Journal of Animal and Veterinary Advances 10 (6): 709-711, 2011
ISSN: 1680-5593

Economic Value of Diets with Different Levels of Energy and Protein with Constant Ratio on Broiler Chickens

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Abstract: This study was conducted to evaluate the economic value of broiler chicken diet containing different levels of energy and protein with constant ratio. Three hundred sixty 1 day old commercial broiler chickens randomly were assigned to three experimental diets. Experimental diets were formulated to have 3 levels of CP and ME, in each feeding phase: 23, 21 and 20% CP with 3031.63, 2768 and 2636 kcal kg^{-1} in the starter phase (1-10 days); 22, 20 and 19% CP with 3174.25, 2886 and 2742 kcal kg^{-1} in the grower phase (11-25 days) and 20, 18 and 17% with 3224, 3063 and 2902 kcal kg^{-1} in the finisher phase (26-42 days). Therefore, the experiment diets were containing: 23, 22 and 20% CP and 3031.63, 3175.24 and 3224 kcal kg^{-1} ME; 21, 20 and 18% CP and 2768, 2886 and 3063 kcal kg^{-1}; 20, 19 and 17% CP and 2636, 2742 and 2902 kcal kg^{-1}, respectively for starter, grower and finisher. The ratio of energy and protein was constant at 131.81, 144.33 and 161.2 in the starter, grower and finisher periods, respectively. The 1 day old Ross-308 broiler chickens were randomly divided into 30 experimental pens, 12 chickens in each pen and each diet was offered to 10 replicates (pen) randomly. The results showed that in compared with control group cost (kg) of feed decreased with decreasing protein and energy in diets. At whole of experiment period (0-42 days), feed intake (4500.30 vs. 4226.46 g) and feed conversion ratio (2.27 and 1.89) in diet 2 was significantly more than control diet ($p<0.05$) but there was no significant difference with diet 1 ($p>0.05$). At whole period of experiment (0-42 days) linearly, the cost of meat production was higher in diets containing low levels of protein and energy ($p>0.05$) but in grower phase (11-25 days) the cost linearly decreased. Although, the low protein and energy diet was cheaper but as its FCR was higher (the worse) therefore the cost of 1 kg meat was more than control diet.

Key words: Protein, energy, constant ratio, economic value, broiler chicken, Iran

INTRODUCTION

The limited supply of good quality raw materials such as soybean meal, maize and cotton seed meal for the poultry feed industry has resulted in a continuous increase in the cost of production causing a phenomenal rise in the unit cost of products.

Thus, these products have become too expensive for the majority of the population in different regions (Tewe, 2003; Esonu *et al*., 2003). The aim of modern poultry enterprise is to reduce feed cost for optimal economic returns because feed constitutes approximately 70% of the total production cost. One of way to reducing the food cost is improvement in the feed efficiency of birds. While formulating a broiler diets, main emphasises are placed on Metabolize Energy (ME) and Crud Protein (CP) because ME itself comprises 70% of the total cost of feed and protein have major cost components in broiler diets.

Lowering CP and ME content of broiler diets may reduce feed cost and allow for use of alternate feedstuffs (Kamran *et al*., 2008).

MATERIALS AND METHODS

The study was conducted in three phases included starter (0-10 days), grower (11-25 days) phase and finisher (26-42 days). About 360 one day old commercial broiler chickens randomly were assigned to three experimental diets. Experimental diets were formulated to have 3 levels of CP and ME, in each feeding phase: 23, 21 and 20% CP with 3031.63, 2768 and 2636 kcal kg^{-1} in the starter phase (1-10 days); 22, 20 and 19% CP with 3174.25, 2886 and 2742 kcal kg^{-1} in the grower phase (11-25 days) and 20, 18 and 17% with 3224, 3063 and 2902 kcal kg^{-1} in the finisher phase (26-42 days). Therefore, the experiment diets were containing: 23, 22 and 20% CP and 3031.63, 3175.24 and

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3224 kcal kg^{-1} ME; 21, 20 and 18% CP and 2768, 2886 and 3063 kcal kg^{-1}; 20, 19 and 17% CP and 2636, 2742 and 2902 kcal kg^{-1}, respectively for starter, grower and finisher. The ratio of energy and protein was constant at 131.81, 144.33 and 161.2 in the starter, grower and finisher periods, respectively.

