Brazilian Journal of Poultry Science
Revista Brasileira de Ciência Avícola

ISSN 1516-635X May - Aug 2003 / v.5 / n.2/ 153 - 156

Protein Requirement of Japanese quail (*Coturnix coturnix* japonica) During Rearing and Laying Periods

■ **Author(s)**

Soares R da TRN[1]
Fonseca JB[2]
Santos AS de O dos[3]
Mercandante MB[4]

1 - Associate Professor LZNA/CCTA/UENF.
2 - Professor LZNA/CCTA/UENF.
3 - Graduate Student, Animal Production.
4 - Technique Nivel Superior LZNA/CCTA/UENF.

■ **Mail Address**

Rita da Trindade Ribeiro Nobre Soares

Av. Alberto Lamego 2000
Horto. LZNA/CCTA/UENF
Campos dos Goytacazes - RJ, Brazil
28015-620

E-mail: rnobre@uenf.br

■ **Keywords**

crude protein, egg production, Japanese quails.

Note: Part of the data presented here were shown as a short communication in the XII Brazilian Animal Science Meeting in Rio de Janeiro (ZOOTEC'2002).

Arrived: july 2002
Approved: february 2003

ABSTRACT

Two completely randomized trials were conducted to estimate protein requirements of Japanese quails during the rearing and laying periods. In each trial, 150 quails were distributed in five treatments with five repetitions. Crude protein levels in the rearing period were 18, 20, 22, 24 and 26% (Trial 1) and during the laying period were 16, 18, 20, 22 and 24% (Trial 2). A quadratic effect of protein level was observed on weight gain from seven to 35 days (Trial 1). There were no effects of protein levels on feed intake and feed conversion. Protein levels in experimental diets during rearing had no effect on egg production up to 63 days. However, laying was delayed and variation in body weight was greater in quails fed lower protein levels. In Trial 2, a quadratic effect of protein levels was seen on egg production and feed conversion; and a linear effect was seen on mean egg weight and feed intake. Crude protein levels of 23.08% and 21.95% were estimated by regression equations for rearing and laying, respectively.

INTRODUCTION

Quail production has shown increasing importance in Brazil because quails show early sexual maturity and have small body size, which results in lower necessity of housing space and feed.

However, most of the data on nutritional requirements were obtained in other countries that have different climatic conditions, preventing that an adequate feeding program is established. It is important to determine more precisely the nutritional requirement of quails raised in Brazil. Although data not produced in our country can be used in feed formulation for quails, this might result in lower productivity and poor economic performance due to the use of a possible excess of some nutrients in the diet.

Protein of high quality with adequate amino acid balance is one of the most important nutrients for quails. It is also one of the most expensive nutrients. Excessive protein intake results in higher nitrogen excretion and lower feed efficiency for egg production.

Four crude protein levels (20, 22, 24 and 26%) were evaluated for Japanese quails and it was concluded that after lysine and methionine + cystine requirements were met, 20% crude protein level resulted in best performance from 1 to 42 days of age (Murakami *et al.*, 1993a).

Hyankova *et al.* (1997) reported that Japanese quails fed 26 and 21.6% crude protein had good performance from 1 to 21 and from 22 to 35 days of age, respectively. Thus, requirements decrease with age, similar to other animal species.

During the laying period, Murakami *et al.* (1993b) recommended 18% of crude protein, which is lower than the level of 22.42% recommended by Pinto *et al.* (1998). Levels of 24 and 20% of crude protein are

recommended by NRC (1994) for quails in the rearing and production periods, respectively.

The objective of this research was to estimate crude protein requirements of Japanese quails in the growing and laying periods.

MATERIAL AND METHODS

Two trials were conducted in the Poultry Farm, Universidade Estadual do Norte Fluminense–UENF, R.J., Brazil, in order to estimate the crude protein requirements of Japanese quails in the growing period (Trial 1) and laying period (Trial 2).

In the first trial, 150 seven-day-old quails were distributed in a completely randomized design in five treatments and five repetitions, with six quails in each experimental unit.

