

Effect of Different Vegetable Protein Sources on Growth and Laying Performance of Japanese Quails (*Coturnix Coturnix Japonica*) in a Derived Savannah Zone of Nigeria

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Abstract: This study examined the comparative utilization of 30% inclusion levels of three vegetable protein sources [Groundnut Cake (GNC); Soybean Meal (SBM) and Cotton Seed Cake (CSC)] in the diets of growing and laying Japanese quails. The findings showed no significant variations ($P>0.05$) on feed intake, weight gain and feed/gain ratio during the growing period among the vegetable protein sources fed. Attainment of sexual maturity (age at first egg laid) was 60, 61 and 62 days for SBM, CSC and GNC based diets, respectively while weight of first egg laid was 9.95, 9.25 and 9.40 g, respectively. At the laying period, results indicated no significant differences among the treatment means for the performance and egg quality parameters measured. However, laying performance and egg quality traits were in general, numerically better ($P>0.05$) in quails fed SBM compared to CSC and GNC diets. The results suggested that the three vegetable protein sources could be used interchangeably in the diets of growing and laying Japanese quails reared in the derived Savannah zone of Nigeria.

Key words: Vegetable proteins % Japanese quails % egg quality % sexual maturity

INTRODUCTION

Animal protein constitute about 17% of the total protein consumption in the average Nigerian diet compared to 68% in New Zealand, 71% in United States of America, 67% in Denmark and 60% in the United Kingdom [21]. There is therefore, the need to increase this protein intake to a level, which compares to that of the developed nations. In Nigeria, the domestic fowl is the major protein source providing both chicken meat and egg. In order to (i) widen the scope of meat and egg supply and (ii) alleviate the problem of pressure on egg and meat supply from chicken, relatively under utilized poultry species are now under focus e. g Japanese quail, duck, guinea fowl and ostrich [1, 5, 13, 15].

Japanese quails (*Coturnix coturnix japonica*) are small-bodied birds of the galliforme family. They are highly prolific and hardy. Since they were introduced into the Nigerian poultry industry in 1992 [6], they have gained tremendous interest among Nigerian populace especially because of their short generation interval, fast growth rate and less susceptibility to common poultry diseases. Japanese

quail in the wild, feed on insects, grains, grass and various seeds. They have also been found to thrive well and grow efficiently in captivity when fed with high protein diet [8]. Nonetheless, little research work has been done in the area of comparative ingredient evaluation for quail birds.

This study is therefore aimed to evaluate three different vegetable protein sources in the diets of growing and laying Japanese quails reared in a derived savannah zone of Nigeria. The three plant protein sources (soybean meal, groundnut cake and cotton seed cake) are readily and widely employed [9, 12] as sources of plant protein in domestic chicken diets.

MATERIALS AND METHOD

Location: The experiment was conducted at the Centre for Quail Research, Lautech Teaching and Research Farm, Ogbomosho, Nigeria. The farm is located in the derived savannah ecological zone of Nigeria. The trial was carried out in February-April 2004 when ambient temperature averaged 27°C and relative humidity ranged between 83-95%.

Table 1: Composition of diets (%)

Ingredient	Diets		
	1 (GNC)	2 (SBM)	3 (CSC)
Maize	55.2	55.2	55.2
GNC	30.0		
SBM	-	30.0	-
CSC	-	-	30.0
Fish meal	4.0	4.0	4.0
Wheat offal	6.4	6.4	6.4
Bone meal	2.7	2.7	2.7
Oyster shell	1.1	1.1	1.1
Premix	0.25	0.25	0.25
Methionine	0.2	0.2	0.2
Salt	0.25	0.25	0.25
Calculated values			
ME Kcal kg ⁻¹	2889.4	3069.4	2949.4
CP%	22.33	22.43	22.33

Supplied per kg ration. Vit A, 1500 I.u; Vit e 5mg; Vit D₃ 300 I.u; Vit K 3 mg; Vit B₁ 2 mg; Vit B₂ 5.5 mg; Niacin 25 mg; Vit B₁₂ 10 ug; choline 120 mg; Mn, 5.2 mg; Mb 240 mg; Zn, 25 mg; Cu, 2.6 g; folic acid 2 mg, I 2 mg; Fe, 5g; Pantothenic acid, 10ug; Biotin, 30.5 g; Antioxidant, 56 mg

Experimental diets: Three basal diets were formulated using groundnut cake (GNC), soybean meal (SBM) and cottonseed cake (CSC) as the sole source of plant protein. The three plant protein sources were each included in a basal diet at the same level of 30% as shown in Table 1. The diets were offered during the growing phase (28-56 days) and subsequently during the laying phase that lasted 10 weeks.

Experimental birds, design and management: A total of 90 Japanese quails selected out of a laying flock obtained from the National Veterinary Research Institute, Vom, Nigeria, were used for this experiment. At four weeks old, the quails were randomly divided into three dietary groups of 30 and further subdivided into three replicates of 10 quails each. They were housed in quail battery cages designed at the center. Each cage was equipped with feed and conical water troughs. Three cages were assigned to each of the three dietary treatments. The quails were offered respective experimental diets and water ad-libitum throughout the growing period (4 weeks) and laying period (10 weeks).

