Effects of Dietary Protein Level on Egg Production and Hatchability in Japanese Quail(*Coturnix japonica*) in Khartoum State, Sudan

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ABSTRACT---- ***The influence of dietary protein level on Japanese quails feed intake and egg production wasstudied for 6 weeks in Khartoum State, Sudan. One hundred and eighty 65day oldbirds with an average body weight 157g, of Japanese quail breed were divided randomly into three dietary treatments (60 birds /treatment)with four replicates of fifteen birds each(ten females and five males). Average minimum and maximum temperatures during the experimental period were 26.1◦C and 38.9 ◦C, respectively. Parameters measured were feed intake, feed conversion ratio, egg production, mortality rate and hatchability.Three dietary treatments were used in this study which contained three different protein levels (20%, 22% and 24% for treatments A, B and C, respectively).All nutrients were calculated to meet the USA National Research Council Requirements (NRC, 1994) for Japanese quails.***

The results indicate that feed consumption was not affected by protein level, except for the six week where treatment A was significantly (P<0.05) highest compared to other treatments. Feed conversion ratio ranged between 3.5-5.7 and the best feed conversion ratio was found in treatment B .Generally, egg production was highest in treatment B but the difference was not reach the significant level. Dietary protein level had no effect on egg weight and hatchability. Dietary protein level 22% was considered to be the best level under Sudan condition.

Keywords---Protein level, egg production, Japanese quails, Performance, Sudan

1. INTRODUCTION

Quails are in the family Phasiandae with pheasants and partridges. They are divided into new and old world Quail subfamilies and the latter includes the Japanese Coturnix (*Coturnix japonica*) and the Chinese Painted Quail (*Coturnixchinesis*). They are domesticated and bred for thousands years. Japanese and Chinese Painted Quail are ground dwellers and used for egg and meat production. It inhabits East Asia, Russia and some parts in Africa including the Nile River Valley from Kenya to Egypt [1]. Quail meat and eggs have high quality protein and biological value and low calori[2].

Quail eggs contained high nutritional contents of amino acids, fatty acids, vitamin E, sex hormone P and minerals of nitrogen, iron and zinc [3].Egg weight is important for hatchability [4], chick weight [5] and early mortality [6].Egg weight increased with age [7] with a high genetic correlation between live weight and egg weight [8]. Live weight, male: female and age significantly affected fertility and hatchability and fertility increased with live weight[7]. According to Santos[9]daily feed intake was 25.86-28.74g, feed conversion ratio (kg/kg) was 2.31-2.55 and 0.34-0.38kg/dozen, laying % was 90.18-92.32, egg weight 12.07-12.3g. Quail type influenced daily feed intake, feed conversion and egg weight [9].The shortage of animal protein intake among the everincreasing human population in the third world countries has long been recognized and remains one of the greatest issues of concern today [10]. Therefore, there is need

to widen the scope of poultry meat and egg by focusing more attention on the relatively unutilized poultry species called quails which has great potentials to ensure a sustainable supply of the additional needed meat and egg.

A lot of poultry farmers in Sudan lack the detailed knowledge and capacity on the profitable production of both meat and egg from quail birds. Nutrient requirements established under temperate conditions may not be entirely satisfactory in the tropical environment [11].

This experiment was conducted to determine the effect of protein level on egg production and hatchability in Japanese quail.

2. MATERIALS AND METHODS

This experiment was carried out in the Animal Production Research Centre at Kuku, Khartoum North, Khartoum State, Sudan. Minimum and maximum temperatures outside the poultry unit were 26.1°C and 38.9°C, respectively.

2.1 Birds:

A total of 180 (65 day old) Japanese quails were used in this experiment. They were weighed and distributed into 12pens, and each pen contained 15 birds (10 females and 5 males) of approximate equal body weight. The pens were randomly allocated to the three experimental diets (60birds / treatment).

2.2 Housing and Management

The experiment was carried out on adeep litter floor system. The pens inside the house were from wire netting. The dimensions of each pen were 1.0 ×1.0 m. Dry wood-shaving was used as litter with 5cm depth. Each pen was provided with clean disinfected feeder and drinker that were filled with feed and water all the time. Light provided was natural light during the day. The house was cleaned and disinfected with formalin before the commencement of the experiment.

2.3 Diets

The Japanese quail nutrients requirement was calculated according to NRC [12].Three diets were used in the experimentwith different CP levels. Diet A had20% CP (control), diet B had 22% CP, and diet C had 24% CP. The experimental diets ingredients and calculated compositions are shown in table 1.

2.4Experimental procedures

The experiment started when the birds were65 days old. Theywere weighed on the first day and at the end of the experiment. The experimental diets were fed for seven weeks.Feed and water were offered *adlibitum* (*ad lib*).Records of feed consumption, egg weight and production were maintained on weekly basis per replicates. Mortality rate was recorded throughout the experimental period.