The 1 day old Ross-308 broiler chickens were randomly divided into 30 experimental pens, 12 chickens in each pen and each diet was offered to 10 replicates (pen) randomly. Diets were formulated according to National Research Council (1994) recommendations. Chemical compositions of diet ingredients are shown in Table 1.

The composition of the starter, grower and finisher diets is shown in Table 2. The average weight of chickens was 45 g and rose from day old to 6 weeks of age. During the experiment birds access *ad libitum* to water and feed. The economic evaluation was performed according to amounts of feed consumption and its cost and weight of chickens and its cost; the cost of 1 kg feed and 1 kg broiler meat at the end of experiment was calculated. Data were analyzed using the General Linear Models (GLM) procedure of SAS (SAS Inst., Cary, NC). The differences between the means of groups were separated by Duncans Multiple Range test.

RESULTS

Effects of different levels of energy and protein with constant ratio on economic value of growing broiler chicken are shown in Table 3. In comparison with control group, the cost of kg feed decreased with decreasing energy and protein in diets.

During starter phase (0-10 day), diets had no significant effect on feed intake ($p>0.05$). Also there was no significant difference in feed conversion ratio at the starter phase ($p>0.05$). There was no significant difference ($p>0.05$) between bird fed control diet with bird fed other diets for the cost of kg meat production. During the grower phase (11-25 days), the cost of kg meat production had significant difference ($p<0.05$) between experimental diets. The lowest feed intake and feed conversion ratio was belonged to bird fed control diets ($p<0.05$). In finishing phase (26-42 days), experiment diets had

Table 1: Chemical composition of diet ingredients (%)

	Nutrients						
Feed	DM	CP	CF	Fat	M	Ca	P
Maize corn	84.11	8.09	17.2	87.3	89.7	0.02	0.08
Soybean meal	74.92	44.88	29.7	43.1	26.7	0.29	0.27

DM: Dry Matter; CP: Crud Protein; CF: Crud Fiber; M: Moisture

Table 2: Composition of experimental diets (%)

	Starter diets			Grower diets			Finisher diets		
Ingredients	Control	1	2	Control	1	2	Control	1	2
Corn	54.06	58.29	55.48	54.90	61.57	55.27	53.87	61.20	67.95
Soybean meal-44% CP	39.73	36.56	34.88	37.15	33.63	32.49	32.25	31.40	28.00
Calcium carbonate	1.10	1.10	1.10	1.00	1.00	1.00	1.00	1.00	1.00
Sodium bicarbonate	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Soya oil	2.21	0.00	0.00	3.95	0.80	1.07	6.80	3.40	0.05
DCP	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60
Grit	0.00	1.15	5.64	3.85	5.64	6.24	3.85	5.64	6.24
Vitamin premix	0.28	0.28	0.28	0.38	0.38	0.38	0.38	0.38	0.38
Mineral premix	0.28	0.28	0.28	0.38	0.38	0.38	0.38	0.38	0.38
Salt	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
DL-Methionine	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
L-Lysine	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Chemical composition									
ME (Kcal kg^{-1})	3031.63	2768.00	2636.00	3174.26	2886.00	2742.00	3224.00	3063.00	2902.00
Protein (%)	23.00	21.00	20.00	22.00	20.00	19.00	20.00	18.00	17.00
Ca (%)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P (%)	0.45	0.45	0.45	0.35	0.35	0.35	0.35	0.35	0.35
Lysine (%)	1.29	1.29	1.29	1.10	1.10	1.10	1.10	1.10	1.10
Met. + Cys. (%)	0.82	0.82	0.82	0.70	0.70	0.70	0.70	0.70	0.70

DCP = Di-Calcium-Phosphate; Met.+Cys. = Methionine+Cysteine; ME = Metabolisable Energy; Diet 1) 23, 22 and 20% CP and 3031.63, 3175.24 and 3224 kcal kg^{-1} ME; Diet 2) 21, 20 and 18% CP and 2768, 2886 and 3063 kcal kg^{-1} and Diet 3) 20, 19 and 17% CP and 2636, 2742 and 2902 kcal kg^{-1}, respectively for starter, grower and finisher. Vitamin-mineral premix: Supplied per kilogram of diet: vitamin A, 8,050 IU; cholecalciferol, 1,800 IU; vitamin E, 20 IU; vitamin K3, 5.1 mg; thiamin, 2.4 mg; riboflavin, 8.2 mg; pantothenic acid, 15.3 mg; pyridoxine, 3.1 mg; cobalamin, 0.02 mg; niacin, 32 mg; choline chloride, 1,000 mg; biotin, 0.20 mg; folic acid, 1.2 mg; Mn, 68 mg; Fe, 85 mg; Zn, 58 mg; Cu, 8.6 mg; I, 0.27 mg and Se, 0.20 mg

