Performance and egg quality parameters of Japanese quail (*coturnix coturnix japonica*) fed kenaf (*Hibiscus cannabinus* L.) seed meal based diets subjected to varying cooking periods

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Abstract

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A sixteen weeks feeding trial was conducted to evaluate the effect of different cooking periods of Kenaf seed (*Hibiscus cannabinus* L.) meal on the performance and egg quality parameters of Japanese quail using 150 seven weeks old growing quail. The birds were randomly divided into five dietary treatment of 30 birds per treatment (i.e. 10 birds per replicate). They were fed five experimental diets containing 0% and 10% of the variously processed kenaf seed meal (control, raw kenaf seed meal, 15 minutes cooking period, 20 minutes cooking period and 25 minutes cooking period) designated as T1, T2, T3, T4 and T5 respectively. Data were collected on feed intake, daily egg production, external and internal egg quality parameters. Initial body weight, final body weight, average feed consumed per bird, feed conversion ratio, egg weight, shell weight, percentage shell thickness, shell surface area, yolk weight, yolk index, albumen weight, albumen percentage and Haugh unit were not significantly ($P > 0.05$) different. However, significant ($P < 0.05$) differences were observed for weight gain (0.53 – 0.55 kg), hen day production (47.29 – 53.24 %), shell thickness (0.64 – 0.79 mm) and yolk percentage (1.37 – 3.25 %). It was concluded that kenaf seeds when cooked for 15 minutes can be used at 10 % level of inclusion in the diets of laying Japanese quails.

Keywords: Kenaf, cooking Japanese quail, egg quality, Performance

Introduction

Eggs provide means through which the animal protein requirements of the populace can be met (Dudusola, 2009). It has various uses and contains many essential nutrients, it supports life during embryonic growth and is one of the most nutritious and complete food known to man (Scolt and Silverside, 2001). Comparatively, chicken eggs contains 4% cholesterol and quail egg has only 1.4%, 3 times less fats, proteins – the quail yolk contains 2% while the chicken yolk has only 16-17% (Mustafa *et al.*, 2009). The use of unconventional feedstuffs as substitutes for grains and other feedstuffs have been suggested thus, the search for non-conventional feedstuffs has been the most active area of animal nutrition research in the Tropical world (Ikani and

Adesehinwa, 2000). The increasing cost of feed resources in livestock production has been identified in livestock production as a serious impediment to meeting the demand of animal protein (Adejinmi *et al.*, 2007). Kenaf (*Hibiscus cannabinus*) has been used as a cordage crop to produce twine rope and sack cloth for over six millennia (Webber and Bledseo, 1993) until Bhardway and Rarrigappa (1995) carried out researches on this plant and found out that it can be used for making textile, livestock feeds and fibres in new and recycled plastic (injected molded and extruded). The leaves contain about 14 to 34% crude protein, while the seed contain 30.88% crude protein, 95.15% organic matter, 18.55% ether extract, and on dry matter, the seed contain 33.21% fatty acid profile of palmitic acid, 50.02% stearic acid, 31.26% oleic acid and 30.15% linoleic

Performance and egg quality parameters of Japanese quail (coturnix coturnix japonica)

(Rajshekher *et al.*, 1993). Odetola (2011) reported that kenaf seed meal is a suitable protein source which compared well with soybean in term of protein content. Despite the rich nutritional composition of kenaf seed, there are reports of the presence of a number of antinutritional (toxic) factors. Hansawasdi and Kawabatta (2000) reported low levels of tannin, amylase inhibitors, protease inhibitors, phytic acid and gossypol in kenaf seed. Kwari *et al.* (2011) however, reported improvements in the growth performance of broiler chickens when kenaf seed was processed by soaking, cooking, sprouting or fermentation. Therefore, this experiment was designed to investigate the effect of cooking periods of kenaf (*Hibiscus cannabinus*) seed meal on performance and egg quality characteristics of Japanese quails (*Coturnix coturnix japonica*).

Materials and methods

Experimental location

The research was carried out at the Poultry research unit of the Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan, Nigeria. The site is located in the rain forest zone of South- western Nigeria on longitude 7° 23' and latitude 4° 53' E and 76m above sea level. The climate is humid with a mean annual rainfall of 1037mm and temperature of 34.7°C, respectively. (Google Earth 6.0, 2014).

Experimental procedures

A total of 150 seven weeks old laying Japanese quails (*Coturnix coturnix japonica*) were used for the study. The quails were obtained from a farm in Ibadan, Oyo state, Nigeria. They were randomly allotted to five treatment groups of 30 birds each with three replicates of 10 birds following a completely randomized

design. Kenaf seeds were obtained from the Institute of Agricultural Research and Training (I.A.R&T) Moor Plantation, Ibadan.

