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The effect of decreased crude protein diets on performance, immune response and carcass traits of Japanese quail chickens

Bahare Sharify Shayan[1*], Nima Eila[1], Hosein Norozian[1]

[1]*Department of Animal Science, Karaj Branch, Islamic Azad University, Karaj, Iran*

ABSTRACT

The aim of this study was evaluation of the effect of reduced protein diets on performance, immune responses and carcass traits of Japanese quails. One-day-old Japanese quail chicks (320) were randomly distributed into 16 cages (4dietary treatments×4 replicates) with 20 chicks in each experimental unit. Treatments were consisted of diets formulated with4 levels of crude protein (CP): A) 21% CP; B) 22%CP; C)23% CP; D)24% CP. Average feed intake, body weight gain and feed conversion ration of the quails within 6 wk of weekly were measured.At 35 d of age two bird of each replicate were inoculated intravenously with 0.2ml of a 1%suspension of SRBC (Sheep Red Blood Cell). Blood samples were collected at the end of period from wing vein. SRBC and white blood cells count were measured respectively by Micro titre Hemagglutination and Wright staining method. Two birds from each cage were slaughtered at 42 d. Body weight gain, feed intake and feed conversion ratio were significantly affected by different diets on 2wk and 6 wk ($p<0.05$).Different levels of protein did not significantly affect the carcass traits ($P\geq0.05$).The highest antibody titers to the non-replicating antigen, SRBC, and Heterophil to lymphocyte ratio were affected by different levels of protein. The results suggest that the reduced protein diets up to 21% crude protein had not adverse effect on quail performance, carcass traits and blood parameters.

Keywords: SRBC, Protein, Japanese quail

Introduction

One of the food products rich in protein and low values, having adipose tissues and a law graft resulting from high digestibility and also admissibility to all religions is poultry meat[12]. In the recent years, due to lower percentage and amount of poultry meat cholesterol, as well as the prevalence of bovine spongiform encephalopathy (BSE), consumer preference for poultry products has been increased, so that with other advantages associated with the poultry industry (requires less investment than cattle, being more efficient and quick yield) has been led to major investment sand growth in the poultry industry. According to anxiety about significant presence of cholesterol in egg products, and in order to diversification of consumer habits, breeding other birds such as quail that has good features is considered a need; that in some communities, has been well received by consumers [2] and these birds have a great interest in the bird's industrial breeding [13-18-25]; also it is used as a Lab flying [16].

Nutritional costs constitute about 65-70 per cent of production costs for poultry industry [6], and protein is one of the most expensive nutrients in poultry diets that its quality and quantity is considered as the main limiting factor of poultry performance and efficiency [5].This has come about a special look to reduce protein levels in Japanese quail chicks in both research and industry; therefore ,methods that increase the efficiency of protein utilization, that is reduce meat production per gram of protein intake, can play a key role in reducing the production cost in the quail breeding industry.

In quail, as in other species, level of dietary energy is considered as a determinant factor at performance. The bird's daily energy requirements depends on several factors such as growth rate, amino acid balance in the diet, race, place

and circumstances of the bird density. Compared to the amount of energy, quail sensitivity is much higher than the level of dietary protein. Protein provides the necessary amino acids for growth and egg production. A dietary protein requirement of quail is influenced by the amount of energy metabolism, and other components used in making the diet.

In the recent years, large-scale breeding of Japanese quail shows an increasing flow. So, principled and high-yield breeding of quails are required to have sufficient knowledge of all aspects of the education management as well as nutritional requirements of the birds' species.

Some research projects have been done in relation with effect of different protein diets on the performance of quails [5-10-11-14-15-19-27]. But in general, very little information is available about optimal protein level associated with optimal performance in Japanese quail; and also values reported by various researchers have an extensive range and a variable; hence this bird requires diets with high level of essential amino acids [23]. In recent years, researchers have focused on improving growth outlook and immune system in addition to feed costs reduction; because industrial development and accumulated of birds on closed hangers (high density per unit area), puts a lot of stress on them that will results in less efficient immune system and as a result increased susceptibility to pathogens. Therefore, in the conducted experiment, crude protein levels reduction of essential amino acid supplied dietsand its effect on performance; carcass traits and immune system of growing quail are studied [3-22].