Experimental diets (Table 1) were corn-soybean based and contained 18, 20, 22, 24 and 26% crude protein (CP) and 2,900 kcal metabolizable energy (ME). Diets were given *ad libitum* throughout the experimental period (seven to 35 days of age).

Laying birds were fed diets with 20% crude protein, 2.5% calcium, 0.35% digestible phosphorus and 2,900 kcal ME, as recommended by NRC (1994).

Feed intake (g/bird), weight gain (g) and feed conversion were evaluated in the period from seven to 35 days. Other characteristics were also evaluated, such as age at the first egg, egg production rate and variance of the weight gain for three laying period (up to 63 days of age).

In the second trial, 150 birds, 42-day-old, were distributed in a completely randomized design in five treatments and five repetitions, with six birds in each repetition. From one to 42 days of age, quails were fed a corn-soybean based diet with 24% crude protein and 2,900 kcal/kg ME. Body weight was evaluated at the beginning of the experimental period (42 days of age), which lasted up to 98 days of age.

Experimental diets with 16, 18; 20; 22 and 24% crude protein (Table 1) were fed *ad libitum* during two periods of 28 days each (periods 1 and 2). Birds were kept in a 17L:7D light schedule, and egg production (%), mean egg weight (g), feed intake (g/bird/day) and feed conversion (kg/kg) were evaluated.

In both trials, data were analyzed using the software SAEG (Universidade Federal de Viçosa, 2000). Crude protein requirements were estimated by regression equations.

RESULTS AND DISCUSSION

Data from Trials 1 and 2 are shown in Tables 2 and 3, respectively. In the first trial, there was a quadratic effect ($p<0.05$) of crude protein on weight gain, and a level of 23.08 % was estimated for maximum gain.

There was no significant effect ($p>0.05$) of crude protein levels on feed intake and feed conversion.

Estimated protein levels in this study were lower than the levels reported by other studies with quails at similar age. Lepore & Marks (1971) reported heavier quails at four weeks of age, when fed diets with 25%

Table 1 – Percentage composition of experimental diets (Trials 1 and 2) according to crude protein content.

	Trial 1 (7 to 35 days)					Trial 2 (42 to 98 days)				
Ingredients	**18**	**20**	**22**	**24**	**26**	**16**	**18**	**20**	**22**	**24**
Corn	70.22	65.25	59.85	52.83	45.98	70.2	64.15	57.43	50.70	43.98
Soybean Meal	27.06	32.10	37.57	43.34	49.10	21.90	27.50	33.14	38.73	44.43
Vegetal Oil	-	-	-	1.32	2.48	-	0.92	2.07	3.27	4.36
Limestone	1.31	1.29	1.26	1.22	1.18	5.14	5.48	5.44	5.41	5.37
Dicalcium. Phosphate	1.02	0.99	0.96	0.94	0.92	1.34	1.31	1.29	1.27	1.25
Salt	0.28	0.27	0.26	0.25	0.24	0.30	0.29	0.28	0.27	0.26
Vitamin Supplement[1]	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Mineral Supplement[2]	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Calculated Composition										
ME (kcal/kg)	2.970	2.918	2.886	2.870	2.872	2.863	2.866	2.869	2.874	2.872
Crude Protein (%)	**18.30**	**20.20**	**22.20**	**24.20**	**26.27**	**15.99**	**18.02**	**20.01**	**21.98**	**24.00**
Met + Cys (%)	0.602	0.650	0.697	0.740	0.793	0.538	0.587	0.633	0.679	0.727
Lys (%)	0.930	1.055	1.190	1.330	1.480	0.784	0.925	1.065	1.203	1.345
Ca (%)	0.863	0.863	0.860	0.860	0.852	2.40	2.50	2.50	2.50	2.50
Availabe P (%)	0.296	0.296	0.296	0.298	0.300	0.346	0.346	0.347	0.349	0.350

1 - Levels per kg: Vit. A – 4.840.000 IU; Vit. D_3 – 1.237.500 IU; Vit. E – 2.750 IU; Vit.K – 180mg; Vit.B_2- 3.135 mg; Vit. B_{12}- 6.875 mcg; Pantothenic acid – 3.850mg; Niacin – 12.100mg; Folic Acid - 110mg; Antioxidant-200mg. 2 -Levels per kg: Cu - 14.520mg; I - 990mg; Mn – 50.000mg; Se - 110mg; Zn –43.890mg.

