) was significantly lower in birds consumed appropriate protein diets than birds fed low protein diets ($P<0.05$). However, protein level had no significant effect on feed conversion ratio related to the second period (21 to 42 d of age) and the whole period of the experiment. Rezaei *et al.* (2004) indicated that reducing dietary protein level did not significantly influenced feed conversion ratio. Although, protexin at 120% of the recommended level improved feed conversion ratio related to the first (0 to 21d of age) and the second (21 to 42 d of age) periods, this improvement was only significant ($P<0.05$) when considered at the whole period of the experiment (0 to 42 d of age). Improvement in feed conversion ratio due to protexin administration into the diet is likely related to the useful microorganisms, in particular *Lactobacillus spp*. that exist in the probiotic cocktail. It is likely that the ingested microorganisms have been able to colonize the gastrointestinal tract and help the establishment of a beneficial microflora. It has been suggested that probiotics do their beneficial effects via different ways including: production of some vitamins, enhancing digestion of the ingested feed via production of some digestive enzymes, competitive exclusion, production of organic acids and bacteriocines (Fuller, 2001; Jin *et al.*, 2000).

According to Table 3, there is a significant dietary protein protexin interaction regarding live weight and carcass weight ($P<0.05$). Given this, recommended protein-120% protexin group had the highest and low protein-recommended protexin group had the lowest live weight at the end of the experiment. These results indicated that addition of probiotic to the diet with appropriate protein level would improve weight gain and live weight of broiler chickens. Kabir *et al.* (2004) reported a significant increase in live weight of broiler chickens when protexin was added at 1.2 g/L to their drinking water. Neither dietary protein level nor protexin had a significant effect on carcass percentage.

As shown in Table 3, low protein diet significantly decreased the liver relative weight ($P<0.05$). Reduction in the liver relative weight due to decrease in dietary protein level can be related to more conversion of ammonia to urea in the liver, when consuming high protein diet, so that it can cause liver enlargement (Ferguson *et al.*, 1998). On the other hand, protexin administration into the diet caused a significant decrease in liver relative weight ($P<0.05$). Mohan and Christopher (1988) reported a significant decrease in liver relative weight due to Lactobacillus administration into diet of broiler chickens. Lactobacillus and other beneficial microorganisms, which are present in probiotics, can prevent pathogens from colonizing the gastrointestinal tract via competitive exclusion. With decrease in harmful microflora of the intestine, less toxic byproducts will be produced, so that the liver would be under a less pressure for detoxifying these byproducts.

There was no significant dietary protein level protexin interaction on feed cost (Table 4). Low protein diet caused a significant decrease in feed cost calculated for the second period (21 to 42 d of age) and the entire period of the experiment ($P<0.05$). Rezaei *et al.* (2004) showed a significant reduction in feed cost due to decrease in dietary protein level. Also, Rahman *et al.* (2002) used different levels of dietary protein and concluded that with decrease in dietary protein level, feed cost as well as meat production cost per kilogram decreased. In the present study, use of protexin at 120% of the recommended level caused a significant reduction in meat production cost ($P<0.05$) during the entire period of the experiment (Table 4).

Overall, these results showed that use of protexin as a probiotic compound could have beneficial effects regarding performance and economical out put of broiler chickens.

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