MATERIALS AND METHODS

Three hundred and twenty day-old Japanese quail were randomly distributed into 4 treatments with 4 replicates of 20 birds. The birds were reared in cages of identical size (100×100 cm floor area and 80 cm height) for 42 days of experimental period.

All groups were subjected to similar management practices (brooding, lighting, feeding and watering) throughout the experiment except the diets offered. Quails were benefited from day-light (average 16 h/day) and water, and experimental diets were continuously available and room temperature was gradually decreased from37°C at first day to 23°C after 21 days of age. No vaccination was performed.

Diets were containing 4 protein levels: A) Diet with 21% crude protein B) Diet with 22% crude protein C) Diet with 23% crude protein D) Diet with 24% crude protein (recommended by National Research Council [18] all diets formulated to supply required essential amino acids according to measuring protein and amino acids in feeds by NIRA method [6-7] and Collaboration by Evonik Company [4] were included in the diets and the diets were formulated by BRILL software. Nutrients compositions of the diets except for protein for quails were based on the National Research Council [18] recommendations (Table 1).

All experimental diets were provided to the same extent in terms of metabolism energy, minerals and vitamins, and the only difference was in the amount of crude protein. Body weight gain, feed intake and feed conversion ration were measured every week. On Thirty-fifth day, two chickens from each experimental repeat (eight birds per experimental group) were chosen randomly and they received 0.2 ml of suspension of sheep red blood cells 1% injection in wing vein [3] using Syringe; the chick's head receiving SRBC were colored to distinguish them from other chicks.

The chicks were weighed on forty-second day, then approximately 2 ml of blood was taken under the wing vein using tubes impregnated with citrate anticoagulation and they were transferred to the laboratory to determine produced Patton against sheep red blood cell by Micro titre Hemagglutination method [25]. Also by the blood samples taken from the quails, on glass lams deploy was provided. Then the blood deploys by using Wright staining, were colored. Finally the percent and the proportion of each was determined by counting total of one hundred Heterophil, Lymphocytes, Monocytes and Eosinophil and after slaughtering them, internal organs of liver, spleen, Bursa of Fabricius gland, Pancreas, heart and abdominal fat were removed from the carcass and were weighed separately. All of the digestive system and reproductive system parts were removed from the body and carcass weight was also recorded to each individual is evaluated separately. The obtained data regarding growth performance, blood parameters and carcass characteristics were subjected to analysis of variance using one-way ANOVA procedure of SAS (2004)[20].

Table1. Ingredients and nutrient composition of experimental diets

Treatments	1	2	3	4
Ingredients (%)				
Corn	61.515	59.54	57.522	55.705
Soybean meal	34	34.7	35.4	36
corn gluten	0.75	2.1	3.5	4.8
DL-Methionine	0.19	0.166	0.145	0.123
Hcl-Lysine	0.248	0.217	0.186	0.155
L- Threonine	0.21	0.18	0.15	0.12
Dicalcium phosphate	1	1	1	1
Limestone	1.26	1.27	1.27	1.27
Vitamin premix°	0.25	0.25	0.25	0.25
Vitamin premix#	0.25	0.25	0.25	0.25
Salt	0.327	0.327	0.327	0.327
Calculated Analysis				
Metabolisable energy(kcal/kg)	2900	2900	2900	2900
Crude protein (%)	21	22	23	24
Calcium (%)	0.8	0.8	0.8	0.8
Available phosphorus (%)	0.3	0.3	0.3	0.3
Sodium (%)	0.16	0.16	0.16	0.16
Lysine (%)	1.3	1.3	1.3	1.3
Methionine (%)	0.5	0.5	0.5	0.5
Met + Cys (%)	0.83	0.85	0.86	0.88
Threonine (%)	1	1	1	1
Arginine (%)	1.38	1.4	1.47	1.48
Tryptophan (%)	0.25	0.25	0.258	0.269

°Vitamin premix content per kg: vitamin A, 10,000 U; vitamin D3, 5,000 U; vitamin E, 40 U; vitamin K3,3 mg; vitamin B1, 2 mg; vitamin B2,5 mg; vitamin B3, 40 mg; vitamin B5, 13 mg; vitamin B6, 3 mg; vitamin B9, 0.1 mg; vitamin B12,1.5 mg; vitamin H2, 0.1 mg;. #Mineral premix content per kg: Mn, 120,000 mg; Fe, 60,000 mg; Zn, 100,000 mg; Cu, 16,000 mg; I, 1,000 mg; Se, 0.300 mg; The remaining carrying wheat bran and calcium carbonate.