Table 2 – Feed intake, weight gain and feed conversion of Japanese quails in the period from 7 to 35 days of age and egg production until 63 days of age according to the crude protein level of the diet (Trial 1).

Crude Protein (%)	Feed Intake (g)	Weight Gain[1] (g/bird)[1]	Feed Conversion (g/g)	Egg Production (%)
18	392.8	91.1	4.3	80.88
20	364.0	93.0	3.9	81.09
22	432.5	112.5	3.9	77.09
24	445.8	108.3	4.1	82.87
26	400.3	100.7	4.0	80.67
CV (%)	**8.0**	**9.0**	**10.0**	**7.0**

1- Quadratic effect ($p<0.05$) $y = -305.242 + 35.83x - 0.772x^2$, $r^2 = 0.74$

Table 3 – Egg production, egg weight, feed intake and feed conversion rate of Japanese quails according to the crude protein level of the diets (Trial 2), from 42 to 98 days of age.

Crude Protein (%)	Egg Production[1](%)	Feed Conversion[2] (kg/dz)	Feed Intake[3] (g/bird/day)	Egg Weight[4] (g)
16	51.6	0.58	19.44	8.24
18	59.5	0.48	18.59	8.85
20	72.3	0.42	21.08	9.23
22	76.7	0.44	23.00	9.23
24	69.6	0.48	23.82	10.04
Period 1[5]	59.10	0.48	21.4	9.10
Period 2[6]	72.70	0.48	21.8	9.13
CV (%)	**9.8**	**19.9**	**8.7**	**5.7**

1- Quadratic effect ($p< 0.5$). $y = - 255.5 + 30.034x - 0.684x^2$. $r^2 = 0.93$. 2- Quadratic effect ($p< 0.05$). $y = 3.32 - 0.278x - 0.0067x^2$. $r^2 = 0.79$. 3- Linear effect ($p < 0.05$). $y = 10.42 + 0.56x$. $r^2 = 0.97$. 4 - Linear effect ($p< 0.05$). $y = 5.13 + 0.20x$. $r^2 = 0.92$. 5- Period 1 – 48 to 70 days of age. 6 - Period 2 – 71 to 98 days of age

crude protein. Lee *et al.* (1977) evaluated protein requirements of Japanese quails in the growing period and reported better growth performance with levels of 24% to 32% CP. Shim & Vohra (1984) recommended 24% CP in diets for growing Japanese quails, which could be lowered to 20% after three weeks of age. On the other hand, the level recommended by Singh & Narayan (2002) was 24% between 4 and 5 weeks of age.

The levels of crude protein in the rearing diet had no effect on egg production up to 63 days of age. However, quails fed 18% CP during rearing began to lay four days later than quails fed higher protein levels. These data suggest that protein deficiency might have impaired the development of the reproductive system. It was observed that birds fed lower protein levels during the growing period had higher weight gain at 63 days of age. Mean values were 49; 39; 33; 34 and 36 g/bird for the levels of 18; 20; 22; 24 and 26% crude protein, respectively. It should be noted that all birds were fed 20% CP during the laying period, which is higher than protein levels in the diets fed during the growing period (18%). The higher protein intake at the beginning of the laying period might have allowed a compensatory gain of the birds.

In the second trial, it was seen a quadratic effect ($p<0.05$) of crude protein level on percentage egg production and feed conversion, with levels of 21.95% and 20.7% crude protein, respectively, estimated by regression analysis. There was a linear positive effect ($p< 0.05$) on feed intake and mean egg weight. Egg production was higher in period 1 (42 to 70 days of age) than in period 2 (71 to 98 days of age). Other parameters were not affected by periods ($p>0.05$)

Murakami *et al.* (1993b) and Pereira *et al.* (2000) reported better performance of laying quails when the birds were fed 18% CP, value much lower than found in this study.

