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Effect of Different Dietary Levels of Energy and Protein on Performance of Japanese Quails (*Coturnix coturnix Japonica)*

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Abstract. An experiment was conducted to evaluate the effects of feeding diets containing different levels of metabolizable energy (2900 and 2700 kcal ME kg^{-1}) and crude protein (high, medium, low, very low) on performance of Japanese quail. 1600 day old quail chicks were assigned into 32 groups of 50 chicks each. Four replicates were allocated to each dietary treatment, randomly. In each level of energy, crude protein levels of high, medium, low and very low were 26, 24, 22, 20%, in the starter period (0-14 d), 24, 22, 20, %18 in the grower period (15-28 d), and 22, 20, 18 and 16%, in the finisher period (29-49 d). There were no significant effects of dietary ME levels on body weight at d 49, daily gain, feed intake and FCR during the whole experimental period (0-49d of age). Nevertheless, increasing dietary protein in different stages of grwoth from very low to low, medium and high levels significantly ($P<0.05$) increased body weight and daily weight gain of the birds. Generally, the results indicated that feeding Japanese quail during the starter, grower and finisher periods using diets containing 2700 kcal/kg ME and low levels of protein (22, 20 and 18%, respectively) is recommendable to achieve a suitable performance.

Keywords: Japanese quail , Metabolizable energy , Protein , Performance

1. Introduction

During the recent years quail production has shown increasing importance because quails have early sexual maturity, rapid growth rate and small body size, which results in lower necessity of housing sapce and feed. A protein source of high quality with adequate amino acid balance is one of the most important nutrients for quail. Soares et al. [7] evaluated five dietary crude protein levels (16,18, 20, 22 and 24%) in the rearing period of Japanes quail (*Coturnix coturnix japonica*) and concluded that protein levels had no effects on feed intake and feed conversion ratio. They estimated that CP requirement for rearing period of Japanes quail is 23.08%. Hyankova et al. [3] also repoted that Japanes quail fed 26 and 21.6% CP had a good performance from 1 to 21 and 22 to 35 d of age, respectively. Thus, their requirements decrease with age, similar to other aniaml species [7]. Generally the CP content in diets of growing quails ranges from 24 to 27% [6], [10]. The response of growing quails to dietary levels of essential amino acids at different energy levels on growth and immunity were investigated by Kaur et al. [5]. They concluded that the optimum level of dietary ME is 2700 kcal kg^{-1} with CP 25.83% for gain and 3100 kcal kg^{-1} with CP 25.83% for optimum feed conversion during 0-5 weeks of age. The present study was performed to investigate the effect of different dietary levels of protein at two energy levels on performance of growing quails.

2. Material and methods

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A total number of 1600 day-old quail chicks were weighed and randomly distributed into 8 treatments with four replicates of 50 chicks each. All groups were subjected to similar management practices throught the experimental period (0-49 d of age). Eight corn-soya dietary treatments were formulated with two levels of energy (2700 and 2900 kcal kg^{-1}) and four levels of protein ((high, , medium, low, very low) in 2×4 factorial design (Table1). Accordingly, in each level of energy, crude protein levels of high, medium, low and very low in the starter period (0-14 d) were 26, 24, 22, 20%, in the grower period (15-28 d) 24, 22, 20, 18% and in the finisher period (29-49 d) were 22, 20, 18 and 16%, respectively. Dietary levels of methionine and lysine were decreased with decreasing levels of CP in the diets.

Table 1: Eight dietary treatments used in the experiment

			Age (day)		
			0-14	15-28	29-49
Treatmnet Number	Dietary ME (kcal kg^{-1})	CP level	Dietary CP(%)		
1	2900	High	26	24	22
2	2900	Medium	24	22	20
3	2900	Low	22	20	18
4	2900	Very low	20	18	16
5	2700	High	26	24	22
6	2700	Medium	24	22	20
7	2700	Low	22	20	18
8	2700	Very low	20	18	16

The data of body weight, feed intake, feed conversion ratio (FCR) and weight gain (WG) were recorded and calculated at weekly intervals. The data obtained from the experiment was analysed using the GLM procedure of SAS [11]. If any differences in treatment means were detected by ANOVA, Duncan multiple mange test was applied to separate means. Statements of statistical significance are based on a probability of $P<0.05$.

3. Results and Discussion

The effect of different dietary levels of energy and protein and their interaction on body weight, feed intake and feed conversion ratio (FCR) of growing quails for different growth phases are shown in Table 2.

