ECONOMIC OF PRODUCTION OF GROWING JAPANESE QUAILS *(COTURNIX COTURNIX JAPONICA)* FED SUN-DRIED MANGO *(MANGIFERA INDICA)* KERNEL MEAL

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ABSTRACT: *This study investigated the cost effectiveness of graded replacement levels of maize with Sun-dried Mango (Mangifera indica) Kernel Meal (SMKM) in the diets of growing Japanese quails (Coturnix coturnix japonica) over a period of four weeks (28 days). One hundred and forty four unsexed Japanese quails of about 2 weeks old and about the same weights (26.56 ± 0.02g) were randomly allotted to three dietary treatments of 48 quails each. Each treatment was replicated thrice with 16 quails per replicate. In each of the three diets, SMKM was used to replace maize at 0% [Treatment I (TI)], 25% [Treatment II (TII)] and 50% [Treatment III (TIII)]. Feed cost reduced with increased supplementation of SMKM. Average cost of feed intake per quail was significantly (P<0.05) lowest in TIII. The cost of feed per gram weight gain reduced across treatments. More saving accrued at 50% inclusion level with highest profit and return to Naira invested. The results indicated reduced cost as levels of SMKM increased in diets of growing Japanese quails.*

KEYWORDS: Japanese quail, SMKM, cost effectiveness.

INTRODUCTION

The livestock industry in Nigeria is undergoing difficulties as a result of expensive nature of livestock feeds. There is therefore, increasing competition between man and livestock for available feedstuff for food, feed and industrial raw materials. According to Bamgbose, *et al.*, (2004), maize account for about 45 % to 55 % of poultry feed. Therefore any effort to substitute maize in poultry feed will significantly reduce the cost of production. The most relevant option to arrest the present feed crisis of the livestock industry is by-product utilization (Atteh, 1986). These deduction point clearly to alternative feed stuff for livestock feed production in order to cut down feed prices and make them more affordable by livestock farmers. As a result of shortage of conventional feed stuffs, livestock nutritionists have continued with their search for alternative feedstuffs. These alternative feed must be cheap, readily available and less competed for by man and industries or not competed for at all (Akinmutimi, 2004). The search for substitute has led to the discovery of non-conventional energy feeds such as; cocoyam, cassava, mango seed kernel etc (*Mangifera indica L.*).

Mangoes are produced in over ninety countries worldwide. Asia accounts for approximately 77% of global mango production and America and Africa accounts for approximately 13% and 9% respectively (FAOSTAT, 2007). India is the largest producer of mangoes, accounting for 38.6% of world production from 2003 to 2005. During the period, India's mango crop averaged 10.79 million metric tons, followed by China and Thailand at 3.61million metric tons (12.9%) and 1.73 million metric ton (6.25%) respectively. Other leading mango producers during the 2003 to 2005 period includes; Mexico (5.5%), Indonesia (5.3%), Pakistan (4.5%), Brazil

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94.3%), Philippines (3.5%), Nigeria (2.6%) and Egypt (1.3%). Out of the 2.6% of mangoes produced in Nigeria about 80% is produced in Benue state.

Mango kernel is a good source of soluble carbohydrates (Saadany *et al.,* 1980; Jansman *et al*., 1995; Teguia, 1995; Diarra *et al.,* 2008). The protein of the kernel (7.80 – 8.00 %) is comparable to that of maize but it has higher fats (7.80 – 9.00 %) than maize (Saadany *et al*., 1980). Mango kernel flour is reported to be equal to rice in food if tannin free (Morton, 1987). Tannins are known to interfere with protein digestibility and render it unavailable. There are other anti-nutrients contained in mango kernel such as; phytate, hydrogen cyanide, Trypsin inhibitor, oxalate, saponin etc. processing method such as; boiling, fermentation, drying has been reported to be effective in reducing these anti-nutrients (Abang *et al.,* 2013; Diarra *et al*, 2008).

