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Growth Response of Quails (*Coturnix coturnix japonica*) to Varying Levels of Cassava (*Manihot esculenta*) Tuber Meal as a Replacement for Maize (*Zea mays*)

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Authors' contributions

The research was a collaborative work of the both authors. Author BIO designed the study while author AEN procured the experimental birds and other materials used for the research. Author AEN also performed the statistical analysis and made the first draft of the manuscript. Author BIO did the final editing. Both authors read and approved the final manuscript.

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ABSTRACTS

The study was conducted to determine the growth response of quails (*Coturnix coturnix japonica*) to varying levels of cassava tuber meal as a replacement for maize. Thirty two

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(32) unsexed Japanese quails were randomly allotted to four dietary treatments. In each of the four diets, sun-dried cassava tuber meal was used to replace maize at 0, 25, 50 and 75% levels. The quails were fed one of four experimental diets over a period of 42 days (6 weeks). Result showed that there was no significant difference (P>0.05) in feed intake between quails fed 0% (T_1) and 25% (T_2) and those fed 50% (T_3) and 75% (T_4) levels of inclusion of cassava tuber meal as a replacement for maize. However, MWFI was significantly (P<0.05) higher in (T_3) 152.2±2.07) than T_2 (131.94±11.24) group. No significant difference in weight gain (P>0.05) was observed between T_1 and T_3 groups just as there was no significant difference in weight gain between T_2 and T_4 groups. MWWG was significantly higher (P<0.05) in T_3 (125.60±10.96) than T_2 (111.41±10.31) group. MWFCR was highest in T_4 (1.58±0.23) with 75% inclusion level of cassava tuber meal and lowest in T_1 (1.18±0.10) with 0% inclusion level of cassava tuber meal. It implies therefore that sun-dried cassava tuber meal can favorably replace maize at 50% level of inclusion in quail diet.

Keywords: Quail; cassava tuber meal; maize; growth performance.

1. INTRODUCTION

Maize (*Zea mays*) forms the base of most livestock feeds, and it is particularly relished by poultry, rabbits and pigs [1] the grains are very useful as food to man and animals as well as raw materials for industries. Hence, there is stiff competition between man and livestock for this feed resource. This competition has resulted in scarcity of the feed ingredient in Nigeria. Also, it has increased the cost of feeding animals beyond the reach of the average Nigerian farmers [2,3].

The high cost of cereals and uncertainty about their sustainable supply as energy source for livestock led to the search for alternative but cheaper feed resources [4]. Cassava (*Manihot esculenta*) is a woody shrub of the *Euphorbiaceae* (Spurge family) native to South America. It is extensively cultivated as an annual crop in tropical and subtropical regions of the world for its edible starchy root, a major source of carbohydrate.

The quest and effort to substitute maize in poultry feed with other less costly energy sources was inculcated significantly to reduce the cost of production in poultry [5]. Cassava tuber, a primary source of carbohydrate, can completely replace maize as an energy source in feeds of pigs and birds. As a matter of fact, its use for this purpose is presently limited to research centre and small scale pig producers. For adoption by large scale commercial producers, appropriate technology needs to be developed to reduce the high moisture and hydrocyanic acid (HCN) contents of the tubers [6].

The protein intake level of humans in most developing countries including Nigeria are very low due to the high cost of the product [7]. There has been call for substantial increase in the intake of proteins of animal origin in the developing countries [8].This may have gradually triggered off interest in quail farming as an important poultry business in Nigeria unlike in the past when all emphasis have been on domestic fowl production. [9] stated that quails have been reared for egg and meat production in Nigeria, mainly by small and medium scale farmers. An online report [10] on quail farm affirmed that Japanese quail in the wild are migratory birds living in grassland and cultivated fields. They have been found to thrive well and grow efficiently in captivity when fed with high protein diet [11]. However, [12] reported

that there is no significant difference in performance parameters (MWFI, MWWG and MWFCR) when fed 30% inclusion levels of three vegetable protein sources (groundnut cake, soya bean and cotton seed cake).Quail species has both nutritional and economic benefits since it is fast growing and resistant to many diseases [13,14]. It possesses distinct characteristic which includes early reproductive maturity, fast growth rate, early attainment of market weight as well as laying age, short generation interval, high rate of egg production, short incubation period of only 17days and much lower feed and space requirement than the domestic fowl [15].

Quail meat is renowned for its low caloric value in addition to having high quality protein of high biological value [16]. These qualities especially the low fat content is likely to divert the attention of people especially the hypertension-prone individuals to quail meat consumption hence the justification of the study.

2. MATERIALS AND METHODS

2.1 Experimental Site

The study was carried out at the Teaching and Research Farm of Enugu State University Science and Technology, Enugu, Nigeria. The site is situated at latitude 06º4^{1}Nand Longitude 08º 65^{1} E. It is located at equatorial rain forest vegetation zone of southeastern Nigeria. It has an annual rainfall that ranges from 1700 – 1800mm and a mean temperature of 39ºC.

