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NUTRIENT DIGESTIBILITY OF GROWING JAPANESE QUAILS (*Coturnix coturnix japonica*) FED FERMENTED MANGO (*Mangifera indica*) KERNEL COMPOSITE MEAL AS REPLACEMENT FOR MAIZE

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ABSRACT

A study on nutrient digestibility of Japanese quails fed fermented mango kernel composite (FMKCM) was carried out using complete randomized design (CRD). One hundred and ninety five (195) unsexed Japanese quails were randomly allotted to five dietary treatments comprising of 0%, 10%, 15%, 20% and 25% inclusion levels of fermented mango kernel composite meal for T_1, T_2, T_3, T_4 and T_5 respectively. Each treatment was replicated thrice with thirteen (13) birds per replicate. The result of this study showed that there were no significant ($P>0.05$) differences across treatments in nutrient digestibility and retention. This shows that fermented mango kernel composite meal had no effect on nutrient digestibility.

Keywords: Fermented mango, Japanese quail, Maize, Nutrient Digestibility

INTRODUCTION

Poultry production is gaining popularity in the developing countries due to its role in bridging the protein malnutrition, economic empowerment of the resource poor segment of the society and its ability to fit well in the farming systems commonly practiced (Gebremedhn *et al.,* 2015). The situation has necessitated the need to source for an alternative or partial replacement of one of the most highly competitive feed ingredient such as maize. Bamgbose *et al.* (2004) reported that maize *(Zea mays)* as a major energy source in poultry feeds accounts for about 50 to55% of most poultry feeds. 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. The resulting effect is high cost of feed which is translating into high cost of animal products. The incorporation of agro-industrial by-products and non-conventional

feed stuff in poultry feed is now been encouraged and explored in order to sustain poultry industry. Some unconventional feedstuff have been investigated as partial or total substitute for maize; they include Africa locust bean meal (*Parkia filicoidea*), avocado seed meal (*Persea americana*), bambara groundnut meal (*Voandzeia subterranean*), coffee pulp meal (*Coffee arabica*), and mango seed kernel meal (*Mangifera indica*) *(*Abang *et al.,* 2016; Joseph and Abolaji, 1997*;* Aregheore, 1998; Kperegbeyi and Onwumere 2007). However, most of these feeds contain anti-nutrients and toxic components such as saponins, lectins, tannins, trypsin inhibitors and cyanogenic glycosides which make them unsafe as protein and carbohydrate sources in livestock production (Aregheore, 1992). These anti-nutrients chelate divalent ions like Ca^{2+}, Mg^{2+}, Fe^{2+}, and Zn^{2+} also react with the charged groups of protein and polysaccharides thereby forming indigestible complexes while the toxic substances interfere with nutrient bioavailability and utilization.

Mango seed kernel (MSK) is reported to be a good source of carbohydrates (NFE) (El Saadany *et al.*, 1980; Jansman *et al.*, 1995; Teguia, 1995; Diarra and Usman, 2008; Diarra *et al.*, 2010; 2011) and contains high quantities of proteins and fats. The major problem affecting the nutritional value of MSK is that it contains various anti-nutritional factors. Although there are reports of the consumption of MSK as porridge in India (El Saadany *et al.*, 1980), this by-product has limited food, feed or industrial uses in most mango producing countries thus making it readily available. MSK meal has received much research attention in recent years as an alternative energy source for poultry.

Ground mango kernel is one of the agro by-products that have been utilized to replace up to 200g of maize per kilogram of quails grower diet. Mango kernel contains 2.75% crude protein, 0.25% crude fibre, 11.96% crude fat, and 3065.2Kcal/kg energy, mango kernels have been reported to contain 2.6% minerals, 0.21% calcium and 0.22% phosphorus depending on variety (Kiflewahid *et al.,* 1982*;* Ravindran and Rajaguru, 1985). Also the kernel is balanced in amino acids and the cake after oil extraction contains two essential amino acids (methionine and lysine) which are found limiting in most plant proteins (Anon, 1967; Arogba, 1989*).* Increase in the amount of mango kernels in the diet induces a linear depression of feed consumption due to the high level of tannin content which ends up reducing growth (Odunsi, 2005; Teguia, 1995*).* Mango kernel also contains anti- nutritional factors such as saponin,

oxalate, Cynogenic glycoside, Phytate, alkaloids, flavonoid and trypsin inhibitor (Kakade *et al.,* 1969). Several study have been done to reduce the anti-nutritional factors present in mango seed kernel limiting its use to poultry such as boiling/cooking which inactivated the activities of tannin (Ogundipe *et al.,*2008) and Fermentation/soaking (Ahamefule and Odemelam, 2008).

