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Research Article

Cost Effectiveness of Japanese Quails (*Coturnix coturnix japonica*) Fed Fermented Mango (*Mangifera indica*) Kernel Composite Meal as a Replacement for Maize

Yerima Shettima Kolo[1] and Hannatu Charles[2]

[1]Department of Animal Production, Federal University of Agriculture, Makurdi, Benue State, Nigeria
[2]Department of Animal Science, Federal University, Gashua, Yobe State, Nigeria
***Corresponding author:** yerimashettimakolo@gmail.com

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ABSTRACT

A feeding trial was conducted to evaluate fermented mango kernel composite meal as a replace for maize in Japanese quails diet. One hundred and ninety five two weeks unsexed Japanese quails of about the same weight were randomly allotted to five dietary treatments comprising of 39 birds. Each treatment was replicated thrice with 13 quails per replicate in a completely randomized design (CRD). In each of the five diets, FMKCM was used to replace maize at 0%, 10%, 15%, 20%, and 25% for treatments I, II, III, V, and VI respectively. Feed cost reduced with increased with increased supplementation of FMKCM. The cost of feed per gram weight gain reduced across treatments. More saving accrued at 10% inclusion levels, quails fed 0% FMKCM had least profit and RNI. Fermented mango (*Mangifera indica*) kernel composite meal could replace maize up to 25% in Japanese quails diets.

Key words: Japanese quails, FMKCM, Maize, Cost effectiveness

INTRODUCTION

One of the greatest challenges of facing the livestock industry in the developing countries is the provision of nutritionally balanced and cost effective rations, since feed constitutes about 65-80% of the total cost of production. Poultry depends on cereals and leguminous crops as source of energy and protein. These crops form the largest percentage of poultry feeds and constitute the highest cost items in formulated feeds especially when supplied from conventional feed sources (Anyachie and Madubuike, 2007).

Cereal and leguminous sources of feed stuffs are in short supply for livestock feed due to stiff competition from man, industries, seasonal effect on availability and low production. These have resulted in increased feed cost which translated into high cost of livestock products. The incorporation of agro-industrial by-products and non-convectional feed stuffs in poultry feed is now been encouraged in order to sustain poultry industry. However, more antinutrient chelate divalent ions like Ca^{2+}, Mg^{2+}, Zn^{2+}, Fe^{2+} and also react with charged groups of protein and polysaccharide thereby forming indigestible complexes while the toxic substances interfere with nutrient bioavailability and utilization (Reed, 1995; Osagie, 1998). Processing methods such as; fermentation, sun-drying, soaking, boiling, autoclaving etc. results in reducing these anti-nutrients to a more tolerable level (Abang *et al*., 2013; Diarra and Usman, 2008).

It is therefore imperative to explore unconventional/ alternative feed resources using suitable processing methods for sustainable livestock production. These alternative feed resources must be cheap, readily available and less competed for by man and industries or not competed for at all (Akinmutimi, 2006). Mango (*Mangifera indica*) kernel meets these demands; cheap and not competed for by man in Nigeria. Porter (2011) reported that mango (*Mangifera indica*) kernel has a Metabolizable of 3527.34 Kcal/Kg and this value was higher than that of maize (3390 Kcal/ Kg) reported by Tuleun *et al*. (2005).

The objective of the study is to investigate the cost effectiveness of Japanese quails (*Coturnix coturnix japonica*) fed fermented mango (*Mangifera indica*) kernel composite meal as a replacement for maize.

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MATERIALS AND METHODS

Experiment site

This experiment was conducted at the Poultry Unit of the Teaching and Research Farm of the Federal University of Agriculture, Makurdi, Benue State. Makurdi is located at the longitude 6º 10' East and latitude 6º8' North. The area is warm with a minimum temperature range of 29.8-35.6ºC. Rainfall is between 508-1016mm and relative humidity is 47%-87% (Anon, 1995). 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 radius. 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. Harmathan with cool weather is experienced from December to early February (Anon, 1995).