2.5 Experimental design and statistical analysis

The completely randomized design was used in the experiment. The data (feed intake, feed conversion ratio, egg production and hatchability) was subjected to analysis of variance (ONE –WAY ANOVA) using the SAS computer program. The least significant difference (LSD) test was used for treatment means separation.

3. RESULTS AND DISCUSSION

Table 2 shows effects of different CP levels on weekly feed intake in Japanese quails.

Weekly feed intake varied among diets in different weeks. It was highest in diet A in all weeks, except the 3rd week and the difference were significant at the 6thweek. It was lowest in diet B at the 1st, 2nd and 5th week.It was lowest in diet A at the 3rdweek. Weekly feed intake varied among weeks in different diets and was highest in the 2nd week in all diets.

The variations in weekly feed intake among diets in different weeks in Japanese quails in this study were due to diets composition, production level, body weight and the environment. The highest feed intake in diet A in all weeks showed it

satisfied the nutrient requirements and well balanced. The increased feed intake up to the 2nd week was due to increased body weight and nutrients requirements.

Table 3 shows the effects of different CP levels on Japanese quails hen - day egg production (HD %) in Kuku Research center farm.

Egg production varied among diets in different weeks, but not significantly (P>0.05). It was highestin diet B in all weeks, except the 2nd where it was highest in diet A and in the 6thweek, it was similar in diets A and B. It was lowest in diet C in all weeks. Weekly egg production increased with weeks in diet C and generally increased with weeks in diet A. It increased up to the 4thweek and then declined in diet B.

Table 4 shows the effects of different CP levels on Japanese quails hen- housed egg production (HH %) in Kuku Research center farm. Egg production varied among diets in all weeks, but not significantly (P>0.05). It was highest in diet A in the 2nd and 6th weeks and in diet B in the 1st, 4th and 5th weeks. It was lowest in diet C in all weeks. Egg production increased with weeks indiet C and increased up to the 4th week and then declined in diet B. It was generally increased with weeks in diet A.

The variations in egg production among diets in different weeks were associated with diets composition and showed that diet B was generally the best and diet C the worst in all weeks. The generally increased weekly egg production with weeks was associated with increased BW and nutrients requirements.

Table 5 shows effects of different CP levels on Japanese quails feeds conversion ratio in Kuku Research center farm.Feeds conversion ratio varied among diets in different weeks, but not significantly (P>0.05). It was highest in diet A in the 1st, 4th, 5th and 6th weeks and in diet C in the 2nd and 3rd weeks. It was lowest in diet B in all weeks. Feed conversion ratio declined with weeks in all diets.

The variations in Feeds conversion ratio among diets in different weeks were associated with diets composition. The generally highest FCR in diet A and the lowest in diet B in all weeks showed the latter had the best FCR and was worse for the former.

Table 6 shows the effects of CP level on Japanese quails performance in Kuku Research center farm. All parameters varied among diets, but not significantly (P>0.05). Diet A had the highest feed intake and egg weight and diet B had the highest egg production. The feed intake values obtained in this study were lower than feed intake values observed by Tuleun*et al*.[2].This could be due to variations in the ambient temperatures.

Feed conversion ratio was highest in diet C and lowest in diet B. Diet C had the lowest egg weight and production. The variations in allparameters among diets were mainly due to the diet CP level. The highest egg weight in diet A was due to increased feed intake.

The increased egg weight with age was mainly due to increased birds weight and nutrients requirements. It was also due to increased ova size and albumen secretion [13]. The increased egg weight with age was reported by many workers [14], [15], [16], [7] with a high genetic correlation between live weight and egg weight [8]. Egg weight was significantly lower in light birds than medium and heavy ones [7]. Mean egg weight was close to the reported 10g [18], [19]. Diet C had the highest Feed conversion and the lowest egg weight and production.

Table 7 shows effects of CP level on Japanese quails mortality rate in Kuku Research center farm.

Mortality rate varied among diets in males and females and was highest in diet B in females and similar in diets B and C in males. It was lowest in diet A for males, females and total mortality.

Table 8 shows effects of CP level on Japanese quails hatchability in Kuku Research center farm.

Hatchability varied among diets in different weeks, but not significantly (P>0.05). It was highest in diet A in the 2nd and 3rd weeks, diet Bin the 1st week and diet C in the 4th week. Hatchability generally increased with increased weeks in all diets.Hatchability varied among diets in different weeks due to diets composition.

4. CONCLUSION

It can be concluded that dietary protein level 22% was considered to be the best level under Sudan condition because it increased hen – day egg production, hen – housed egg production and improved feed conversion ratio.