Data collection:

(I) Growing phase: At the start of the trial, body weights were taken and subsequently on a weekly basis. Weekly feed intake was also monitored on group basis. From the feed intake and body weight data, the feed/gain ratio was calculated.

(ii) Laying phase:

(a) Performance parameters: During the laying period, age at first egg was noted and weight of such eggs recorded. Performance characteristics monitored included weekly hen day production, feed intake and final body weight.

(b) Egg quality traits

Sampling of eggs: Four eggs per replicate of 10 quails were sampled at random for 3 consecutive days fortnightly for five times. Each egg was assessed separately for internal and external egg quality traits. For external quality traits, data on egg weight, egg length, egg breadth, egg shape index and shell thickness were collected. Individual egg weight was measured using a sensitive electronic balance while egg length and breadth were measured using a vernier caliper. The egg shape index is a ratio of the length and breadth of the egg. Shell thickness was measured for individual dry eggshells to the nearest 0.01mm using a micrometer screw gauge. The interior egg quality traits were measured in terms of Haugh unit and yolk index. The haugh unit was calculated from egg weight and albumen height while yolk index was calculated as the proportion of yolk height to diameter. Yolk colour:-Yolk colour was scored for individual egg yolk by comparing the colour of the yolks with the colour of the chips of a Hoffman-La Roche yolk colour fan. To determine the egg proportions, each egg was carefully broken and shells separated and air-dried overnight. Eggshells air-dried overnight were weighed and the relative weight calculated by relating the shell weight to the weight of the egg. An egg separator was used to separate the yolk from the albumen. Relative yolk weight was calculated in percentages by relating the yolk weight measured to the nearest gramme to the whole weight of that particular egg and multiplied by 100. The albumen weight was calculated by subtracting the yolk and dry shell weights from the whole egg weight. The albumen weight relative to the individual egg weight was calculated.

Analysis: The compounded diets and samples of test ingredients i.e GNC, SBM and CSC were analyzed for their proximate composition [2]. The data obtained were subjected to Analysis of Variance [19]. Duncan's multiple range test was used to determine the differences between treatment means [4]. When a significant treatment effect was obtained in the analysis of variance, a probability level of P<0.05 was required for a statement of significance.

RESULTS AND DISCUSSION

Composition of test ingredients: The proximate composition of GNC, SBM and CSC used in this study are shown in Table 2. The crude protein values of the three vegetable protein sources falls within the range of 40-45% with SBM having the highest value followed by GNC and CSC. This indicated little variations, which expectedly did not seriously influence the protein content of the diets. Crude fat is highest for GNC and least for CSC whereas crude fibre is highest for CSC and least for GNC. [3] reported a chemical content for cotton seed cake as 11.69% ether extract, 21.2% crude fibre, 28.42% crude protein, 4.46% ash and 30.23% nitrogen free extracts. The values for protein and ash are lower while fat and fibre are higher compared to our own findings. The high fibre level in the CSC based diet was due to the high level of fibre in the CSC.

Growing phase: The performance characteristics of quails fed different vegetable protein based diets are depicted in Table 3. Results showed that daily feed intake, weight gain and feed/gain ratio had no significant variations among the three dietary groups. The Live Weight (LW) recorded at 8 weeks (138-141g) was lower than the 142-148 reported by [14] at 7 weeks of age. However, in their own study, cocoa husk based diets varying in energy levels were used. The feed/gain ratio was generally poor across the treatments. However, GNC and SBM had slightly better feed conversion ratio than the CSC based diets. The feed conversion ratio in this study averaged 10.1-10.6 which is generally poorer than the 4.6-4.7 recorded by Duncans, [4]. The reason might be due to the fact that laying strain was used in this study compared to the unsexed (male and female) strains used by Edache [5]. In any case, [6] had reported generally poor efficiency of feed conversion among growing Japanese quails.

Laying period: Attainment of sexual maturity (age at first egg laid) was 60, 61 and 62 days for birds fed. SBM, CSC and GNC based diets respectively, while, weight of first egg laid was 9.95, 9.25 and 9.4 gms respectively (Table 3). This showed that quails fed SBM reached laying age earlier than CSC or GNC. The age at maturity did not conform to that observed by Wagasugi [20] in which quails had an onset of egg laying between 42-50 days of age.