The seeds were cleaned to remove dirt; the seed were divided into four equal portions of 12.5kg each. Twenty five (25) litres of cold, clean water was first brought to boiling point of 100°C in a 50 litres drum. A batch of 12.5kg raw kenaf seed was then poured into the boiling water and covered and allowed to cook for 15 minutes. The time for cooking was taken from the moment the kenaf seed was poured into the boiling water. At the end of 15 minutes cooking, water was drained off and the cooked seeds sun-dried for 4 days. The same procedure was repeated for 20 minutes and 25 minutes respectively. The dried seeds were ground to pass through 2 mm sieve size and stored. Five experimental diets were formulated such that cooked kenaf and raw kenaf seed meal replaced full fat soybean meal at 10% inclusion level (Table 1). The diets were analyzed for proximate composition (AOAC, 2000). All routine management practices and vaccinations were duly followed. The quails were offered feed and water *ad libitum* throughout the experimental period (16 weeks).

Data collection

Performance characteristics monitored included initial body weight, feed intake, hen-day production, body weight gain, final body weight and feed conversion ratio (FCR). Egg quality traits were assessed using three eggs per replicate. The eggs were sampled at random every week throughout the period of sixteen weeks. Each egg was assessed separately for internal and external egg quality traits. For external quality traits, data on egg weight (g), egg length (cm), egg width (cm), egg shape index and shell thickness (mm) were collected. Individual egg weight was

measured using a sensitive electronic balance (Mettler PM 400 model) 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 egg shells to the nearest 0.01mm using a micrometer screw gauge. The internal egg quality traits measured include yolk percentage (%), Yolk colour measured with Roche yolk colour fan, Albumen weight (g), Albumen height (mm), Albumen percentage (%) and Haugh unit. The Haugh unit was calculated from egg weight and albumen height according to the method of Haugh (1937). An egg separator was used to separate the yolk from the albumen. The height of the albumen was measured at its widest expanse and midway between the yolk edge and the external edge of the thick albumen using a tripod micrometer (Adeyemo and Longe, 2008). Yolk height was measured at the highest point using a tripod micrometer. The yolk and albumen were placed in separate Petri dishes, which had initially been

weighed. The differences in the weight of each Petri dish after and before the introduction of the yolk and albumen were taken as the weights of the yolk and albumen respectively. The weights were taken with the aid of Mettler analytical balance.

The shell surface area was calculated by the formula:

$$SSA = W^{0.66} \times 4.67$$

Where SSA = Shell Surface Area

W = Average egg weight

0.667 and 4.67 are constants.

Yolk index was calculated as ratio of yolk height to yolk width, percentage yolk weight was calculated as the ratio of yolk weight to egg weight multiply by 100, while percentage albumen weight was calculated as the ratio of albumen weight to egg weight multiply by 100.

Statistical analysis

Data generated were be subjected to analysis of variance using SAS statistical package SAS, (2003). The mean where significant, was separated using Duncan's (1955) multiple range tests.

Table 1: Gross composition of the experimental diets (g/kgDM)

Ingredients	T1	T2	T3	T4	T5
	Control	Raw	15min	20min	25min
Maize	50.00	50.00	50.00	50.00	50.00
Groundnut cake	6.40	6.40	6.40	6.40	6.40
Soyabean meal	30.00	20.00	20.00	20.00	20.00
Kenaf seed meal	0.00	10.00	10.00	10.00	10.00
Fish meal (72% CP)	2.00	2.00	2.00	2.00	2.00
Wheat offal	7.30	7.30	7.30	7.30	7.30
Salt (NaCl)	0.25	0.25	0.25	0.25	0.25
Bone meal	2.00	2.00	2.00	2.00	2.00
Premix (Layers)	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Limestone	1.50	1.50	1.50	1.50	1.50
Methionine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Determined analysis					
Dry matter	91.62	91.48	91.31	91.25	91.29
Ash	5.36	5.39	6.13	6.38	6.45
Crude protein	23.16	22.63	21.62	22.46	21.78
Crude fibre	3.68	3.68	3.85	3.77	3.81
Ether extract	5.53	5.59	3.74	3.61	3.69
Nitrogen free extract	55.89	54.76	55.97	55.03	55.56

Results and discussion

The effects of different cooking periods of kenaf seeds meal on performance characteristics of Japanese quail is as presented in Table 2. There were no significant ($P>0.05$) difference in all the parameters measured except for weight gain and hen-day production. Birds fed control diets and those fed T3 and T4 had similar weight gain which was significantly higher than what was obtained for T2 and T5. Highest hen-day production was obtained for birds fed T3 while those fed T4 had the lowest. The hen-day production (47.29-53.24%) obtained in this study was higher than 16.51-29.50% reported by Ijaiya *et al.* (2012) who fed Japanese quail with graded levels of Tallow (*Deterium micocarpum*). The non-significant effect observed for the feed conversion ratio is an indication that the cooked kenaf seeds were well tolerated by the birds. This agreed with the work of Odetola and Eruvbetine (2012) who reported that kenaf seed possesses a good dietary protein.

