Cost Effectiveness of Anak Broiler (Gallus gallus domesticus) Chick Fed Fermented Mango (Mangifera indica) Kernel Composite Meal as an Alternative Energy Source

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ABSTRACT

A twenty-eight day feeding trial was conducted to evaluate fermented mango kernel composite meal as an alternative energy source of feed ingredient in broiler starter. One hundred and forty-four day old broiler chicks of about same weight were randomly allotted to four dietary treatments comprising of 36 birds . Each treatment was replicated thrice with 12 chicks per replicate in a completely randomized design (CRD). In each of the four diets, FMKCM was used to replace maize at 0%, 10%, 15% and 20% for treatments I, II, III and IV respectively. Feed cost reduced with increased supplementation of FMKCM. Average cost of feed intake per chick was not significantly (P>0.05) different. The cost of feed per gram weight gain reduced across treatments. More saving accrued at 10% inclusion levels, chick fed 0% FMKCM had least profit and RNI. Fermented mango (Mangifera indica) kernel composite meal could replace maize up to 20% in broiler starter diet, however, for maximum profitability, 15% inclusion level is recommended as the optimum where chick\'s weight is a price determining factor.

Keywords: broiler chick, FMKCM, alternative energy source, maize, cost effectiveness.

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I. ABSTRACT

A twenty-eight day feeding trial was conducted to evaluate fermented mango kernel composite meal as an alternative energy source of feed ingredient in broiler starter. One hundred and forty-four day old broiler chicks of about same weight were randomly allotted to four dietary treatments comprising of 36 birds. Each treatment was replicated thrice with 12 chicks per replicate in a completely randomized design (CRD). In each of the four diets, FMKCM was used to replace maize at 0%, 10%, 15% and 20% for treatments I, II, III and IV respectively. Feed cost reduced with increased supplementation of FMKCM. Average cost of feed intake per chick was not significantly (P>0.05) different. The cost of feed per gram weight gain reduced across treatments. More saving accrued at 10% inclusion levels, chick fed 0% FMKCM had least profit and RNI. Fermented mango (Mangifera indica) kernel composite meal could replace maize up to 20% in broiler starter diet, however, for maximum profitability, 15% inclusion level is recommended as the optimum where chick's weight is a price determining factor.

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II. INTRODUCTION

One of the greatest challenges 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 sources of energy and protein. These crops form the largest percentages 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 is translated into high cost of livestock products. The incorporation of agro-industrial by-products and non-conventional feed stuffs in poultry feed is now been encouraged in order to sustain poultry industry. However, most of these feeds contain anti nutrients and toxic components such as; tannins, saponins lectins 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+}, Zn^{2+} and also react with the charged groups of protein and polysaccharides 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 gross energy of 3527.34 Kcal /Kg and this value was higher than that of maize (3390 Kcal /Kg) reported by Tuleun *et al.* (2005).

2.1 Objective of the study

The objective of the study is to investigate the cost effectiveness of Anak broiler (*Gallus gallus domesticus)* chick fed fermented mango (*Mangifera indica)* kernel composite meal as an alternative energy source.

III. MATERIALS AND METHODS

The experiment was carried out at the Poultry Unit of the Livestock Teaching and Research Farm of the University of Agriculture Markudi, Benue State, Nigeria. Many cultivars of both indigenous and improved mango seeds were collected in the month of October, from Makurdi and Gboko Local Government Areas of Benue State. The seeds were broken to get the kernel by manual cracking. The fresh kernels were soaked in water at room temperature and allowed to ferment for a period of 2 days (48hrs) rinsed thoroughly with clean water and sun-dried for seven days (7 days) to reduce moisture content to less than 10% for proper keeping. The dried mango kernel and other feed ingredients were milled separately into grit. Soybean was toasted to reduce anti-nutrients before crushing. Feeds were formulated to meet the nutritional requirements for broiler chicks (23% CP). Fermented mango kernel composite meal (FMKCM) replaced maize at 0%, 10%, 15% and 20% in treatments T1, T2, T3, and T4 respectively. The proximate composition was analyzed according to (AOAC, 2000) techniques. One hundred and forty four (144) un-sexed New farm size day old broiler chicks of about the same weight were randomly selected and assigned to one (1) of the four (4) dietary treatments comprising of thirty six (36) broiler chicks per treatment. Each treatment was replicated thrice with 12 broiler chicks per replicate and the dietary treatments were administered over a period of 4 weeks. The chicks were raised in deep litter cages; the cages were constructed with wire mesh and a wooden floor. The brooding unit was swept and disinfected with izal daily. A foot dip was also provided to check transmission of diseases from visitors and personnel working in the unit. Chick drinkers were washed and disinfected daily and fresh clean cool water was given to the birds *ad libitum*. Feeders were washed once a week and also disinfected. Chicks were vaccinated regularly following the vaccination schedule programme.. Chicks body weights were taken weekly using electronic weighing balance. Wood shavings were changed when due. Antibiotics were given as therapeutic / prophylaxis when necessary. Appropriate diets (one of the four experimental diets) of equal quantities (500g) were given to the birds daily at about 8am. This amount was increased by 100g on weekly basis (as birds grew older). Water was provided *ad libitum*. Data were collected on performance (feed intake, body weight, weight gain and efficiency of feed utilization). The birds were weighed on weekly basis and their differences were used to determine average weekly weight gain (AWWG). Feed intake was divided by weight gain to get the efficiency of feed utilization (EFU) and feed intake (FI) was calculated by subtracting left over feed from feed served. The economics of production of broiler chick fed fermented mango (*Mangifera indica*) kernel composite meal was assessed by calculating the following parameters: Cost per gram feed,cost of feed consumed (g), cost per Kg weight gain, feed cost saving/g meat (₦/g), total cost of production, profit and Return to Naira Invested.