Preparation of Experimental Materials

Different cultivars of both indigenous and improved mango 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 fresh kernels were soaked in water at room temperature to allow it ferment for a period of 2 days (48hrs) in order to reduce the anti-nutrients to a more tolerable level and rinsed thoroughly with clean cool water. The fermented kernel was sundried in order to reduce the moisture content to less than 10% to prevent microbial build up and for prolonged storage. The ingredients were crushed separately into fine grit and were later mixed at varying inclusion levels with other ingredients to formulate the various diets.

Chemical analysis

Chemical analysis of fermented mango kernel and experimental diets were analyzed using (AOAC, 2006).

Formulation of diets

Feeds were formulated to meet the nutritional requirements for quails during the growing phase. Fermented mango kernel composite meal replaced maize at 0% (control diets was compounded with 100% maize and 0% FMKCM) 10% (diet was compounded with 90% and 10% FMKCM) 15% (diets was compounded with 85% maize and 15% FMKCM) 20% (diet was compounded with 80% maize and 20% FMKCM) and 25% (diet was compounded with 75% maize and 25% FMKCM) in treatments I, II, III, IV, V respectively.

Animal grouping

A total of one hundred and ninety five two weeks old un-sexed Japanese quails of about 33.60g of weight purchased with the national veterinary research institute Vom –Jos, Nigeria. At the start of the feeding trial, three groups were allotted to five dietary treatments of 39 quails each. Each treatment was replicated thrice with 13 quails per replicate.

Table 1: Composition of Diets with Varying Levels of Fermented Mango Kernel Composite (FMKCM) Meal for Growing Quails (Kg)

Ingredients	T1 (0%)	T2 (10%)	T3 (15%)	T4 (20)	T5 (25)
Maize	45.00	40.50	38.25	36.00	33.75
FMKCM	0.00	4.50	6.75	9.00	11.25
Soybean meal	21.00	21.00	21.00	21.00	21.00
Groundnut cake	15.95	15.95	15.95	15.95	15.95
Maize offal	9.00	9.00	9.00	9.00	9.00
Bone meal	4.00	4.00	4.00	4.00	4.00
Blood meal	2.50	2.50	2.50	2.50	2.50
Fish meal	2.00	2.00	2.00	2.00	2.00
Vit/min premix	0.30	0.30	0.30	0.30	0.30
Salt	0.25	0.25	0.25	0.25	0.25
Analyzed nutrients:					
ME(Kcal/kg)	2968.03	2995.84	3006.95	3018.05	3029.16
Crude protein	24.46	24.53	24.59	24.64	24.70

Housing

The birds were grown intensively in cages of three levels. Each level was separated with wood. Wire mesh was used for the walls and doors to allow adequate ventilation/lighting. The dimension of each level was ($1.0m^2$ x $0.78m^2$). Litter materials (wood shaving) were used on the wooden floors. Each level was equipped with adequate drinkers and feeding troughs. A floor space of about 0.007 m^2 to 0.009 m^2 per quail was provided. Artificial lighting was provided with the use of one battery lantern for each level to ensure adequate feed intake.

Routine operations

Feeds were weighed with a micro scale balance of 5kg before serving to ensure a uniform amount across treatments. Quails were served with 250grams of feeds for the first week at about 8 am on daily basis, the quantity was increased by 50grams on weekly basis. Fresh clean water was supplied ad-libitum. Drinkers and feeders were washed and disinfected when appropriate. Litter materials were changed when due and replaced accordingly. The birds were weighed on weekly basis and their difference were used to determined average weekly weight gain (AWWG). Feed intake (FI) was calculated by subtracting left over from feed served. The economics of production of Japanese quails fed fermented mango kernel composite meal was assessed by calculating the following parameters: cost per gram feed, cost of feed consumed (g), total cost of production, profit and return to naira invested.

Design and analysis

All the parameters were subjected to one-way analysis of variance (ANOVA) using statistical package for the Social Science (SPSS) version 2010. The means that differed significantly were separated using the least significance difference (LSD) method as described by Steel and Torries (1980).