Table 2: Proximate composition of the diets and test ingredients (%)

Variables	Diets			Test Ingredients		
	1	2	3	GNC	SBM	CSC
Protein	21.2	21.9	20.8	42.4	44.6	41.6
Fat	5.46	4.62	3.72	7.6	4.8	1.80
Fibre	3.43	4.67	6.26	4.18	8.3	13.6
Ash	3.79	2.91	3.69	7.52	4.6	7.2
Nitrogen free extract	57.91	57.03	56.96	30.71	32.1	29.0

GNC: Groundnut cake, SBM: Soybean meal, CSC: Cotton seed cake

Table 3: Effect of different vegetable protein sources on performance of Japanese quails during the growing phase

Parameters	Diets			
	1 (GNC)	2 (SBM)	3 (CSC)	SEM
Final body weight (g)	140.8	139.6	137.8	4.31
Daily weight gain (g)	1.87	1.95	1.75	0.67
Daily feed intake (g)	19.0	20.2	18.5	1.54
Feed/gain ratio (g)	10.2	10.4	10.6	0.04

Table 4: Effect of different vegetable protein sources on laying performance and egg quality values of Japanese quails

Parameters	Diets			
	1 (GNC)	2 (SBM)	3 (CSC)	SEM
Laying period				
Age at 1 st egg (day)	62	60	61	-
Weight of 1 st egg laid (g)	9.45	9.95	9.25	-
Final body weight (g)	154.0	149.7	141.3	5.49
Weight gain (g)	8.3	10.2	7.5	2.42
Hen day production (%)	49.8	59.0	52.0	3.12
Feed intake (g/week/bird)	185.4	201.7	179.4	4.18
Egg quality				
Haugh unit (%)	92.9	89.9	90.4	2.54
Yolk index	0.36	0.26	0.37	0.01
Yolk colour	1.2	1.2	1.5	0.01
Shell Thickness (mm)	0.22	0.23	0.22	0.01
Egg weight (g)	9.33	10.1	9.98	1.30
Egg length (cm)	2.97	3.04	3.04	0.03
Egg breadth (cm)	2.34	2.42	2.46	0.02
Egg shape index	0.78	0.79	0.80	0.01
Shell density (cm ³)	0.98	0.99	0.97	0.01
Shell weight (g)	0.65	0.69	0.65	0.02
Shell surface area (cm ²)	2.87	3.24	2.94	0.03
Egg proportions (%)				
Yolk	32.7	30.4	32.9	2.30
Albumen	51.6	52.2	50.6	0.05
Shell	6.60	7.52	6.77	0.32
Membrane	1.11	0.99	1.03	0.01

Performance indices (Table 4) were not significant (P>0.05) among the treatment means. Feed intake, final live weight and weight gain were least in quails fed the CSC based diet. [10] reported a depressed feed intake and

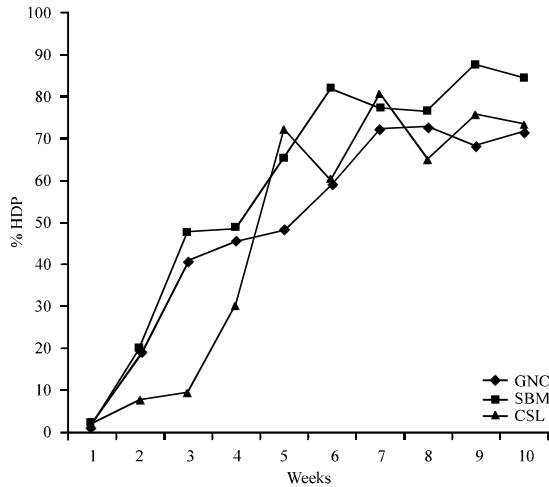


Fig. 1: Trends in hen day production of quails fed three different vegetable protein sources

feed conversion ratio in layers fed cotton seed cake and attributed it to high gossypol content of cotton seed cake. Hen day production did not show any significant ($P>0.05$) variations; however, the values were generally low because its calculations started from the first egg laid. The similar values across dietary treatments in terms of performance may be due to the ability of quails to utilize easily the nutrients in the protein sources [8].

The egg quality parameters showed no significant variations ($P>0.05$) as shown in Table 4. Quails fed GNC diet had the least values in term of egg length, egg breadth, egg weight, egg shape index and shell surface area. The SBM fed quails had the highest values in terms of egg weight, shell density, shell weight and shell surface area. Quails fed CSC had the highest values in terms of egg shape index, yolk index and yolk colour than those on GNC and SBM diets. The shell thickness across dietary treatments was relatively similar which showed that there are no differences in the amounts of calcium and phosphorus furnished by the diets.

The proportions of the various egg components fed various vegetable proteins are indicated in Table 4. The SBM fed quails had the highest values in terms of albumen and shell than GNC and CSC fed quails. GNC fed quails have highest value for membrane than CSC and SBM fed quails with 1.11, 1.03 and 0.99% respectively. The % yolk is highest for quails on CSC diet (32.9%) followed by GNC (32.7%) and SBM (30.4%). The proportion of the various egg components does not follow a general trend.

Over a ten-week period (Fig. 1), it was observed that quails fed SBM had a consistently better production than GNC or CSC. The reason can be easily added to the better amino acid profile of SBM in comparison to GNC or CSC. This also showed that quails responded in like manner to dietary ingredients like the domestic chicken. [12] observed comparative performance in broilers fed 30% soybean meal, pigeon pea seed meal, groundnut cake, cashew nut meal and cottonseed meal. Findings in this study generally indicated that GNC, SBM and CSC were well tolerated and utilizable by quails.

Based on the fact that no significant differences occurred among the dietary treatments, it would be safely concluded that quails could be easily fed any of the three protein sources without deleterious effect on performance and egg quality parameters.

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