Table 3: Economic evaluation: the effects of different levels of energy andprotein with constant ratio on cost of feed and meat

	Diets			
Items	Control	1	2	SEM
Starter				
C_f (Rial[1])	3220.00[a]	3154.00[b]	3138.00[c]	-
FI (g)	267.35	290.80	265.20	12.9700
FCR	1.21	1.36	1.39	0.0740
C_m (Rial)	3917.00	4307.00	4380.00	0.3510
Grower				
C_f (Rial)	3271.00[a]	3159.00[b]	3085.00[c]	-
FI (g)	1176.50[a]	1185.50[a]	1216.60[b]	25.4700
FCR	1.54[a]	1.55[a]	1.98[b]	0.0180
C_m (Rial)	7021.00[a]	6397.00[b]	6100.00[c]	0.9630
Finishing				
C_f (Rial)	3675.00[a]	3266.00[b]	3110.00[c]	-
FI (g)	2822.61[b]	2837.90[b]	3018.50[c]	20.5100
FCR	2.24[a]	2.22[a]	2.57[b]	0.0120
C_m (Rial)	5088.00[a]	5666.00[b]	6157.00[c]	0.7460
Whole period				
C_f (Rial)	3219.00[a]	3057.00[b]	3016.00[c]	-
FI (g)	4226.46[b]	3414.20[b]	4500.30[a]	25.4700
FCR	1.89[a]	1.93[a]	2.27[b]	0.0140
C_m (Rial)	6885.00[a]	7191.00[b]	7774.00[c]	0.9141

1$ = 10371 Rial; FI = Feed Intake; FCR = Feed Conversion Ratio; C_f = the cost of 1 kg feed; C_m = the cost of 1 kg meat production; SEM = Standard Error of Means; Diet 1) 23, 22 and 20% CP and 3031.63, 3175.24 and 3224 kcal kg^{-1} ME; Diet 2) 21, 20 and 18% CP and 2768, 2886 and 3063 kcal $^{-1}$kg; Diet 3) 20, 19 and 17% CP and 2636, 2742 and 2902 kcal kg^{-1}, respectively for starter, grower and finisher

significant effect on the cost of kg meat production ($p<0.05$). The lowest feed intake and feed conversion ratio was belonged to bird fed control diet ($p<0.05$).

At whole of experiment (0-42 days) there was significant differences ($p<0.05$) in feed intake between control group and diets 1 and 2. The birds fed control diet had the lowest feed intake than control and other trial group. Feed conversion ratio of experimental diets were significantly different, diet 2 had highest (the worse) feed conversion and bird fed control diet had best feed conversion than other group. The cost of each kg of feed was significantly different ($p<0.05$) between diets and the cost of feed decreased with decreasing energy and protein. The cost of kg meat production was higher with decreasing energy and protein in diets ($p<0.05$).

DISCUSSION

In compared with control group, the cost of kg feed decreased with decreasing energy and protein in diets, this could be attributed to dearth of the energy and protein sources. There was significant differences ($p<0.05$) in feed intake between control group and diet 3 that was agreed with finding of Kamran *et al.* (2008) and Hidalgo *et al.* (2004). In fact, the feed conversion ratio value that is the most sensitive factor in assessing performance, significantly increased, an indication of poor utilization of diets by the birds because probably due to low energy and protein diets compared to the basal diet. The results agreed with what obtained by Ojewola and Ozuo (2006), Hussein and Alhadrami (2003), Ezieshi and Olomu (2004) and Kamran *et al.* (2008). The results obtained from cost of kg meat production contradicted by report of Hosseini, they reported when diets with lower energy and protein was used, the performance and economic parameters considered were better than all the other diets including the control diet. Also, the results of present experiment agreed with reports of Kamran *et al.* (2008) who reported that decreasing ME and CP levels (23-20%) resulted in reduced feed cost per kg and which clearly indicated that this approach was useful. But the cost of meat production increased as the result of increasing the FCR in low protein and energy diets.

CONCLUSION

Therefore, using low energy and protein diets reduced the cost of diets but increased the meat cost.

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