The aim of this research is to determine the effect of replacing maize with fermented mango kernel composite meal on the nutrient digestibility of growing quails.

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 6° 10' East and latitude 6°8' North. The area is warm with a minimum temperature range of 29.8-35.6°C.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, 1995).

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.

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

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.

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 (1.0m^2 x 0.78m^2). Litter materials (wood shaving) were used on the wooden floors. Each tier 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 tier 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 using izal when appropriate. Litter materials were changed when due and replaced accordingly.

Design and Analysis

Digestibility trial was conducted on the sixth week of the grower phase to determine the apparent nutrient digestibility. Three birds were randomly selected from each replicate and transferred into metabolism cages. Known weight of feeds which match their daily intake was fed to the birds for seven days. The birds were allowed to acclimatize to the cage for a period of two days. On the third day, the birds were starved for eighteen hours; Daily excreta voided for the remaining four days were collected. For each group of birds total faecal samples will be collected by placing clean trays under the cages. Faecal samples will be separated from feeds and other foreign materials, weighed, oven dried at 80^{0}C for 24 hours. The faecal sample from each group were thoroughly mixed and sampled. The samples were finely ground and analyzed for proximate composition (A.O.A.C, 2006).

The percentage nutrient retention was calculated using the equation below;

Nutrient digestibility = [(Nutrient intake- Nutrient in excreta)/ Nutrient intake] x100

Data obtained were subject to analysis of variance using the completely randomized designed as described by Steel and Torries (1980). The least significant means method was used to separate means that differed significantly (Steel and Torries, 1980).

RESULTS AND DISCUSSION

The digestibility coefficient obtained for proximate components in the growth phase showed no significant (P>0.05) differences among the various treatments. This agrees with the report of Faniyi (1998), who investigate the effect of replacing maize with mango seed kernel meal in the diet of broiler chicken. The result in this study showed a decline in amount of crude fibre digested. This is similar to the report of Nwokolo *et al.* (1985) and Njidda *et al.* (2006) that crude fibre and phytic acid found in most plant do not only resist digestibility by monogastric endogenous enzymes but are also two common organic compounds known to sequester feed nutrient, rendering them unavailable for animal use. Similar depression in nutrients digestibility has been reported in rabbits (Jokthan *et al.*, 2006) and in broiler chicken (Abdelsamie *et al.,* 1983). Kass *et al.* (1980) and Fielding (1991) attributed such depression in apparent digestion to higher rate of passage of digester in animals fed on high diets. Beside fibre, anti-nutritional factors such as trypsin and tannin may have contributed to the observed depression in crude fibre. This agrees with the findings of Ravindran and Sivakanesan (1996) that anti-nutritional factors in mango kernel caused depression in digestibility, absorption and retention.

Table 2: Nutrient Digestibility by Japanese Quails Fed Fermented Mango Kernel Composite Meal (FMKCM)

Parameters	(0%)	(10%)	(15%)	(20%)	(25%)	SEM	P-Value
Dry matter	82.55	82.40	81.22	81.00	79.37	1.69	0.38
Crude protein	77.00	78.00	79.67	80.00	82.00	2.83	0.14
Ether extract	79.67	71.67	70.67	67.00	66.67	1.03	0.12
Crude fibre	27.25	25.25	24.38	23.14	21.38	10.64	0.85
N.F.E	86.45	86.25	84.15	83.12	81.15	1.72	0.07

N.F.E – Nitrogen free extract
SEM – Standard error mean

CONCLUSION

Fermented mango kernel composite meal could replace maize in Japanese quails diet without deleterious effect on nutrient digestibility.

RECOMMENDATION

Fermented mango kernel composite meal can be recommended as a replacement for maize in Japanese quails diets up to 25% level of inclusion.

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