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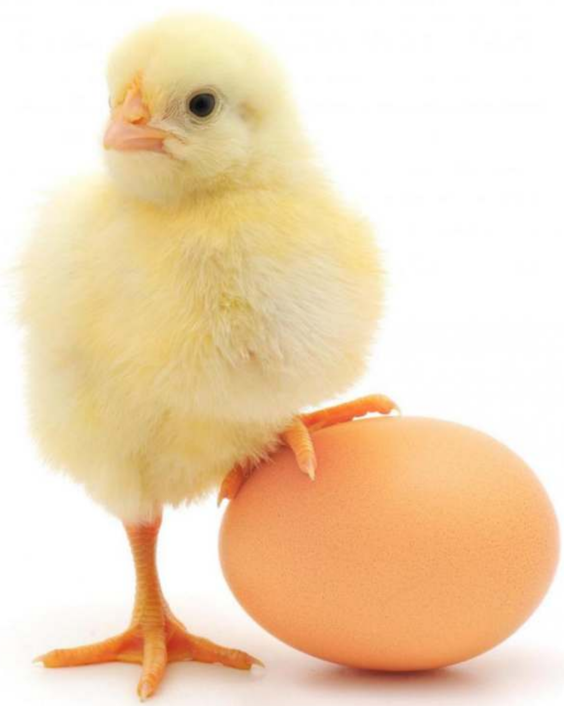

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The Optimum Protein Content in High-Energy Starter Diet for Chukar Partridge (*Alectoris chukar chukar*)

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Abstract: The optimum protein content in high-energy starter diet was investigated in the experiment. The birds were fed one of the 6 isocaloric (3200 kcal/kg Metabolizable energy) diets containing 18, 20, 22, 24, 26, and 28 % protein from hatch to 8 weeks of age. Body weight, feed consumption and feed conversion ratio of partridges were examined in the experiment. There were no significant effects of the protein content in high-energy starter diet on the body weight at any age. According to the result of the present experiment chukar chicks does not need high protein in high-energy starter diet when with supplemented methionine and lysine. The best results of feed conversion and feed consumption were observed in partridges fed 24 % protein.

Key words: Chukar partridge, protein content, high energy, starter diet

Introduction

Quail are produced mainly for meat and eggs, with a few being released, while chukar partridge are raised both for release and for meat. For birds designed for release, fast growth or maximum body weight are not major considerations. This of course would not be true for birds raised for meat and egg production. Therefore, the feeding of game birds for reared meat and hunting requires a different regime (Leeson and Summers, 1991; Ensminger, 1992; Woodard *et al*., 1993; Özek, 2003). Bird management is a major consideration in selecting a feeding program for game birds (pheasant, partridge and quail).

Meat-type partridge management is aimed at achieving the targeted final body weight and high processing yield at minimum costs. The main factors determining the production cost of partridge are growth rate and feed cost per unit of growth. Feed contributes to about 60-70% of the total cost of game bird production (Vohra, 1993). One of the most expensive major nutrients in a poultry diet is its energy content. Energy alone contributes to about 70% of the total cost of poultry diets (Skinner *et al*., 1992). High-energy broiler diets are recommended to achieve maximum weight gain and optimal feed conversion ratio. Indeed, feed efficiency is influenced by changes in dietary energy concentration in two partially dependent pathways. Firstly, as dietary energy increases, less feed is taken in to satisfy the energy need. Secondly, growth rate is promoted by increasing levels of dietary energy (Jackson *et al*., 1982; Pesti *et al*., 1983; Donaldson, 1985; Plavnik *et al*., 1997; Yalçin *et al*., 1998; Dublecz *et al*., 1999).

High energy content will increase the total of feed cost. However, high dietary energy decreases feed conversion ratio (Scott *et al.,* 1982). Higher energy levels may allow for more rapid gains or for a greater quantity of meat to be produced in a given time so that capital cost of housing, equipment and labor may be reduced (Saleh *et al*., 2004). It has been demonstrated (McDonald and Evans, 1977) that a higher dietary energy level may be more economical if it provides for more rapid rate of gain and subsequently a greater number of flocks per year. The income from improved performance can more than compensate this extra feed cost. High-energy starter diet can enhances total performance and profitability of chukar.

More recently Özek *et al*. (2003) investigated the protein and energy contents of the starter and grower diets for chukar partridges. They recommended 2800 kcal/kg metabolizable energy 20 % crude protein in starter diet. The present experiment was a further step of this study conducted by Özek *et al*. (2003).

This study was conducted to determine optimum protein content in high-energy starter diet.