3.1. Feed intake

Dietary energy levels did not affect average feed intake, except for days 29-49, body weight and FCR. However, decreasing ME content of finisher diet (29-49 d of age) from 2900 to 2700 kcal kg^{-1} resulted in an increase of average feed intake from 24 to 25.7 g day^{-1}. It seems that a higher feed intake with decreased dietary energy concentration was due mainly to compensate energy intake, partially in finisher phase in which chick energy requirements is relatively higher than starter and grower phases. Kaur et al. [5] also reported that feed intake of Japanease quails increased linearly with the decrease in dietary energy from 3100 to 2900 and 2700 kcal ME kg^{-1} during 0-3 or 0-5 weeks of age. Barque et al. [1] found that influence of different dietary energy (2600, 2800 and 3000 kcal ME kg^{-1}) on feed intake of Japanese quail were not significant. However, the birds fed on ration containing 3000 kcal ME kg^{-1} apperantly consumed less feed as compared to 2800 and 2600 kcal ME kg^{-1}. Dietary protein concentration did not affect average daily feed intake in the first (0-14 days), third (29-49 days) and the whole rearing (0- 49 days) periods, wherase in the second rearing period (15-28 days) the highest daily feed consumption was observed in the group fed high level of protein ($P< 0.05$). These results are in agreement with the findings of Tarasewicz et al. [8] who reported that a lowered level of protein in fodder did not affect average quail feed intake in the whole rearing period (0-42 days).

3.2. Body weight

One-day chicks were in a similar body weight ranging from 7.2 to 7.3 g. The average live body weight in quail chicks fed on 2700 or 2900 kcal ME kg^{-1} were similar at 14, 28 and 49 days of age (Table 2). It is in agreement with the reports of Barque et al. [1] who showed that weight gain of quail chicks was not affected by various levels of energy (2600, 2800 and 3000 kcal ME kg^{-1}). On the other hand, body weight of quail chicks particularly at early age (14 and 28 days) was significantly influenced by dietary protein level ($P<$

0.05). Mean body weight in the high protein group was higher than medium, low and particularly very low protein groups (P < 0.05). Wherase, these differences in the body weights were not reflected on day 49 of life , being simillar in high, medium and low protein groups (Table 2) but lower by about 13 g when compared to that of high protein group (P< 0.05). It showes the importance of dietary protein and also amino acid concentrations in starter (0-14 d) and grower (15-28 d) than finisher period (29-49 d) in the quail chicks.

Tarasewicz et al. [8] also observed that feeding low protein level and maintaining a similar level of lysine and methionine caused a final lower body weight, by 4.4 to 4.7% in the quail of both medium and low protein groups when compared to high protein group. However, in the current research regarding final body weight at 49 d of age (Table 2) it seems that feeding quail chicks on diets containing medium and low protein gurantee to achieve an acceptable final body weight. Wherase feeding on very low protein diet reduced final body weight by 6% compared to high protein diet. In the experiment of Vohra and Roudybusk [9] and Tarasewicz et al. [8], quail fed diet containing very low protein level weighed significantly lower than high protein group in the 6 week of life (120 and 159.17 g vs 130 and 167.04 g, respectively).

Table 2: Effect of different dietary energy and protein levels on performance of growing quails at different phases

