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Effect of Graded Levels of Toasted Pigeon Pea [*Cajanus cajan* (L.) Millsp] Seed Meal Diets on Growth Performance and Carcass Characteristics of Japanese Quails (*Coturnix coturnix japonica*)

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Abstract: A five week study was conducted to determine the effect of graded levels of toasted pigeon pea on growth performance and carcass characteristics of Japanese quail chicks. In a completely randomized design, three hundred unsexed, seven day old Japanese quails used for the study were divided into four groups of seventy five birds each. Each group was divided into three replicates of twenty five birds. Four isonitrogenous (24%CP) diets incorporating graded levels (0, 10, 20 and 30%) of toasted pigeon pea were evaluated. Average daily feed intake (18.62, 19.68, 19.58 and 20.29 g), Feed conversion ratio (4.87, 5.13, 5.36 and 5.38) and feed cost (Naira) per bird (38.34, 40.86, 41.46 and 43.57) increased ($p<0.05$) with increasing levels of dietary toasted pigeon pea inclusion. However, average daily weight gain (3.82, 3.83, 3.65 and 3.77 g) and dressing percentages (59.53, 61.91, 58.89 and 61.92) and percentage of breast to live weight were statistically similar ($p>0.05$) for all the treatments respectively. The back, wings, thighs and drumsticks were affected ($p<0.05$) by levels of toasted pigeon pea inclusion. By this study, pigeon pea may be included in diets of Japanese quails by not more than 10% for optimum growth and cost effective feeding.

Key words: Toasted pigeon pea, growth performance, carcass characteristics, Japanese quails

INTRODUCTION

With human population increasing rapidly in developing and third world countries such as Nigeria, it has become increasingly difficult for the animal protein needs of man to be met. This is in view of the fact that ruminants (cattle, sheep and goats) and bush game like antelopes and rodents used in the past to meet the animal protein needs of man could no longer cope with the increasing demand (Vietmeyer, 1985; Egbunike, 1997). This has led to the development of the poultry industry (Smith, 2001). However, since the mid eighties, poultry production has been on the decline mainly due to high cost of feed and drugs, disease, biologicals, inadequate supply and poor quality of day old chicks amongst other factors (Musa *et al*., 2008). Thus, average animal protein intake of persons in most of these countries is far below the recommendations of nutritionists (Oyawoye, 2002). There has therefore, been calls for a substantial increase in animal protein intake by man in developing countries (FAO, 1989).

In their quest to make animal protein more available and affordable for the common man, animal scientists in general and nutritionists in particular have preoccupied themselves with promoting the rearing of species which in the past were regarded as less important. Thus dwindling productivity of common poultry species like broilers, layers and turkey as a result of factors that militate against their expansion, has led to search for alternative and cheaper means of poultry production and the subsequent introduction of quails in Nigeria (NVRI, 2006; Musa *et al*., 2008).

Japanese quails are small sized, hardy and prolific birds (Robbins, 1981). They attain maturity and lay their first eggs between 5 to 6 weeks of age (Martins, 1987). The meat is lean and the egg is low in cholesterol (Schwartz and Allen, 1981) which is of public health importance in addition to its low caloric value (Haruna *et al*., 1997). These qualities of quail meat and eggs are likely to divert the attention of hypertensive prone individuals to quail consumption (Olubamiwa *et al*., 1999).

In formulating poultry diets, plant energy and protein sources such as maize, soya beans and groundnuts constitute the highest proportion of ingredients (Church, 1991; Aduku, 1992; Aduku, 2004). Their high inclusion rates translate into high cost of feed because of the seasonality of their production and competition for their use by man and livestock (Agbede *et al*., 2002). In consideration of this, any alternative crop that could be used to reduce the level of inclusion of these energy and protein sources would help in reducing the cost of producing feed for livestock provided the crop itself is available in reasonably good quantities, cheap, easy to process and possibly contribute as much if not higher levels of nutrients than the conventional ones in the diet. The pigeon pea considered as one of the underutilized legumes in Nigeria (Oboh *et al*., 1998) is a crop that is