Materials and Methods

Housing and birds: This study was carried out at Selçuk University in Konya, Turkey. A total of 180 day-old chukar chicks (*Alectoris chukar chukar*) were used in the study. The chukar chicks were kept in multi-deck battery brooders at a density of 150 cm^2/bird from hatch to 8 weeks of age. The wire floor of each battery was covered with small mash matting for the first 2 weeks of the study. Temperature was set at 35°C during the first week and gradually reduced by 2.5°C per week to 25°C. Feed and water were offered *ad libitum*. The birds were kept under continuous fluorescent light.

Experimental treatments: Total birds were divided into six equal groups and were assigned to six dietary treatments. Each diet was fed to 30 birds with three replications and 10 birds were randomly placed in each replication.

Table 1: Ingredient and composition of the experimental diets

Ingredients (%)	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	Diet 6
Maize	50	47	43	40	32	29
Barley	6	5	4	2.55	3.2	2.5
Soybean meal	22.4	27	30	33.6	39.1	43
Sunflower seed meal	2.5	2	2.45	2	1	2.5
Cotton seed meal	4	2.8	3	3	4.9	2.5
Fish meal	1.65	3	4.5	6	5.8	7.3
Vegetable fat	8.1	8.3	8.7	9	10.3	10.3
Limestone	1.1	1	1	0.9	0.9	0.7
Dicalciumphosphate	2.3	2.15	1.8	1.6	1.6	1.17
Salt	0.5	0.5	0.5	0.5	0.5	0.5
Vitamin mix*	0.25	0.25	0.25	0.25	0.25	0.25
Trace mineral mix**	0.1	0.1	0.1	0.1	0.1	0.1
DL-methionine	0.4	0.35	0.3	0.25	0.24	0.18
L-lysine	0.7	0.55	0.4	0.25	0.11	-
Calculated Composition						
Crude protein	18.0	20.0	22.0	24.03	26.03	28.06
ME (kcal/kg)	3200	3202	3200	3201	3201	3200
Calcium	1.09	1.09	1.09	1.08	1.09	1.08
Available phosphorus	0.59	0.59	0.58	0.59	0.59	0.60
Lysine	1.57	1.57	1.57	1.58	1.57	1.59
Methionine	0.72	0.71	0.71	0.70	0.71	0.72

*Vitamin mix supplied (per kg diet): vitamin A, 1.000 IU; vitamin D_3, 3.500 IU; vitamin E, 100 mg; vitamin K_3, 3 mg; vitamin B_1, 3 mg; vitamin B_2, 6 mg; vitamin B_6, 5 mg; vitamin B_{12}, 0.03 mg; niacin, 45 mg; calcium pantothenate, 15 mg; folic acid, 1 mg; biotin, 0.15 mg; ethoxyquin (antioxidant), 150 mg. **Trace mineral mix supplied (mg/kg diet): iron, 60; manganese, 100; zinc, 60; copper, 5; iodine, 2; cobalt, 0.2; selenium, 0.15; choline chloride, 400.

Six test diets were formulated to contain six dietary protein levels of 18, 20, 22, 24, 26 and 28%. The ingredients used in the diets and calculated analyses are shown in Table 1. Energy content in all experimental diets was 3200 kcal ME/kg, in other word, all diets were isocaloric. Energy to protein ratios (ME kcal/kg ÷ % protein) of the 6 experimental diets were 178, 160, 145, 133, 123 and 114. Synthetic methionine and lysine were used to balance the methionine and lysine contents of the diets. Each diet contained methionine and lysine concentrations that met or exceeded the levels formulated.

Measurements: Body weights of birds were determined at 2, 4, 6, and 8 weeks of age. Feed consumption was measured for 0 to 2, 2 to 4, 4 to 6, and 6 to 8 week periods. Feed conversion ratios of birds were calculated at the same periods. Mortality was recorded as it occurred.

The data were analyzed using the General Linear Models procedure of ANOVA (Minitab, 1990). When significant differences among treatments were found, means were separated using the Duncan's new multiple-range test with a 5 % probability (Duncan, 1955).

Results and Discussion

Body weight, feed consumption and feed conversion ratio of partridges fed high-energy starter diet containing different level of protein are shown in Table 2. During to starter period, the body weight of chukar chick increased from approximately 14 g at hatching to nearly 300 g at 8 weeks of age. The rate of growth, continually increased during this period: body weight was triple in the second week of life; nearly triple during the fourth week. There were no significant effects of protein content on body weight. This results may be explained by the fact that low-protein diets supplemented with essential amino acids meet standart dietary recommendations. Lowering dietary protein content can lower the body weight. However, when low protein diets were supplemented with synthetic amino acid, body weight seemed to be unaffected. It has been shown that poultry fed commercial diets with a reduction of 2 percentage units of protein perform as well as better than poultry fed diets containing higher protein levels if the low crude protein diets are supplemented with the most limiting amino acids (lysine, methionine, and threonine) (Han *et al.*, 1992; Moran *et al.*, 1992; Kidd *et al.*, 1996; Lippens *et al.*, 1997).