RESULTS AND DISCUSSION

The data about body weight gain is shown in Table2. A significant weight increasing in the second week within the protein level of 22% rather than 21% was seen, and this process in the sixth week within the protein level of 23% rather than 24% was seen too. In the entire period, attendance 3 with 23% protein has shown maximum weight gain numerically rather than other attendances. [23] levels of protein (18%, 20%, 22%, 24% and 26%) were studied on 150 quail chicks in the growth period and finally they proposed the protein level of 23/08% after regression equations as the best protein levels that the highest weight gain was observed in it, and also [5], there was not seen any significant difference in the weight increasing of experimental treatments in the growing quails during a 42-day experimental period. Effect of different protein levels on feed intake and Japanese quail FCR are shown in Tables 3 and 4 respectively.

In the sixth week and total period, treatments related to21 and 23 % Crude Protein had better improvement in feed intake reduction. We concluded that FCR of treatment related to 23% Crude Protein had improved rather than other treatments in the sixth week; and also in this week, treatments related to21% Crude Protein is stand on the second place. Among the research done in this field, such as [1-5-23] there was no significant difference between treatments according to feed intake and FCR; for example [9] who reported that feed intake did not differ significantly between the groups receiving levels of CP , too an improvement in feed conversion ratio in growing quails during 0-3 weeks of age with increasing dietary CP level was also reported earlier [9] may be the difference between the present studies to the previous studies is because of supplying essential amino acids and the difference in chosen diets [21].

Table2. Effects of different Protein levels on weight gain of Japanese quails (g).

	Body weight, g						
Protein level (%)	1_{th}wk	2_{th}wk	3_{th}wk	4_{th}wk	5_{th}wk	6_{th}wk	Whole period
21	14.1	32.43^{b}	49.1	49.5	34.9	25.8^{ab}	205.8
22	13.4	34.7^{a}	46.7	51.4	37.9	23.4^{b}	207
23	11.9	32.8^{ab}	46.8	49.5	35.4	23.8^{a}	210
24	12.8	32.8^{ab}	51.7	49.7	33.8	23.4^{b}	204.2
SEM	0.71	0.64	2.19	1.84	2.93	2.91	2.95
P-value	0.25	0.012	0.35	0.86	0.79	0.009	0.55

Different alphabetic words referred as existence of significant difference between treatments ($p \leq 0.05$).

Table 3. Effects of different Protein levels on feed intake of Japanese quails (g).

	Feed intake, g						
Protein level (%)	1_{th}wk	2_{th}wk	3_{th}wk	4_{th}wk	5_{th}wk	6_{th}wk	Whole period
21	30.8	86.2	107.2	163.8	147.9	194.3^{b}	730.3^{b}
22	30.4	88.5	111.3	167	144.7	214.8^{a}	756.8^{a}
23	31	86.3	105.4	159.7	150	191^{b}	723.4^{b}
24	30.2	87.7	109.6	164.3	148.8	207.5^{a}	748.2^{ab}
SEM	0.75	1.8	2.07	3.26	2.46	2.74	7.84
P-value	0.85	0.75	0.26	0.49	0.5	0.001	0.05

Different alphabetic words referred as existence of significant difference between treatments (p≤0.05).

Table 4. Effects of different Protein levels on feed conversation ratio of Japanese quails (g feed/g gain).