The relevance of protein in human and animal nutrition cannot be over emphasized. In recent times, there has been a significant short fall between the production and supply of animal protein to feed the ever increasing population. The human population projection for the sub-Saharan Africa will amount to about one billion by the year 2020 (Winrock, 1992). Nigeria at present with a population of over 140 million (NPC, 2006) is expected to contribute a significant percentage of anticipated population growth. This means greater pressure on feeding the populace. The present rate of growth in the Agricultural sector is considered too slow to match the expected population growth (Abu and Soetan, 2009). Nigeria notwithstanding the anticipated thick population is highly deficient in animal protein security with per capital consumption put at 9.3 g/day against the 34 g/day recommended by the FAO to be the minimum requirement for the growth and development of the body (Lamorde, 1997; Esobhawan, 2007; Esobhawan *et al.,* 2008). This implies that only about 27.35 % of the minimum requirement in animal protein intake is secured in Nigeria. To arrest this unacceptable trend, efforts have been directed towards boosting the animal industry with micro-livestock having prolific tendency, short generation interval, rapid growth and disease resistance. Among the micro-livestock animals is the Japanese quail (*Coturnix coturnix japonica*) which falls within the above description and should therefore be the animal of choice for increasing animal protein. Quails have adapted in Nigeria in places like Kano, Benue, Kaduna, Kebbi, Borno, Oyo, Lagos, Enugu, Yobe, Akwa ibom, Niger, Kwara, Jigawa, Plateau states and Abuja. The Japanese quails (*coturnix coturnix japonica)* is different from the common *coturnix coturnix* quail. The Japanese quails have gained relevance in value as food animal and several reasons account for the utility of this bird: it is bred for egg and meat production which has a unique flavour and its meat has no ethical issues. Over 50% of the women are involved in quail's farming due to the fact that it has low maintenance cost as a result of its small body size (80-300g), short generation interval (which is usually between 3-4 generation in a year) , disease resistance, high egg production and provision of meat with low body fats and cholesterol (Garwood and Diehl, 1987; Schwartz and Allen, 1981). This study investigated the cost effectiveness of growing Japanese quails fed sun-dried mango (*Mangifera indica*) kernel meal.

MATERIALS AND METHODS

Experimental site

This experiment was conducted at the poultry unit of the Teaching and Research Farm of the Federal University of Agriculture, Makurdi,Benue State.

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Makurdi is located at longitude 6°10’ East and latitude 6°8’ North. The area is warm with a minimum temperature range of 29.8-35.6°C. Rain fall is between 508-1016mm and relative humidity is 47% -87% (Tac, 2009). One important geographical features of this area is the River Benue which divides Makurdi into the Northern and Southern parts. Makurdi local government has an area of 16km radium. It lies within the Guinea savannah region of the Nigeria vegetative belt located in the Benue valley. Makurdi experiences a typical tropical climate with two distinct seasons (dry and wet). The dry season begins in November and ends in March while the wet season starts in April and ends in October. Hama than with cool weather is experienced from December to early February. (Tac, 2009)

Preparation of experimental materials

Mango seeds were collected during the month of May (peak of the mango season) in Gboko and Makurdi area of Benue State, Nigeria. Mango kernel was removed by cracking manually with the aid of hammer. The kernel was sun-dried for 7 days in order to reduce the moisture content to less than 10% for prolonged storage. Soybean was well toasted to a dark brown colour to reduce the level of anti- nutrients such as tannin, oxalate, trypsin inhibitors, saponin, phytate, flavonoid, cyanides etc. The ingredients were crushed separately into fine grit (maize and soybean) and were later mixed at varying inclusion levels with other ingredients to formulate the various diets.

Chemical analysts

Chemical analysis of sun-dried mango kernel and experimental diets were analysed using AOAC (2000) methods.

Formulation of diets.

Feeds were formulated to meet the nutritional requirements of quails during the growing phase. Sun- dried mango kernel meal replaced maize at 0%, 25% and 50% in treatment I, II and III respectively.

