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EFFECTS OF TOASTED AFRICAN NUTMEG (*MONODORA MYRISTICA*) ON THE GROWTH PERFORMANCE OF JAPANESE QUAILS (*CORTUNIX CORTUNIX*)

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ABSTRACT

A research work was carried out to evaluate the effects of toasted *Monodora Myristica* spice as feed additive in quail nutrition. The proximate, vitamin and mineral composition and anti-nutritional factors, growth performance, cut parts and organ characteristics, biochemical parameters and egg quality traits were evaluated in this study that lasted for fifteen weeks in a completely randomized design. A total of 300-day-old quail chicks were brooded for 14 days. Thereafter, they were allocated to 4 dietary treatments designated D1, D2, D3 and D4 and having 0%, 0.5%, 1.0% and 1.5% *Monodora Myristica* respectively. Each treatment was replicated 3 times at 25 quails (5 males: 20 females) per replicate. The growth performance and carcass characteristics study lasted for 8 weeks while the eggs were collected for 4 weeks. From the results, the proximate composition of the toasted *Monodora Myristica* revealed a crude protein (25.38%), crude fibre (6.24%), ether extract (21.54%), ash (9.40%) and NFE 37.44%. These values were significantly ($P<0.05$) higher than the values (15.75% CP, 9.64% CF, 28.60% EE and 8.84% ash) obtained in raw *Monodora Myristica.* The mineral and vitamin contents were reported to be 5.22% Calcium, 2.00% Magnesium, 0.33% Sodium, 25.26%Zinc, 14.51% iron, 240.46mg/100g Ascorbic, 0.98mg/100gThiamin and 0.14mg/100g Riboflavin. Daily feed intakes were reported to be 2.39g/b/d, 2.83g/b/d, 3.22g/b/d and 3.15g/b/d respectively for 0%, 0.5%, 1.0% and 1.5% *Monodora Myristica*-flavoured diets. There was no significant ($p>0.05$) increase in the daily feed intake though it increased only numerically as level of inclusion increased from 0% to 1.0% but decreased at the level above 1.0%. There were significant differences ($P<0.05$) in the average daily weight gain and feed conversion ratio among the varying treatments. Average daily weight gains for the groups were 1.68g/b/d, 2.18g/b/d, 3.35g/b/d and 3.37g/b/d respectively for D1, D2, D3 and D4. Significant differences ($P<0.05$) were observed in the cut parts and organ characteristics. From

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the results, *Monodora Myristica* was not observed to be detrimental to the quails with respect to the weight of organs and cut parts. Dressed weight increased as level of inclusion increased up to 1.0% but then declined afterwards to 137.69g. Liver weights were 3.55%, 2.55%, 1.79% and 1.77% respectively for D1, D2, D3 and D4. Quails fed the control diet recorded the highest liver weight ($P<0.05$) of 3.55% indicating stress condition. The low liver weight in quails fed *Monodora*-flavoured diet indicates potential of *Monodora* to protect the liver from free radicals that cause stress. Breast meat was significantly reduced at 1.0% and 1.5% *M. myristica* inclusion.

Keywords: Monodora myristica, African nutmeg, Japanese quails (Coturnix coturnix), Feed additive, Growth performance, Carcass characteristics, Organ weight

INTRODUCTION

Poultry is one of the major sources of animal protein and generally accepted worldwide (FAO, 1990). Chicken, duck, guinea fowl, turkey are the major classes of poultry. The Japanese quail was introduced in Nigeria in 1992. In the recent times, attempts are being made to domesticate and popularize quail production. Since 1993, quail farming has been growing in popularity in Nigeria (Daikwo *et al.*, 2011). Quails are small bodied birds of weight varying between 150 – 700 g when fully matured. It has feathers and the female lay small eggs of less than 15g compared to egg laying chicken of about 40 – 70g. The meat is a delicacy and highly nutritious. The high prolificacy and hardy nature of the quail bird as well as the recent discovery of the health benefits of its egg have made rearing of Japanese quails suitable for the resource poor tropical Sub-Saharan African countries.