2.2 Experimental Birds

Thirty-two (32) unsexed Japanese quails *(Coturnix coturnix japonica)* of twenty one days of age were randomly grouped into four dietary treatments of 8 quails per treatment. Each treatment was further replicated twice with 4 birds per replicate. The four diets had 0, 25,50 and 75% levels of sun-dried cassava tuber meal as a replacement for maize. The nutrient composition of cassava tuber meal is as shown in Table 1.

Table 1. Proximate Composition of cassava tuber meal (CTM) and cassava peel meal (CPM) % on dry matter basis

Nutrients (%)	CTM	CPM
Dry matter	28.50	27.94
Crude protein	2.58	5.29
Ether extract	0.45	1.18
Crude fiber	0.43	20.97
N.F.E	94.12	66.13
Total Ash	2.41	5.93

Source: Oyenuga and Opeke, [17]

2.3 Experimental Diets

Cassava tubers sourced from Agbani market in Nkanu Local Government Area of Enugu State, Nigeria were peeled, washed and chopped into chips of 1mm, and sun-dried. Sun-drying which lasted for ten days was aimed at reducing the moisture content. The dried

cassava and other ingredients were milled separately and used to compound the experimental diets shown in Table 2.

Table 2. Composition of the experimental diets

Ingredients (%) treatments	T_1(0%)	T_2(25%)	T_3(50%)	T_4(75%)
Maize	50.00	37.05	25.00	12.50
Cassava	0.00	12.50	25.00	37.50
Soya bean cake	26.89	26.89	26.89	26.89
Fish meal	7.36	7.36	7.36	7.36
Wheat offal	10.00	10.00	10.00	10.00
Bone meal	4.80	4.80	4.80	4.80
Salt	0.25	0.25	0.25	0.25
Premix	0.50	0.50	0.50	0.50
Lysine	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10
Total Calculated analysis:	100.00	100.00	100.00	100.00
Crude protein%	21.18	20.37	19.55	18.73
M.E. (kcal kg^{-1})	2527	2509	2491	2473

2.3 Experimental Procedure

Thirty two (32) quails sourced from Songhai Farm, Amukpe, Sapele. Local Government Area of Delta State, Nigeria were housed and managed intensively in battery cage. Each cage was assigned to each of the four dietary treatments consisting of 0, 25, 50 and 75% levels of cassava tuber meal respectively. The diets and clean water were offered respectively *ad libitum* throughout the experimental period.

2.4 Data Collection and Analysis

Data were collected on daily feed intake as well as on weekly body weight. Feed conversion ratio was computed as feed intake divided by weight gain. Data collected were subjected to analysis of variance according to [18]. Least significant difference method was used to separate means that differed statistically ($P<0.05$).

3. RESULTS AND DISCUSSION

Results of performance characteristics of quails fed varying levels of cassava tuber meal as a replacement for maize are as summarized in Table 3. There was no significant difference ($P>0.05$) in feed intake between quails fed 0% and 25% just as there was no significant difference in feed intake between those fed 50% and 75% inclusion levels of the sun-dried cassava tuber meal. However, feed intake was significantly higher ($P<0.05$) in group fed 50% than group fed 25% of cassava tuber meal as a replacement for maize. Surprisingly, there is increased feed intake with decreased crude protein level. This contradicts the report by [19,20] that quails fed 24% crude protein recorded better growth performance.

There was no significant difference ($P>0.05$) in weight gain between T_1 and T_3 and between T_2 and T_4 groups. Values of weight gain were significantly higher ($P<0.05$) in T_3 than T_2 groups. This is seemingly difficult to explain but [21] has stated that growing quails are able to keep body growth rate over a wide range of dietary energy levels.

Feed conversion ratio (FCR) varied significantly (P<0.05) among the different treatment groups. It was highest in T_4 group with 75% inclusion level of cassava tuber meal followed by T_3, then T_2 and lowest in T_1 with zero percent inclusion level of cassava tuber meal as a replacement for maize. This implies that there was increasing FCR with decreasing crude protein level.

Table 3. Performance characteristics of quails *(Coturnix coturnix japonica)* fedvarying levels of cassava tuber meal as a replacement for maize

	Inclusion levels of sun-dried cassava tuber meal (%)				
Parameters	**T_1(0)**	**T_2(25)**	**T_3(50)**	**T_4(75)**	**SEM**
MWFI(g)	136.10±11.42^b	131.94±11.24^b	152.22±12.07^a	153.60±12.12^a	9.25
MWWG(g)	123.75±10.88^a	111.13±10.31^b	125.60±10.96^a	105.25 ±10.40^b	8.38
MWFCR	1.18± 0.10^c	1.25± 0.16^c	1.31± 0.21^b	1.58± 023^a	0.15

MWFI: Mean weekly feed intake; MWWG: mean weekly weight gain and MWFCR: mean weekly feed conversion ratio; a,b,c: Means with different superscripts in the same row are statistically different (P<0.05) according to least significant difference test

4. CONCLUSION AND RECOMMENDATION

It can be concluded that the best level of inclusion of cassava tuber meal as a replacement for maize is 50% since the quails achieved their highest feed intake and weight gain at this level.

In view of the high cost of maize and the uncertainty about their sustainable supply as energy source for livestock and poultry, we recommend that cassava tuber meal can be used as a replacement for maize at 50% level in quail diet. This will obviously improve on the productivity.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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