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said to be one of the most widely grown agricultural legumes in tropical and subtropical countries (Oyenuga, 1968; Singh and Diwakar, 1993; Purdue, 2006) and has very low human food and industrial preference (Amaefule and Obioha, 2001). The crude protein content ranges from 19-29% which is of good quality except that it is low in methionine (Olomu, 1995). The seed however, contains antinutritional factors that interfere with digestion of certain nutrients in the digestive system (Oboh *et al*., 1998). Therefore, these factors would have to be removed or detoxified by heat processing before the seeds can safely be consumed by livestock (Ani and Okeke, 2003). The effect of pigeon pea on growth and productive performance of broilers and layers have been investigated (Etuk *et al*., 2003; Amaefule *et al*., 2007; Matthew *et al*., 2010), but there is dearth of information on its effect on performance of quails. This study is aimed at evaluating the effect of graded levels of toasted pigeon pea on growth performance and carcass yield of Japanese quails.

MATERIALS AND METHODS

The experiment was conducted in the poultry unit of the Federal College of Animal Health and production Technology, National Veterinary Research institute, Vom, Plateau State.

Source and processing of pigeon pea: The pigeon pea seeds used in this study were the brown variety obtained from Angwar Mailafiya local market in Jama`a Local Government Area of Kaduna State. Toasting was done in a manner similar to what was described by Etuk *et al*. (2003). The seeds were poured into a large locally made frying pan set over burning firewood with temperatures fluctuating between 100-110°C and constantly stirred to prevent charring for about 12-15 min until about 75% of them were cracked to reveal a slight change in colour (from brown to darker brown) and a "roasted" aroma was achieved. The seeds were then spread out in the air to cool and then crushed and included in the diet. Table 1 contains the percent ingredient composition of the experimental diets.

Experimental birds and management: In a completely randomized design, three hundred (300) seven - day old unsexed Japanese quails were divided into 4 groups of 75 birds each. Each group was further divided into 3 replicates of 25 birds. Each replicate was housed in a covered floor pen measuring 2.7 m^2 equipped with feeders and drinkers and the floor covered with wood shavings as litter material. At the beginning of the study, the birds were administered glucose and a mixture of multivitamins and antistress in their drinking water.

Experimental diets: The birds were fed four different isonitrogenous diets (24%CP). The diets labelled T_1 (control), T_2, T_3 and T_4 contained 0.00% (control) 10, 20 and 30.00% levels of inclusion of toasted pigeon pea seed meal (Table 1). The diets along with clean drinking water were provided *ad libitum* throughout the 5 weeks of the experiment. The experimental diets and toasted pigeon pea were analyzed for proximate composition (AOAC, 2006).

Table 1: Ingredient composition of experimental diets (%)

	Levels of toasted pigeon pea inclusion (%)			
Ingredients	0	10	20	30
Maize	43.34	38.34	33.35	28.35
Wheat offal	10.00	9.00	8.00	7.00
Rice bran	4.45	3.78	3.12	2.45
GNC	36.97	33.63	30.29	26.95
PPSM	0.00	10.00	20.00	30.00
Fish meal	2.00	2.00	2.00	2.00
Bone meal	1.50	1.50	1.50	1.50
Limestone	1.00	1.00	1.00	1.00
Salt	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00

Data collection: The average weekly body weights and feed consumption of the birds were recorded from 1 to 6 weeks. Average daily feed intake was determined by dividing the total feed intake by the number of days of the study while average daily weight gain was determined by dividing the difference between the initial and final weight by the number of days of the study. From the mean daily feed intake and the mean daily weight gain values, feed conversion ration and feed cost per kilogram gain were calculated.

Carcass characteristics: Nine birds per treatment (i.e three birds having their weight closest to the average of each replicate) after being fasted for four hours were selected and slaughtered for determination of carcass yield.

Data analysis: Data collected were subjected to analysis of variance using SPSS statistical package (SPSS, 2006) version 16.