Japanese quails are hardy birds that thrive in concrete and small cages and are inexpensive to keep; they are affected by common poultry diseases, but fairly resistant. Japanese quail birds mature in about six weeks and are usually in full egg production in 50 days of age. Quails with proper care hens lay 200 eggs in the first year of lay. Life expectancy is 2 – 21 years (Oluwatomi, 2011). Japanese quail has a great impact on research field due to its unique properties of easy maintenance, low generation interval (Wenk, 2003). In meat lines of Japanese quail, the productivity and quality of the eggs is important for an economical breeding and for propagation of the flocks (Fetuga *et al.,*1976).

Egg remains the only sources of supply of day-old chicks for the success of the poultry production chain. External and internal quality of egg is of major importance to both layer and breeder industries worldwide (Altinel *et al.* 1996). Production of eggs and its quality are influenced by many factors both genetic and non-genetic such as breed, nutrition, mortality rate, culling age and season (North and Bell, 1990; Salahuddin and Howlider, 1991; Oluyemi and Robert, 2000). Hen's egg has been traditionally considered as an important source of nutrients for humans (Fetuga *et al.*, 1976). It is a source of protein, lipids, mineral and vitamin easily renewable.

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MATERIALS AND METHODS

Location

The Research work was carried out at the Poultry Unit of the Teaching and Research farm of the Faculty of Agriculture, Abia State University Umuahia, campus located in Umudike. Umudike is located within the tropical rain forest zone and lies between latitude $5^0$29'N and longitude $7^0$32'E and 122m above sea level and the environment is characterized by an annual rainfall ranging from 60-68mm. The ambient temperature ranges between 30^0C – 32^0C while the relative humidity is in the range of 60 -80% (Eke-Okoro, 1999)

Source of *Monodora Myristica* and Processing

The study commenced with the procurement of the test ingredient *Monodora Myristica*. Seeds of *Monodora Myristica* were bought from Ndoro market in Ikwuano Local Government Area of Abia State. They were cleaned and toasted for one hour at 65^0Cmilled into powder and bottled in air tight container for the chemical analysis and for the feeding trial.

Proximate Composition Analysis

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Determination of the proximate composition of the test ingredient was carried out according to the procedure of A.O.A.C. (1990) using the microkjeldahl method for protein and soxhlet extraction procedure for ether extract. Gross energy of the sample was done by the use of the Adiabetic oxygen Bomb calorimeter technique.

Feeding trials were conducted in a completely randomized design involving the supplementation of *Monodora Myristica* spice in the diet. It involved assessment of the effect of *Monodora Myristica* on the growth performance (feed intake, weight gain and feed conversion ratio) of the quail birds and evaluation of the effect of *Monodora Myristica* on their carcass characteristics.

This phase lasted for six weeks.

Experimental Birds and Design

One hundred and twenty unsexed quail birds were brooded for 2 weeks in deep litter and thereafter allocated to the four experimental diets designated as D1, D2, D3 and D4 following a completely randomized design with 30 birds per treatment and replicated three times with 10 quails per replicate. The treatments contained 0.0%, 1.0%, 1.5% and 2.0% *Monodora Myristica* respectively.

Experimental Diets and Management of the Birds

Monodora Myristica herein called the test ingredient was toasted, milled and then used for the formulation of the experimental diets which were isocaloric and isonitrogenous. *Monodora Myristica* was added at the rate of 0%, 1.0%, 1.5% and 2.0% to the diets D1, D2, D3 and D4 respectively (Table 1). During the brooding period, the quails were given feed and water *ad-libitum*. Routine vaccination programmes were also administered during the experimental period. After the stabilization period, weighed quantities of feed were given daily and water supplied *ad-libitum*. Feed consumption and water intake were measured daily while the weight of the birds were taken weekly in groups.

At the end of the rearing phase that lasted for 7 weeks, the quails were evaluated for growth performance parameters. Thereafter, at the laying phase, eggs were collected daily from each replicate for 4 weeks and the total number of eggs at the end of the fourth week was recorded. Two eggs from each replicate were randomly picked per week for the four weeks (eight eggs per replicate) for analysis of the egg quality parameters.