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Table 1. The ingredients (%) and calculated composition of the experimental diets fed to Japanese quails in the Animal Production Research Centre in Kuku , Khartoum North, Khartoum State, Sudan

Ingredients	Diets		
	A	B	C
Sorghum	67.80	65.00	60.5
Groundnut cake	18.00	23.00	28.8
Wheat bran	3.50	1.00	0.00
Concentrates	5.00	5.00	5.00
Calcium carbonate	5.30	5.30	5.20
Diphosphate	0.20	0.20	0.20
Salt	0.25	0.25	0.25
Methionine	0.10	0.10	0.10
Lysine	0.00	0.00	0.00
Antifunaltoxins	0.10	0.10	0.10
Total	100.00	100.00	100.00
Calculated composition: Crude Protein	20.00	22.00	24.00
Ether Extract	3.5	3.6	3.9
Crude Fiber	4.2	4.3	4.6
Calcium	2.5	2.5	2.5
Available Phosphorus	0.56	0.56	0.57
Lysine	1.0	1.0	1.1
Methionine	0.46	0.48	0.50
ME (kcal/kg)	2835	2835	2831

Table 2.Effects of different Crude Protein levels on weekly feed intake (g/bird) in Japanese quails in Kuku, Khartoum North, Sudan.

Age (weeks)	Diets			
	A	B	C	LS
1st	73.2±13.8	66.8±7.4	71.0±6.8	NS
2nd	88.8 ±7.5	80.2±6.4	85.6±7.1	NS
3rd	60.6 ±22.5	71.8±6.5	66.4±16.3	NS
4th	73.0±10.2	69.3±10.8	66.6±11.6	NS
5th	73.0±12.3	54.2±10.7	59.1± 12.0	NS
6th	71.6±5.9	54.9±10.6	54.7±8.4	**

**= Significantly different at P<0.01, NS= Not significantly different at P>0.05.

Table 3.Effects of different Crude Protein levels on egg production (HD %) of Japanese quails in Kuku, Khartoum North, Sudan.

Age (weeks)	Diets			
	A	B	C	LS
1st	14.0±18.9	16.4±10.2	13.6±10.5	NS
2nd	26.4±24.5	23.6±9.1	14.6±8.4	NS
3rd	35.0±29.5	37.3±10.7	22.5±12.9	NS
4th	34.6±25.8	46.2±17.0	28.5±6.6	NS
5th	32.9±17.1	39.7±6.9	29.1±4.4	NS
6th	39.8±3.8	39.8±3.8	30.3±6.1	NS

NS= Non significant differences at P>0.05).

Table 4.Effects of different Crude Protein levels on egg production (HH%) of Japanese quails in Kuku, Khartoum North, Sudan.

Age (weeks)	Diets			
	A	B	C	LS
1st	14.3±18.9	15.4±10.4	13.3±10.7	NS
2nd	26.4±24.5	22.1±10.2	14.3±8.7	NS
3rd	35.0±29.5	35.0±12.7	21.9±13.3	NS
4th	34.6±25.8	42.9±17.2	27.6±7.0	NS
5th	32.1±17.4	36.1±9.2	28.1±4.4	NS
6th	37.5±11.6	34.6±2.7	28.1±4.4	NS

NS= Non significant differences at P>0.05).

Table 5. Effects of different Crude Protein levels on quails feeds conversion ratio of Japanese in Kuku, Khartoum North, Sudan.

Age (weeks)	Diets			
	A	B	C	LS
1st	10.7±15.2	7.6±5.7	10.2±5.9	NS
2nd	5.0±5.2	4.9±1.3	9.1±4.4	NS
3rd	5.3±5.2	2.6±0.4	5.5±3.6	NS
4th	4.5±3.4	2.2±0.6	3.4±0.6	NS
5th	3.5±1.3	1.9±0.4	3.0±1.0	NS
6th	3.6±1.4	1.9±0.5	3.0±1.0	NS

NS= Non significant differences at P>0.05).

Table 6. Effects of Crude Protein level on performance of Japanese quails in Kuku, Khartoum North, Sudan.

Parameters	Treatment			
	A	B	C	LS
Feed intake (g/bird/day)	10.5±0.6	9.5±0.6	9.6±0.9	NS
Feed intake (g/bird/week)	73±4.3	66±4.2	67±6.0	NS
Egg weight(g)	10.9±0.34	10.6±0.29	10.3±0.51	NS
Egg production (HD %)	30±9.9	33.8±4.2	23.1±7.9	NS
Egg production (HH %)	30±9.8	31±6.6	22.0±8.0	NS
Feed conversion ratio(Kg feed/Kg egg)	5.4±2.7	3.5±2.2	5.7±3.2	NS

NS= Non significant differences at P>0.05).

Table 7. Effects of Crude Protein level on mortality rate of Japanese quails in Kuku, Khartoum North, Sudan.

Diets	Female mortality		Male mortality		Total mortality	
	Number	%	Number	%	Number	%
A	1	1.3	0	0	1	1.3
B	5	6.3	1	1.3	6	7.5
C	2	2.5	1	1.3	3	3.8
Total	8	2.9	2	1.3	10	4.2

Table 8. Effects of Crude Protein level on hatchability (%) of Japanese quails in Kuku, Khartoum North, Sudan.

Age (weeks)	Diets			
	A	B	C	LS
1st	50.0	62.5	50.0	NS
2nd	65.6	50.0	59.3	NS
3rd	89.8	87.5	83.3	NS
4th	70.1	78.9	82.25	NS

NS= Non significant differences at P>0.05).