The results of the egg quality parameter of Japanese quail fed the experimental diets revealed that there were no significant effects on all the parameters measure except for shell thickness and yolk percentage (Table 3). Dietary treatment did not have any effect on shell weight as this showed that shell deposition was similar in all dietary treatments. Ablanap (1957) reported that the same amount of shell is deposited in eggs irrespective of the size of eggs. The Haugh unit (HU) is an objective measure of egg quality based on the logarithmic function of albumen height and egg weight.

HU values were almost similar for the dietary treatments. The result indicated that the dietary treatments did not affect the internal quality of eggs. None of the treatments recorded values lower than the minimum 75 % Haugh unit required for excellent quality eggs (Babangida and Ubosi, 2006). Economically, the yolk colour is important because it is a quality criterion for consumer (Matt *et al.*, 2011). The intensity of yolk colour is usually measured using Roche Scale. A darker colour is highly desirable by consumers in many countries, for example in Australia, the preferred yolk colour is 11 on the Roche scale (Roberts, 2004). The yolk colour score was the same for average (2.0) obtained was because white maize was used in formulating the diets. White maize and other ingredients used lack colouring pigments which could have impacted colour on the yolk. Similar low yolk colour scores were obtained from layers fed maize offal, cassava peel and reject cashew nut meal by Onifade *et al.* (1999). El Boushy and Raterink (1987) reported that the degree of pigmentation of egg yolk depends on the Xanthophyll concentration in the feed, the composition of the feed, and health of the birds. Carotenoid pigments are usually transferred to the yolk from the carotenoid rich plants consumed by the hen since birds and animals generally do not have the ability to synthesize carotenoid. The National Extension and Research Liaison Services NAERLS (1990) confirmed that yellow maize was preferable to white maize in poultry ration because yellow maize contains the yellow substance (Xanthophyll) which makes the skin of the chicken and the yolk of eggs yellow.

Table 2: Performance characteristics of Japanese quail fed the experimental diets

Parameters	T1	T2	T3	T4	T5	±SEM
	Control	Raw	15min	20min	25min	
Initial weight (g/bird)	122.00	120.00	122.00	120.00	120.00	
Final weight (g/bird)	169.00	174.00	177.00	176.00	173.00	0.01
Weight gain (g/bird)	55.00 ^a	54.00 ^b	55.00 ^a	56.00 ^a	53.00 ^b	0.01
Average feed consumed (g/bird)	990.00	980.00	920.00	1030.00	530.00	0.04
Feed conversion ratio	2.81	2.66	2.74	2.65	2.75	0.12
Hen day production (%)	53.22 ^a	50.83 ^a	53.24 ^a	47.29 ^c	49.52 ^b	4.54

abc: Means on the same row with different superscript differ significantly (P<0.05)

Table 3: Egg quality parameters of Japanese quail fed the experimental diets

Parameters	T1	T2	T3	T4	T5	±SEM
	Control	Raw	15min	20min	25min	
Egg weight (g)	9.27	9.77	9.27	10.10	9.33	0.13
Egg length (cm)	3.54	3.43	3.50	3.50	3.43	0.03
Egg width (cm)	2.86	2.97	3.01	3.00	3.08	0.04
Egg height (cm)	0.85	0.79	0.83	0.83	0.78	0.02
Shell weight (g)	1.58	2.00	1.83	1.75	2.00	0.08
Shell thickness (mm)	0.64 ^b	0.72 ^{ab}	0.79 ^a	0.72 ^{ab}	0.74 ^a	0.02
% shell thickness	17.01	21.31	20.40	16.41	19.85	1.02
Shell surface area	20.63	20.70	20.23	20.64	20.50	0.20
Yolk weight (g)	3.25	2.92	2.75	3.08	2.75	0.09
Yolk height (mm)	2.90	2.97	2.80	2.88	2.96	0.03
Yolk index	3.63	4.07	3.52	.73	6.35	0.44
Yolk percentage (%)	1.95 ^{bc}	2.97 ^{ab}	2.35 ^{abc}	3.27 ^a	1.37 ^c	0.18
Yolk colour	2.00	2.00	2.00	2.00	2.00	0.00
Albumen weight (g)	4.58	4.50	4.67	5.17	4.92	0.11
Albumen height (mm)	3.78	3.93	3.97	3.99	3.90	0.04
Albumen percentage (%)	52.44	49.01	47.88	53.75	51.15	1.34
Haugh unit	87.97	87.10	87.58	87.56	88.00	0.32

abc: Means on the same row with different superscript differ significantly (P<0.05)

Conclusion

From the results of this study, it can be concluded that Japanese quail can be fed with both raw and cooked kenaf seed meal without any detrimental effect on the performance and egg quality parameters.

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Performance and egg quality parameters of Japanese quail (Coturnix coturnix japonica)

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