Animal grouping

A total of one hundred and forty four two weeks old un-sexed Japanese quails of about 26.56±0.02g of weight purchased with the National Veterinary Research Institute Vom- Jos, Nigeria were studied over a period of four weeks (19th June-18th July). The birds were randomly selected at the expiration of one week acclimatization and allotted to three dietary treatments (I- III) of 48 quails each. Each treatment was replicated thrice with 16 quails per replicate. The experiment lasted for four weeks by this time quails were six weeks old.

Housing

The birds were managed intensively in cages of three tiers. Each tier was separated with wood. Wire mesh
was used for the walls and doors to allow adequate ventilation/lighting. The dimension of each tier was (1.0m2 x 0.78m2). Litter materials (wood shavings) were used on the wooden floors. Each tier was equipped with adequate drinkers and feeding troughs. A floor space of about 0.007m2 to 0.009m2per quail was provided. Artificial lighting was provided with the use of one kerosene lantern for each tier to ensure adequate feed intake.

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Routine operations

Feeds were weighed with a micro scale balance of 2kg before serving to ensure a uniform amount across treatments. Quails were served with 200gms of feed for the first week at about 8.am on a daily basis, the quantity was increased by 50gms on weekly basis. Fresh clean water was supplied daily *ad-lib*. Drinkers and feeders were washed and disinfected using izal when appropriate. Litter materials were changed when due and replaced accordingly. Manure was sold to generate revenue whenever litter materials were changed.

Data collection/design and analysis

At the end of the experiment (28th day or 4th week), the birds were sold and data were collected and analysed for economics of production: Cost of compounded feeds were calculated in Kg and g, based on the prevailing market prices of feed ingredients at the time the experiment was carried out, cost of feed intake, feed cost to weight gained (feed efficiency x cost of feed intake), feed cost savings per g meat produced and gross profit (obtained as revenue less total variable cost) were calculated. Feed efficiency was also determined. The data obtained on all the parameters studied were subjected to one-way analysis of variance (ANOVA) and least significant method was used to separate means that differed significantly (Steel and Torrie, 1980). Results were presented as mean± standard error of mean (SEM).

Table1: Composition of diet with sun-dried mango *(Mangifera spp.)* kernel meal for broiler Japanese quails *(Coturnix coturnix japonica)*.

	Levels of inclusion (%)		
	0%	**25%**	**50%**
Ingredients			
Maize	55.20	39.90	26.60
Mango	0.00	13.30	26.60
Full-fat soybean	26.67	25.87	25.37
Fish meal	5.20	6.00	6.50
Wheat offal	6.93	6.93	6.93
Bone meal	7.00	7.00	7.00
Salt	0.50	0.50	0.50
Vit/min. premix	0.50	0.05	0.05
Total	100.00	10.00	100.00
Calculated nutrients:			
Crude protein (%)	21.87	21.63	21.34
M.E (Kcal/Kg)	2836.47	2846.12	2846.39
Analysed nutrients:			
Crude protein (%)	23.02	22.75	22.70
M.E (Kcal/Kg)	3690.00	3629. 00	3700.00

Results and discussion

The economic analysis of Sun-dried Mango Kernel Meal (SMKM) fed to quails are presented in tables 6 and 7. The cost of feed and average cost of feed consumed were significantly (P< 0.05) higher in quails fed the control diets (0% [T1]) and least values were recorded with quails fed 50% (T3) SMKM. The findings showed that cost of feed reduced as levels of SMKM in the diets increased. This was in agreement with the reports of Okon *et al.,* (2008) and Abang

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et al., (2013) who observed that cost of production reduced with increasing levels of boiled sundried and fermented taro cocoyam in the diet of growing Japanese quails respectively.
Feed cost per gram weight gained was also reduced as levels of SMKM in the diet increased leading to cost saving per gram of meat. Similar results have also been reported using cassava and fermented taro cocoyam meals for growing quails (Edache *et al.*, 2007 and Abang *et al*., 2013 respectively) as replacement for maize.