Except during the 6 to 8 week period, feed consumption was not affected by the protein content and energy to protein ratio (Table 2). For the 6 to 8 week period, the partridges fed a diet containing 20 % protein consumed significantly more feed than partridges fed 18, 22, 24, 26 or 28 % dietary protein ($P<0.001$). At the same period, the partridges fed a diet containing 22 % protein consumed significantly more feed than those for the

Table 2: Body weight, feed consumption and feed conversion ratio of chukar partridge (birds number of each treatment:30)

	Protein levels, %							
	18	20	22	24	26	28	P values	SEM
Weeks	Body weight							
Hatch	14.4	14.3	14.3	14.4	14.3	14.2	0.059	0.04
2	40.8	45.0	44.6	47.6	43.5	43.5	0.117	1.48
4	115.4	123.6	126.5	126.2	122.4	121.2	0.134	2.80
6	196.3	209.2	209.5	213.4	206.5	205.6	0.224	4.54
8	280.4	307.4	298.9	304.1	286.1	279	0.115	8.25
	Feed consumption, g							
0-2	70	66.6	66.9	70.2	66.8	69.9	0.157	1.29
2-4	179.6	182.5	173.4	169.6	171.8	171.6	0.105	3.34
4-6	262.2	257.2	255.4	244.3	256.9	258.0	0.148	4.24
6-8	291.1[c]	308.1[a]	301.7[b]	293.3[c]	294.3[c]	290.2[c]	<0.001	2.00
0-8	802.9	814.4	797.4	777.4	789.8	789.7	0.121	8.57
	Feed conversion ratio, g feed / g wieght gain							
0-2	2.6[a]	2.2[bc]	2.2[bc]	2.1c	2.3[bc]	2.4[b]	0.005	0.08
2-4	2.4[a]	2.3[ab]	2.1[c]	2.2[bc]	2.2[bc]	2.2[bc]	0.032	0.06
4-6	3.2[a]	3.0[ab]	3.1[a]	2.8[b]	3.1[a]	3.1[a]	0.047	0.08
6-8	3.5	3.1	3.4	3.2	3.8	4.1	0.213	0.27
0-8	3	2.8	2.8	2.7	2.9	3	0.113	0.09

[a, b, c]Treatment means within a row with superscripts differ significantly

partridges fed 18, 24, 26 or 28 % dietary protein. For the 0 to 8 week period, the lowest and highest feed consumption was found in partridges fed the diets containing 24 and 20 % protein, respectively. It has been reported that there isn't an effect of protein content on feed consumption of partridge (Özek *et al.*, 2003), but in contrast Woodard *et al.* (1977) reported that there was linear relationship between feed consumption of pheasant and dietary protein content. The feed consumption results of present study are not in agreement with result reported by Woodard *et al.* (1977). The protein content of the diet had a significant effect on the feed conversion ratio for the 0 to 2, 2 to 4, and 4 to 6 week periods (Table 2). For the 0 to 2 week period, the feed conversion ratio of the group fed a diet containing 18 % protein was significantly poorer than those for the groups fed 20, 22, 24, 26 or 28 % protein ($P<0.01$). At the 2 to 4 week period, feed conversion ratio of partridges fed a diet containing 18 % protein was significantly poorer than those for the partridges fed 22, 24, 26, and 28 % dietary protein ($P<0.05$). It has been reported that body weight and feed conversion ratio of partridges fed a starter diet containing 16 % protein are poorer than those for partridges fed 20, 24 and 28 % dietary protein (Özek *et al.,* 2003). In the present experiment, the best result was observed in partridges fed 24 % protein diet. For the 0-8 week period, feed conversion ratio was highest in the 18 and 28 % protein groups, and lowest in the 24 % protein group.

Protein content of the diet did not influence mortality. Mortality of the groups fed 18, 20, 22, 24, 26, and 28% dietary protein was 11, 9, 12, 10, 10, 13, respectively.

Conclusions: According to the results of the present experiment, body weights of partridges are not affected by protein content of high-energy starter diet. Feed consumption of partridges tend to decreasing, as protein content increased. The best results of feed conversion and feed consumption were observed in partridges fed 24 % protein. There was no adverse effect of protein content on mortality.

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