Trait	Feed intake (g d^{-1})				Body weight (g)			Feed conversion ratio (g/g)			
Age (day)	0-14	15-28	29-49	0-49	14	28	49	0-14	15-28	29-49	0-49
Main Effects											
ME (kcal kg-1)											
2900	5.9	15.3	24.0^{b}	15.5	39.3	117.3	210.1	2.58	2.76	5.21	3.67
2700	5.7	15.25	25.7^{a}	15.8	38.6	115	208.4	2.54	2.82	5.55	3.76
SE	0.08	0.32	0.31		0.48	1.82	2.26	0.03	0.06	0.12	0.04
Protein level											
High	5.9	16.8^{a}	25.1	16.4	41.4^{a}	129.7^{a}	215.5^{a}	2.44^{b}	2.67^{b}	5.85^{a}	3.77
Medium	5.81	15.1^{b}	25.08	15.5	39.2^{b}	113.5^{bc}	208.2^{ab}	2.54^{ab}	2.86^{ab}	5.33^{b}	3.69
Low	5.7	14.9^{b}	25.1	15.4	38.4^{bc}	114.8^{b}	210.9^{ab}	2.57^{ab}	2.65^{b}	5.26^{a}	3.62
Very low	5.7	14.7^{b}	24.2	15.4	36.8^{c}	106.5^{c}	202.4^{b}	2.68^{a}	2.96^{a}	5.07^{b}	3.78
SE	0.12	0.46	0.44	0.32	0.67	2.58	3.19	0.04	0.09	0.17	0.0
Interaction effects											
Energy* Protein											
2900*high	5.9	17.3^{a}	24.4^{bc}	16.4	42.3^{a}	132.3^{a}	218^{a}	2.35^{c}	2.69^{ab}	5.72^{ab}	3.73
2900*Medium	5.98	15.4^{abc}	23.6^{c}	15.3	40.2^{abc}	115.3^{b}	207.4^{ab}	2.54^{bc}	2.88^{ab}	5.13^{bc}	3.67
2900*Low	5.8	14.1^{c}	24.2^{bc}	15.3	38.2^{bcd}	113.8^{b}	209.8^{ab}	2.65^{ab}	2.62^{b}	5.10^{bc}	3.62
2900*very low	5.8	14.4^{bc}	23.8^{c}	15.2	36.9^{d}	107.7^{b}	205.2^{ab}	2.78^{a}	2.83^{ab}	4.89^{c}	3.67
2700*high	6	16.4^{ab}	25.7^{abc}	16.4	40.5^{ab}	127^{a}	213.1^{ab}	2.52^{bc}	2.65^{b}	5.98^{a}	3.81
2700*medium	5.6	14.7^{bc}	26.5^{a}	15.6	38.1^{bcd}	111.8^{b}	209.1^{ab}	2.55^{bc}	2.84^{ab}	5.54^{abc}	3.71
2700*low	5.6	14.8^{bc}	26.0^{ab}	15.5	38.5^{bcd}	115.8^{b}	211.9^{ab}	2.50^{bc}	2.68^{ab}	5.42^{abc}	3.62
2700*very low	5,	15^{bc}	24.6^{abc}	15.6	37.2^{cd}	105.2^{b}	199.5^{b}	2.59^{ab}	3.09^{a}	5.24^{abc}	3.89
SE	0.17	0.65	0.63	0.45	0.96	3.64	4.52	0.06	0.13	0.24	0.08

3.3. Feed conversion

In the present study dietary energy levels did not induce any influence on average feed conversion ratio (FCR) at any growth phases (Table 3) which was in contrast with earlier findings of Kaur et al. [4,5] and Elangovan et al. [2] who repoted an improvement of FCR in growing quails with increasing dietary enegy level. The FCR differed significantly during starter (0-14 d), grower (15-28 d), finisher (29-49 d) and the whole rearing period (0-49 d of age) due to dietary CP level. The FCR emerged at medium and low levels of protein, remained statistically similar to high protein level, but was poorer (P<0.05) in very low protein level during 0-14 and 15-28 days of age. Kaur et al. [4,5] also reported that FCR improved with increasing essential amino acid levels only during early growth phase (0-3 weeks of age). An improved FCR and energy efficiency with the increased level of CP or amino acids were also observed in guinea fowls during initial growth period [12].

On the other hand, the FCR improved linearly with decreasing dietary protein level at finsher phase (29-49 d) and the best (P<0.05) FCR emerged from very low protein comapred to high protein diet (5.07 vs. 5.85). An improvement in FCR in growing quails with increasing dietary energy level or increasing dietary enegy to protein ratio have also been reported earlier [5, 2]. The improved FCR during last phase of rearing period (29-49 d) might be due to the ability of aged Japanese quails to retain more energy as fat in body tissue, which had been supported particularly by diet containing 2900 kcal ME kg^{-1} and very low level of protein. Dietary levels of energy and protein and their interaction did not influence on FCR in the whole

experimental period (0-49 d of age). However, in both levels of energy (2700 and 2900 kcal ME kg^{-1}) the best FCR was emerged from the birds fed low protein diets.

4. Conclusion

It can be concluded that the optimum level of dietary ME is 2700 kcal kg^{-1} with low protein levels during starter (0-14 d), grower (15-28 d) and finisher (29-49 d) periods (22, 20 and 18% CP, respectively) to achieve optimum average gain and feed conversion during 0-49 d of age in Japanese quail.

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