Pires Jr (1981) reported that 20% CP determined the highest egg production rate, however, Pinto *et al.* (1998) found levels of protein requirement (22.42%) similar to that found in our study. Singh & Narayan (2002) also recommended 22% protein for quails in the production period. A higher level of protein requirement was reported by Vilar *et al.* (1991), who observed higher egg production when the quails were fed 24% CP in the diet.

Due to the linear effect of crude protein on mean egg weight, it was not possible to estimate the level that produces maximum egg weight, but data suggest

that higher diet protein is required to produce larger eggs.

Murakami & Furlan (2002) reported that egg size depends greatly on daily crude protein intake, since layers do not store large amounts of protein; thus, both protein diet level and feed intake are important to control protein intake as a function of egg production.

CONCLUSIONS

The findings of this study suggested that the levels of 23.08% and 21.95% of crude protein in the diet of Japanese quails are recommended for the rearing period (7 to 35 days) and laying period (42 to 98 days), respectively.

REFERENCES

Hyankova L, Dedkova L, Knizetva H, Klecner D. Responses in growth, food intake and food conversion efficiency to different dietary protein concentrations in meat-type lines of Japanese quail. British Poultry Science 1997; 38(5):564-570.

Lee TK, Shim KF, Tan EL. Protein requirement of growing Japanese quail in the tropics. Singapore Journal of Primary Industries 1977; 5: 70.

Lepore RD, Marks, HL. Growth rate inheritance in Japanese quail. Protein and energy requirements of lines selected under different nutritional environments. Poultry Science 1971; 50:1335-1341.

Murakami AE, Moraes VMB, Ariki J, Junqueira OM, Kronka SN. Níveis de proteína e energia para codornas japonesas (Coturnix coturnix japonica) em crescimento. Revista Brasileira de Zootecnia 1993a; 22(4):534-540.

Murakami AE, Moraes VMB, Ariki J, Junqueira OM, Kronka SN. Níveis de proteína e energia para codornas japonesas (Coturnix coturnix japonica) em postura. Revista Brasileira de Zootecnia 1993b; 22(4):541-552.

Murakami AE, Furlan AC. Pesquisas na nutrição e alimentação de codornas em postura no Brasil. In: 1º Simpósio Internacional de Coturnicultura; 2002; UFLA, Lavras, Minas Gerais. Brasil. p. 113-120.

NRC National Research Council. Nutrient Requirements of Poultry. National Research Council, National Academy Press, Washington, D. C., 9th Revised Edition, 1994.

Pereira TA, Silva YL, Figueiredo ACS. Diferentes níveis de proteína bruta e energia metabolizável na ração e o desempenho de codornas (Coturnix coturnix japonica) poedeiras. In: Reunião Anual da Sociedade Brasileira de Zootecnia 37; 2000. Viçosa, Minas Gerais. (CD ROM).

Pinto R, Ferreira AS, Albino LFT, Gomes PC. Níveis de proteína e energia para codornas japonesas em postura. In: XXXV Reunião Anual da Sociedade Brasileira de Zootecnia; 1998. FMVZ- UNESP – Botucatu – São Paulo. v. IV: 147-149.

Pires Jr JF. Diferentes níveis de proteína em rações de codornas em postura. [Trabalho de Graduação].Jaboticabal UNESP, 1981 25p.

Shim KF, Vohra P. A review of the nutrition of Japanese quail. World's Poultry Science Journal 1984; 40: 261-374.

Singh RV, Narayan R. Produção de codornas nos trópicos. In: 1º Simpósio Internacional de Coturnicultura; 2002; UFLA, Lavras, Minas Gerais. Brasil. p. 27-35.

Universidade Federal de Viçosa – UFV - 2000. SAEG (Sistemas para Análises Estatísticas e Genéticas). Viçosa, Minas Gerais. (versão 8.0).

Vilar EA, Reis OV, Sena DD. Efeito dos níveis de proteína sobre a produção de ovos e o desenvolvimento ponderal do ovário-oviduto em codornas (Coturnix coturnix japonica). In: Reunião Anual da Sociedade Brasileira de Zootecnia; 1991; João Pessoa, Paraíba. p.352.