Measurement of Parameters

Growth parameter:

$$\textbf{Feed consumed per bird} = \frac{\text{B-A}}{\text{Number of birds}} \times \frac{\text{Number of days}}{1}$$

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B= quantity of feed left over

A= quantity of feed given

Average weight gain= Final weight – Initial weight

Average daily weight gain=$\frac{\text{Average weight gain}}{\text{Number of days}}$

Feed conversion ratio =$\frac{\text{Mean daily feed intake}}{\text{Mean daily weight gain}}$

Carcass Evaluation

Two quails per replicate were randomly selected at the end of the metabolic trial. The birds were then starved for twenty-four hours two birds were selected, weighed and slaughtered by severing the jugular vein. The birds were bled, dipped in hot water for 10 minutes and then defeathered. The head, neck and visceral were separated. Thighs, drumstick, breast and backs were dissected from each carcass and weighed separately. The heart, kidney, emptied gizzard was also separated and weighed.

Statistical Analysis:

The data collected were subjected to analysis of variance (ANOVA) for completely randomized design. Where significant differences occurred, means were further subjected to Duncan's multiple range test (Duncan 1952) as packaged in SPSS 2006 for windows; version 16, SPSS Inc.

Experimental Diets:

Table 1: Dietary Composition of the experimental diets supplemented with *Monodora Myristica*

Ingredients	D1 (0%)	D2 (1.0%)	D3 (1.5%)	D4 (2.0%)
Maize	25.00	25.00	25.00	25.00
Maize offal	15.00	15.00	15.00	15.00
Wheat offal	15.00	15.00	15.00	15.00
P.K.C	4.00	4.00	4.00	4.00
G.N.C	4.00	4.00	4.00	4.00
S.B.M	15.00	15.00	15.00	15.00
Fish meal	5.00	5.00	5.00	5.00

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M. myristica	0.00	0.50	1.00	1.50
Methionine	0.50	0.50	0.50	0.50
Lysine	0.50	0.50	0.50	0.50
Bone meal	4.00	4.00	4.00	4.00
Oyster	2.00	2.00	2.00	2.00
vit/min premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Rice Bran	9.50	9.50	9.50	9.50
Total	100	100	100	100
CALC.				
ME(Kcal/kg)	2739.89	2709.36	2694.10	2678
CP (%)	20.61	20.31	20.36	20.15
EE (%)	6.30	6.22	6.35	6.26
Lys (%)	1.10	1.15	1.15	1.13
Meth (%)	0.40	0.45	0.45	0.45
Ca (%)	2.20	2.21	2.26	2.26
P (%)	0.75	0.80	0.80	0.80

P.K.C; G.N.C and S.B.M represent palm kernel cake, groundnut cake and soybean meal respectively. CP, EE, Lys, Meth, Ca and P represent crude protein, ether extract, lysine, methionine, calcium and phosphorus respectively

RESULTS AND DISCUSSION

Growth Performance of Quails Fed Toasted *Monodora*-flavoured Diets

The effects of *Monodora Myristica* on the growth performance of *Cortunixcortunix* is summarized in Table 3.

The average daily feed intake recorded were 2.39g/b/d, 2.83g/b/d, 3.02g/b/d and 3.15g/b/d while final body weights were 76.89g/b, 97.89g/b, 147.03g/b and 147.96g/b for quails fed diets 1, 2, 3 and 4 respectively. The Gain in body weight of the quails was observed to be 1.68g/b/d, 2.18g/b/d, 3.35g/b/d and 3.37g/b/d for D1, D2, D3 and D4 respectively. The result also revealed a feed conversion ratio of 1.42, 1.30, 0.90 and 0.93 respectively for quails fed D1, D2, D3 and D4 respectively.

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The results revealed that the least consumed diet ($p > 0.05$) was the *Monodora*-free diet (0% *Monodora*) while feed consumption appeared to increase though insignificantly ($p>0.05$) as inclusion level increased but declined only numerically when *Monodora* was included beyond 1.0%. There was no significant difference ($p > 0.05$) in the average daily feed intake between the 1.0% and 1.5% inclusion levels. The quails fed 1.5% and 2.0% *Monodora Myristica* significantly ($p<0.05$) recorded higher final weight than those fed the control diets and 1% *Monodora Myristica*-flavoured diets. The *Monodora* supplemented diets significantly ($p <0.05$) improved the mean daily body weight gain over the control diet. The weight gain in the *Monodora* -flavoured diet appeared to increase as the level of inclusion increased from 0.5% to 1.5% even though there was no significant difference ($p >0.005$) between the weight gain of quails fed 1.0% and 1.5% *Monodora Myristica* (Diets 3 and 4). There were significant differences ($p<0.05$) in the feed conversion ratios of the various diets. The best feed conversion ratio was observed in diets 4 even though it was statistically similar ($p>0.05$) to that obtained in diet 3. The conversion rate of feed to meat was poorest for the quails fed control diet.