The average cost of feed intake of quail fed treatment 50%SMKM was significantly (P<0.05) lower than quails fed the control diet (0%). However there was no significant (P>0.05) difference in the cost of feed intake of quails fed 25%SMKM and those fed 0%. Even though there was no significant (P>0.05) difference in cost of feed intake of quail in treatment I and II, treatment I had numerically higher values than II. This result was similar with the reports of Okon *et al.*, (2008) and Abang *et al.*, (2013) who observed significantly (P<0.05) low differences in the cost of feed intake as the levels of inclusion of boiled Sun-dried and fermented taro cocoyam increased across treatments respectively.

The result equally recorded highest profit with increase in supplementation of SMKM. The Return to Naira Invested (RNI) (Table 5) for quails fed 50% SMKM was the highest (2.35) followed by 25% (1.22) and the least of all 0% (0.93). This was in line with the results of Okon *et al.*, (2008) and Abang *et al.*, (2013) who observed similar trend.

Table 4: Cost of compounded feed for growing quails in Kg and g(#).

Treatments	Cost of feed in ₦/kg	Cost of feed ₦/g
0%	88.36	0.088
25%	81.83	0.082
50%	74.99	0.075

Table2: Proximate analysis of study diets (dry matter basis %).

CP	E.E	C.F	ASH	NFE
23.02	3.00	7.75	8.00	58.23
22.75	5.20	8.25	10.00	53.85
22.70	7.70	8.70	10.50	50.40

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Table 3: Proximate analysis of sun -dried mango kernel (%)

	Parameters					
	CP	**E.E**	**C.F**	**ASH**	**NFE**	**Moisture**
SMK.	**7.0**	**5.0**	**2.25**	**2.0**	**78.59**	**5.16**

SMK= Sun-dried mango kernel.

Table 5: Cost of feed intake/quail/week/treatment (₦/g)

Week	0%	25%	50%
3	6.91	4.86	3.44
4	9.71	5.69	4.05
5	13.39	6.53	6.10
6	14.02	9.26	6.91
∑x	44.03	26.34	20.50
$\bar{x}$±SEM	11.01±1.28^{a}	6.59±0.77^{ab}	5.13±0.60^{b}

Table 6: Economic analysis of sun-dried mango kernel meal fed to growing Japanese quails.

	0%	25%	50%
Cost of F Feed in ₦/g	0.088	0.082	0.075
Feed efficiency	1.68±1.26	1.81±1.18	2.32 ± 1.20
Average cost of feed consumed/quail(g)	11.01±1.28^{a}	6.59±0.77^{ab}	5.13±0.60^{b}
Cost of feed/g weight gain(₦/g)	15.30	10.35	10.16
Feed cost saving/g meat (₦)	_	4.95	5.14

ISSN 2053-5805(Print), ISSN 2053-5813(Online)

Table 7: Return to Naira invested per growing (broiler) quail.

Expenditure	0% (TI)	25% (TII)	50% (TIII)
Cost of unsexed quail (2 weeks)	50.00	50.00	50.00
Cost of feeds/g/quail consumed from (3-6 weeks)	44.03	26.34	20.50
Cost of transportation from Jos to Universityof Agriculture Makurdi, Benue state.	33.13	33.13	33.13
Cost of medication per quail	4.75	4.75	4.75
Miscellaneous	2.2	2.2	2.2
Total cost (TC)	**134.11**	**116.42**	**110.08**
Revenue:			
Sales per quail	250	250	250
Sales of manure/quail	8.89	8.89	8.89
Total revenue	258.89	258.89	258.89
Gross profit: (TR-TC)	**124.78**	**142.47**	**148.81**
RNI = profit/TC	0.93	1.22	2.35

CONCLUSION

The result of this study showed that feed cost reduced with increased inclusion levels of Sun-dried Mango Kernel Meal (SMKM) thereby leading to a reduction in the cost of production .
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