RESULTS AND DISCUSSION

The cost benefit analysis of Producing Japanese quails using fermented mango kernel composite meal (FMKCM) were presented in Table 2 and Return to Naira Invested Table 3. The cost of feed was higher in quails fed the control

Table 2: Cost-Benefit Analysis of Producing Quails Using Graded Levels of Fermented Mango Kernel Composite Meal (FMKCM)

Parameter	(0%)	(10%)	(15%)	(20%)	(25%)
Daily feed intake (g/bird)	25.73	24.90	24.37	22.91	22.81
Total feed intake (g/bird)	1080.66	1045.80	1023.54	962.22	958.02
Total Feed cost (Naira/bird)	141.56	133.86	127.94	116.00	113.04
Total cost of production (Naira/ bird)	491.56	483.86	477.94	466.00	463.04
Total egg produced/ bird	32.00	34.00	35.00	37.00	38.00
Revenue from eggs (Naira/ bird)	640.00	680.00	700.00	740.00	760.00
Revenue from carcass (Naira/ bird)	350	350	350	350	350
Total revenue (Naira)	990	1030	1050	1090	1110
Profit (Naira/bird)	498.44	546.14	572.06	624.00	646.96

Table 3: Return to Naira Invested on Broiler Quails Fed Diets Containing Graded Levels of Fermented Mango Kernel Composite Meal (FMKCM)

Parameters	(0%)	(10%)	(15%)	(20%)	(25%)
Cost of 2 week old quails	106.25	106.25	106.25	106.25	106.25
Cost of medicine/ vaccine	3.08	3.08	3.08	3.08	3.08
Feed cost (Naira / gram)	0.097	0.092	0.090	0.083	0.080
Cost of feed (Naira/kg)	97.00	92.00	90.00	83.00	80.00
Total feed intake (g)	429.80	421.96	394.52	391.16	365.96
Miscellaneous	3.58	3.58	3.58	3.58	3.58
Cost of feed consumed (Naira/ bird)	41.69	38.83	35.50	33.25	29.28
Total cost (TC)	154.60	151.73	148.41	146.16	139.11
Revenue (Naira/bird)					
Sales Price	350	350	350	350	350
Manure sale price	4.00	4.00	4.00	4.00	4.00
Total revenue (TR)	354	354	354	354	354
Profit : (TR-TC)	199.40	202.27	205.59	207.84	214.89
R. N.I (Profit/Total cost)	1.29	1.33	1.39	1.42	1.54

R.N.I- Return per naira invested.

diets (0% [T1]) and least values were recorded with quails fed 25% FMKCM. The findings showed that cost of feed reduced as levels of FMKCM in the diets increased. This was in agreement with the report of Abang *et al*. (2018) who observed that the cost of feed reduced with increasing levels of FMKCM in the diets of broiler chicks. Feed cost per gram was also reduced with the incorporation of fermented mango kernel composite meal in the diets leading to cost saving per gram of meat and eggs. Similar results have also been reported using Cassava meal, fermented taro cocoyam meal, sun-dried mango kernel meal and fermented mango kernel composite meal for growing quails and broiler chicks (Edache *et al.,* 2007; Abang *et al*., 2013 and Abang *et al*., 2018 respectively) as replacement for maize. Kanan *et al.* (2015) recorded a non-significant difference on cost of feed consumed across treatment with inclusion levels of mango fruit reject meal (MFRM), which was in line with this findings. However, cost of feed consumed numerically decreased with inclusion levels of fermented mango kernel composite meal (FMKCM). The average cost of feed intake of Japanese quails fed 25% FMKCM was lower than that fed the control diet (0%). This result was in agreement with the findings of Abang *et al*. (2018) who also observed lower values in the average cost of feed intake as the levels of inclusion of fermented mango kernel composite meal increased across treatment. The Return to Naira Invested (RNI) for Japanese quails fed 25% of FMKCM was highest (1.54) followed by 20% (1.42) and the least of all 0% (1.29) the body weights of the quails were not the price determining factor as birds were sold at same prices. This was in line with the finding of Abang *et al*. (2016) who observed a similar trend when sun-dried mango kernel meal was fed to growing quails.

Conclusions

It was concluded that feed cost reduced with increased levels of fermented mango (*Mangifera indica*) kernel composite meal in the diet of Japanese quails.

Recommendations

Fermented mango (*Mangifera indica*) kernel composite meal (FMKCM) could be used in Japanese quails diet as an alternative energy source up 25% replacement levels.

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