Monodora Myristica was observed to improve feed intake, indicating that the spice- *Monodora* had appetite stimulating properties like others spices such as turmeric (Wenk, 2002), ginger (Okoye*etal*., 2006). A similar report was given by (Ukoha, 2011) when *Monodora Myristica* was included in broiler diet. Feed intake which increased as the level of inclusion of *Monodora* beyond 1.0% did not make any significant improvement in the feed intake by quails. The result is an indication that quails like chickens, have well developed taste birds, in line with the observation and report by Holdas and May (1966). The quails may have been able to detect the flavor added by *Monodora* spice. The low intake of diet I (control) could be attributed to low palatability of the diet which could have been due to the absence of *M. myristica.*

However, it was in contrast to the observation made when piglets were fed with turmeric spice as recorded by Samarasinghe and Wenk (2002) was due to the absence of *Monodora* spice.

Monodora spice was observed to improve the weight gain of the quails ($p<0.05$) over the control fed quails. The highest average daily weight gain (3.37/b/d) was observed among the quails fed diets having 1.5% *Monodora*. However, there was no significant difference in average weight gain between quails fed diet 3 (1.0% *Monodora*) and diet 4 (1.5% *Monodora*). The average daily weight gain was observed to increase significantly ($p<0.05$) as *Monodora* inclusion increased from 0.5% to 1.0% but was not statistically better beyond this level.

The increase in weight gain for quails fed *Monodora*-flavoured diets over the control is in line with the report by Ukachukwu (2000) and Adeniji and Balogun (2002) who reported an increase in body weight gain of broilers fed garlic and ginger, mixed spices, vanilla and curry mixed spiced respectively. Ukoha (2011) also made a similar observation of increased weight gain resulting from

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Monodora spice in broilers diets. The *Monodora Myristica* may have improved the feed utilization that was evidenced in the improved daily weight gain.

Feed conversion ratio was significantly ($p<0.05$) improved over the control. The absence of *Monodora Myristica* in quail diet resulted to the poor rate of conversion of feed to meat 1.42g of feed was used to produce only weight increase by 1g. However, as *Monodora* was introduced into the diet at 0.5, 1.0% and 1.5%, the rate of conversion increased. The lowest quantity of feed 0.93g in diet 4 was needed to produce 1g increase in weight due to the 1.5% level of inclusion of *Monodora*. This was followed by the diet flavoured with 1.0% *Monodora*. Thus, there was an improvement in the efficiency of feed utilization for the *Monodora Myristica* -flavoured diet. This observation is in line with the result observed with *Capsaicin* (Jamroz and Kamel, 2002) and *Oregano* oil Extract (Botsoglou *et al*, 2002). The improved weight gain and feed efficiency (feed conversion ratio) by *Monodora* supplementation indicates rapid growth and this is desirable because it minimizes the overhead cost of maintenance per unit meat produced. The implication of low/poor feed conversion ratio of the *Monodora*-free diet is that more feed and consequently more money will be required to increase or achieve a unit increase in the body weight, due to poor nutrient absorption and probably low protein availability due to absence of *Monodora Myristica* in the diet.

The effects of Toasted *Monodora Myristica* spice on the carcass and organ characteristics of quails

The weights of cut parts and organs proportions of quails fed *Monodora Myristica* supplemented diets are presented in Table 5. Live weights recorded were 76.89g, 97.89g, 147.03g and 147.96g respectively for quails fed diets D_1, D_2, D_3 and D_4. *Monodora Myristica* significantly ($p<0.05$) improved the live weight of the quails. The liveweights were observed to increase as the level of inclusion increased. Thigh weights were observed to be 1.69g (2.02%), 1.63, (1.67%), 1.82g (1.24%) and 1.97g (1.33%) for quails fed diets having varying levels of *Monodora Myristica.* The breast-bone cut weight observed were 28.70g (19.41%) for 0% *Monodora* diets while others measured 24.90g (16.94%), 21.20g (21.66%), and 20.40g (26.55%) for quails fed 0.5%, 1.0% and 1.5% *M. myristica.*