RESULTS

There appears to be a slight reduction in crude protein and metabolizable energy content of the diets containing pigeon pea compared to the control in Table 2 showing the chemical composition of the experimental diets and toasted pigeon pea. The crude fibre contents of the diets containing pigeon pea are also slightly higher than that of the control. In Table 3, there were no significant differences ($p>0.05$) in initial and final weights between dietary treatments. Thus, no significant differences ($p>0.05$) in were observed in weight gain between

Table 2: Proximate composition of experimental diets and pigeon pea

	Levels of toasted pigeon pea (%)				
Nutrient	0 (Control)	10	20	30	PP
Dry matter	88.30	88.52	88.24	88.77	88.55
Crude protein	24.76	24.72	24.50	24.29	23.03
Crude fibre	6.21	6.86	5.83	6.99	8.76
Ether extract	3.10	3.18	3.27	2.93	1.72
Nitrogen free extract	58.59	57.37	58.40	57.64	61.15
Total ash	7.30	7.87	8.00	8.15	5.34
Calcium	0.88	0.90	0.89	1.00	1.08
Phosphorus	0.65	0.69	0.71	0.68	0.03
ME (kcal/kg)	3004.83	2961.62	2992.18	2951.45	3009.21

PP = Pigeon Pea, ME = Metabolizable Energy calculated according to the formula of Pauzenga (1985): ME = (35 x %CP) + (18.8 x % EE) + (35.5 x %NFE)

Table 3: Growth performance of quail birds fed graded levels of toasted pigeon pea seed meal diets

	Levels of toasted pigeon pea (%)				
Parameter	0 (Control)	10	20	30	SEM
Initial weight (g/bird)	8.89	8.99	8.91	9.02	0.22^{NS}
Final weight (g/bird)	142.72	143.06	136.60	141.13	2.00^{NS}
Daily feed intake (g/bird)	18.62^{b}	19.68^{a}	19.58^{a}	20.29^{a}	0.31*
Daily weight gain (g/bird)	3.82	3.83	3.65	3.77	0.08^{NS}
Feed conversion ratio	4.87^{b}	5.13^{ab}	5.36^{a}	5.38^{a}	0.11*
Feed cost (Naira/bird)	38.34^{c}	40.86^{b}	41.46^{b}	43.57^{a}	0.61*

^{a,b,c}Means in the same row having different superscripts are significantly different (p<0.05). SEM = Standard Error of the Mean, NS = Not significant, *= Significant (p<0.05)

Table 4: Carcass characteristics of quail birds fed graded levels of toasted pigeon pea seed meal diets

	Levels of toasted pigeon pea (%)				
Parameter	0 (Control)	10	20	30	SEM
Live weight (g/bird)	142.72	143.06	136.60	141.13	2.00^{NS}
As % live weights					
Eviscerated carcass	59.53	61.91	58.89	61.92	1.03^{NS}
Breast	23.10	22.37	21.19	23.51	0.45^{NS}
Back	16.99^{b}	17.52^{a}	16.48^{b}	17.80^{a}	0.59*
Wings	5.57^{b}	6.31^{b}	5.71^{b}	6.65^{a}	0.51*
Thighs/drumsticks	13.89^{b}	14.74^{a}	13.42^{b}	14.92^{a}	0.24**
Shank	1.43	1.81	1.55	1.77	0.03^{NS}

^{a,b}Means in the same row having different superscripts are significantly different (p<0.05). SEM = Standard Error of the Mean, NS = Not significant, * = Significant (p<0.05), **= Highly significant (p<0.01)

dietary treatments. However, there were significant differences (p<0.05) in average daily feed intake, feed conversion ratio and the cost of feed per bird. Average daily feed intake was significantly higher (p<0.05) with birds that consumed diets containing toasted pigeon pea compared to those fed the control diet.

The carcass components of the quail birds (Table 4) show that proportion of eviscerated carcass, breast and shank to live weight did not differ (p>0.05) between dietary treatments. However, the percentage of back, wings and thighs and drumsticks to live weight differed (p<0.05) between treatments though not in a consistent manner.