Protein level (%)	1_{th}wk	2_{th}wk	3_{th}wk	4_{th}wk	5_{th} wk	6_{th}wk	Whole period
21	2.2	2.7	2.2	3.3	4.3	7.6^{ab}	3.6
22	2.3	2.6	2.4	3.3	3.8	9.6^{a}	3.7
23	2.6	2.6	2.2	3.2	4.3	6^{b}	3.5
24	2.4	2.7	2.2	3.3	4.5	9.2^{a}	3.7
SEM	0.16	0.05	0.11	0.15	0.27	0.86	0.07
P-value	0.24	0.29	0.35	0.96	0.61	0.05	0.14

Different alphabetic words referred as existence of significant difference between treatments (p≤0.05).

Table 5.Effects of different Protein levels on antibody response toSRBC of Japanese quails

Protein level (%)	21	22	23	24	SEM	P-value
SRBC*	2^{ab}	2.5^{a}	1^{b}	1.7^{ab}	0.31	0.04

**serum haemagglutinintitres (log_2). Different alphabetic words referred as existence of significant difference between treatments (p≤0.05).*

Table 6.effects of different Protein levels on blood cells (hematology) of Japanese quails

Protein level (%)	H%*	L%	H/L	M%	E%	WBC(µl)
21	28^{b}	69.7^{a}	0.41^{b}	2.3^{ab}	0	28200
22	28.3^{b}	68.5^{a}	0.42^{b}	2.7^{a}	0.5	24900
23	33.7^{a}	63.8^{b}	0.53^{a}	0.8^{b}	0.5	25317
24	28.7^{b}	68.7^{a}	0.42^{b}	2.3^{ab}	0.3	26283
SEM	1.12	1	0.02	0.41	0.13	2295
P-value	0.04	0.02	0.03	0.1	0.12	0.88

**H: Heutrophil , L: Lymphocyte, H/L: Heterophil to Lymphocyte ratio, M: Monocyte, E: Eosinophil. Different alphabetic words referred as existence of significant difference between treatments (p≤0.05).*

Table7.Effects of different Protein levels on carcass traits of Japanese quails.

	yield						
Protein level (%)	Dressing percentage	Heart*	Liver*	Pancreas*	Abdominal fat*	Spleen*	Bursa of fabricius*
21	62.7	0.9	2.5	0.3	0.87	0.06	0.06
22	61.5	0.79	2.5	0.3	0.64	0.06	0.06
23	61.3	0.78	2.4	0.2	1	0.07	0.08
24	62	0.74	2.4	0.2	0.95	0.06	0.06
SEM	1.35	0.06	0.14	0.02	0.21	0.01	0.01
P-value	0.87	0.21	0.96	0.66	0.63	0.87	0.61

*Different alphabetic words referred as existence of significant difference between treatments (P<0.05).*organs are measured as relative weight of each organ to live body weight (%).*

In Table 5, theresults of the SRBC titre showed that chicks were received 23 % crude protein diet have been a significant reduction comparing with other treatments. The hematologic results (Table 6) shows: Heterophil and lymphocyte percentage in treatment 23 % Crude Protein is caused a significant increscent and reduction respectively to the other treatments. According to these assessed factors; Heterophil to lymphocyte ratio shows significant increscent rather than other treatments. Increasing of Heterophil percentage presents a tension within chicken and quail [8] and Heterophil to lymphocyte ratio also as a criterion to measure the tension is used. Percentage of monocytes on treatment23 % Crude Protein rather than other treatments is of significant reduction. There was not seen any significant difference in a separate study of factors related to Eosinophil and white blood cells numbers. Results for carcass traits in chickens that received different levels of protein are presented in Table 7. After examining the dressing percentage that is the most important economic trait of quail, there was no significant difference among treatments. The results of this study are contrary to [16]. Also after examining other inner organs

(heart, liver, pancreas, visceral fat, spleen, bursa of fabricius) we did not see any significant difference; similarly results [16] also showed that body organs were not affected by the level of protein.

CONCLUSION

In general, according to the results": reduction of crude protein diets for Japanese quail in the growing period using synthetic amino acid, does not create a significant reduction up to level of 21% and in the field of economic according to this fact that protein is the most expensive nutrient of dietary, will be economical. Except 23 % protein diet which showed adverse effects on performance and immunity parameters.

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