The weights of the heart recorded were 2.04g (2.65%), 2.12g (2.17%), 2.49g (1.69%) and 2.87 (1.94%) for D_1, D_2, D_3 and D_4respectively. Liver weights were observed to record 3.55%, 2.55%, 1.79% and 1.77% for the quails fed 0%, 1.0%, 1.5% and 2% *Monodora Myristica* respectively. The quails that were fed the *Monodora*-free diet had the largest liver size of 2.73g (3.55%) while the quails fed *Monodora* flavoured diets at 0.5%, 1.0% and 1.5% recorded 2.50g (2.55%) 2.63g (1.79%) and 2.62g (1.77%) respectively. The increase in the size of the liver of quails fed *Monodora Myristica*-free diet may have been as a result of the presence of anti-nutritional factors

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such as tannin, saponin, flavonoid and alkaloids. The liver has been reported to be the organ that tries to fight toxins present in diets. As a result of the detoxification activities, the liver enlarges. The enlarged liver weight of the birds fed the control diet could be an indication of stress. The low weight of liver observed in the groups fed *Monodora Myristica* – flavoured diet indicate that *Monodora* can effectively protect the liver from the free radicals that cause stress.

From the result, *Monodora Myristica* was not detrimental to the quails with respect to the weight of organs and cut parts.

Table 2: Proximate composition of toasted *Monodora Myristica*

M.C (%)	D.M (%)	C.P (%)	Ash (%)	C.F (%)	E.E (%)	N.F.E(%)	G.E(Kcal/kg)
8.24	91.76	25.38	9.40	6.24	21.54	37.44	445.14

Table 3: Vitamin and Mineral Composition of toasted *Monodora Myristica*

Ascorbic acid (g/100g)	**Thiamin (mg/100g)**	**Riboflavin (mg/100g)**	**Niacin (mg/100g)**	**Ca (%)**	**Fe (mg)**	**Na (%)**	**Mg (%)**	**K (%)**
240.46	0.98	0.14	16.44	5.22	14.51	0.33	2.01	1.38

Ca, Fe, Na, Mg, K represent calcium, iron, sodium, magnesium and potassium respectively

Table 4: Effects of Toasted *Monodora Myristica* spice on the growth performance of quails.

Parameters	**(D1) 0%**	**(D2)0.5%**	**(D3)1.0%**	**(D4)1.5%**	**SEM**
D.F.I (g/b/d)	2.39	2.83	3.22	3.15	1.21
I.B.W (g/b)	6.33	6.33	6.33	6.28	0.12
F.B.W (g/b)	76.89^{b}	97.89^{b}	147.03^{a}	147.96^{a}	14.21
A.W.G (g/b/d)	1.68^{b}	2.18^{b}	3.35^{a}	3.37^{a}	0.63
F.C.R	1.42^{b}	1.30^{b}	0.96^{a}	0.93^{a}	0.24

^{a,b,c}– means in a row with the same superscripts are not significantly ($p>0.05$) different from one another. D.F.I, I.B.W, F.G.W, A.W.G and F.C.R represent daily feed intake, initial body weight, final body weight, average weight gain and feed conversion ratio respectively.

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Table 5: Effect of Toasted *Monodora Myristica* on the cut parts/organ weight of quails

Parameter	D1 (0%)	D2 (0.5%)	D3 (1.0%)	D4 (1.5%)	SEM
Live weight (g)	76.89 [b]	97.89[b]	147.03 [a]	147.96 [a]	4.65
D.F.W (%)	98	91	94	93	0.23
D.W (g)	75.35 [b]	89.08 [b]	138.21 [a]	137.60 [a]	4.21
Thigh (%)	2.02	1.67	1.24	1.33	0.95
Breast meat (%)	19.41[d]	16.94[c]	21.66[b]	26.55[a]	0.30
Kidney (%)	5.07 [b]	3.30[b]	2.24[a]	2.48[a]	0.38
Liver (%)	3.55 [b]	2.55 [b]	1.79[a]	1.77 [a]	0.25
Provent (%)	0.87[a]	0.79[a]	0.61[c]	0.74[b]	0.05
Herat (%)	2.65	2.17	1.69	1.94	0.13

D.F.W., D.W. and provent represent defeathered weight, dressed weight and proventriculus respectively. Organ and cut part weight expressed as percentage of dressed weight.

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