DISCUSSION

The crude protein content of the experimental diets in this study (24.29-24.76%) is consistent with the dietary crude protein recommendation of 23 to 26% for growing quail birds by NRC (1994), Aduku (2004) and Musa *et al.* (2008). Though there is a dearth of information on fibre and fat requirements of quails, the values of their composition (5.83-6.99% for fibre and 2.93-3.27% for fat) compare favourably with the 5-7% and 3-5% respectively recommended generally for poultry by the same authors above. The calcium (0.88-1.00%) and phosphorus (0.65-0.71%) levels also compare favourably to the recommendations of Bolton and Blair (1986), NRC (1994) and Dafwang (2006) for calcium (0.75-0.80%) and phosphorus (0.65-0.90%) requirements of quail birds. The energy levels of the diets (2951.45-3004.83 kcalME/kg) are however, slightly higher than 2650-2900 kcalME/kg recommended by Bolton and Blair (1986), NRC (1994), Olomu (1995) and Aduku (2004). This however, does not have a deleterious effect on growth rate of the birds as excess carbohydrate is normally converted to fat in the body (McDonald *et al.*, 1995).

In Table 3, the growth performance indices of the quail birds show that average daily feed intake

(18.62-20.29g), feed conversion ratio (4.87-5.38) and feed cost per bird were significantly ($p<0.05$) better with birds fed the control diet than those fed diets containing pigeon pea. The values of these parameters increased ($p<0.05$) with increasing levels of pigeon pea inclusion suggesting that diets containing pigeon pea may not be as nutritious as that of the control. This also indicates the higher the level of pigeon pea inclusion, the lower the ability of the birds to convert feed. This trend of the quantity of feed, FCR and feed cost in Naira per bird values increasing with increasing levels of dietary pigeon pea inclusion was also reported by Yisa *et al.* (2010) when they fed graded levels of boiled and dried pigeon pea to growing cockerels. The feed intake of the birds in this study is similar to the average daily fed intake of quails reported by Edache *et al.* (2007) and Edache *et al.* (2009). The values are also slightly higher than 13-15 g per day reported by Musa *et al.* (2008). The average daily weight gains of the quail birds in this study (3.65-3.83 g) are slightly higher than the 3.28-3.67 g reported by Edache *et al.* (2007) and 2.90-3.11 reported by Edache *et al.* (2009). The Feed Conversion Ratio (FCR) of the birds in this study (4.87-5.38) are better than the FCR values reported by Edache *et al.* (2007) and Edache *et al.* (2009) which were 5.28-6.85 and 6.12-7.61 respectively. Showing a higher efficiency of feed utilization, probably as a result of the feed being of higher quality or less feed being wasted. Thus, the amount it cost to raise the average bird to maturity in this study was also less than what was reported by the last two authors.

The final weights of the birds at the end of the study (Table 3) are however, slightly below the range of 150-180 g reported by Garwood and Diehl (1987) and Schwartz and Allen (1981) for Japanese quails.

The percentages of eviscerated carcass, breast and shank were not affected ($p>0.05$) by levels of toasted pigeon pea inclusion in the diets. However, the back, breast and thighs/drumsticks differed ($p<0.05$) significantly amongst dietary treatments. The percentages of these components relative to live weight increased ($p<0.05$) with increasing levels of dietary toasted pigeon pea inclusion. This trend cannot be explained since levels of pigeon pea inclusion did not have any significant effect on the other carcass components.

Conclusion and recommendation: Pigeon pea seeds are usually cheaper than maize and soya beans at their time of harvest (October to December) a period during which poultry diets can be made with pigeon pea at a lower cost. However, based on the findings of this study, utilization of feeds becomes less with increasing levels of toasted pigeon pea inclusion. Since growth rate and percentage of eviscerated carcass were not affected by levels of pigeon pea, it is recommended that in areas where the seeds are in abundance especially at harvest time, pigeon pea may be included in Japanese quail diets at a maximum 10% level without any detrimental effect on growth performance and carcass yield.

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