Design/statistical analysis: The data obtained on all the parameters were subjected to one-way analysis of variance (ANOVA) *using Statistical*

Package for the Social Sciences (SPSS) version 2010. The means that differed significantly were separated using the least significance difference (LSD) method as described by Steel and Torrie (1980).

IV. RESULTS AND DISCUSSION

The economic analysis of fermented mango kernel composite meal (FMKCM) of broiler chick is presented in Tables 2 and Return to Naira Invested; (Table 3). The cost of feed was higher in broiler chick fed the control diets (0% [T1]) and least values were recorded with broiler chick fed 20% 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.* (2016) who observed a reduction in feed cost with increasing levels of sun-dried mango kernel meal in the diets of growing Japanese quail. Feed cost per gram weight gain was also reduced with the incorporation of fermented mango kernel composite meal in the diet leading to cost saving per gram of meat. Similar results have also been reported using cassava meal, fermented taro cocoyam meal and sun-dried mango kernel meal for growing quails (Edache *et al.,* 2007; Abang *et al.,* 2013 and Abang *et al.,* 2016 respectively) as replacement for maize.

Table 1: Composition of diet with (48 hours) fermented mango (*Magnifera spp*) kernel composite meal for broiler chicks (Kg)

Ingredient	Levels of inclusion (%)			
	0%	10%	15%	20%
Maize	48.60	43.74	41.31	38.88
FMKM	0.00	4.86	7.29	9.72
Soybean	37.78	37.78	37.78	37.78
BDG	2.00	2.00	2.00	2.00
Rice Bran	3.00	3.00	3.00	3.00
Bone Ash	3.00	3.00	3.00	3.00
Palm oil	3.00	3.00	3.00	3.00
Lysine	0.50	0.50	0.50	0.50
Salt	1.12	1.12	1.12	1.12
Methionine	0.50	0.50	0.50	0.50
Vita/Min. Premix*	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100
Analyzed nutrients:				
Crude Protein (%)	22.54	22.42	22.36	22.30
M.E (Kcal/Kg)	3248.81	3081.91	2998.47	2915.02

Kanan *et al.* (2015) recorded a non-significant difference on cost of feed consumed across treatments 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 broiler chick fed 20% FMKCM was lower than that fed the control diet (0%). This result was not in agreement with the findings of Abang *et al.* (2016) who observed significantly ($P<0.05$) low values in the cost of feed intake as the levels of inclusion of sun-dried mango kernel meal increased across treatments. The feed cost saving per gram meat was highest with broiler chick fed 10% (25.94) of FMKCM, followed by 15% (12.08) and lastly 20% (4.18). This could be attributed to poor feed conversion ratio (FCR) due to the presence of anti-nutritional factors which interfered with nutrient bioavailability and utilization, probably, the chicks were unable to

handle the anti- nutrients beyond 15% inclusion levels. On the whole,more profit accrued with increased supplementation of FMKCM. The Return to Naira Invested (RNI) for broiler chick fed 20% of FMKCM was the highest (0.66) followed by 10% (0.64), 15% (0.63) and the least of all 0% (0.61) probably the body weights of the chicks were not the price determining factor as birds were sold at same prices. This was in line with the findings of Abang, *et al.* (2016) who observed a similar trend when sun-dried mango kernel meal was fed to growing quails.

Table 2: Economic analysis of fermented mango kernel composite meal for broiler chick

Parameter	0%	10%	15%	20%
Cost of feed ₦/g	0.091	0.089	0.088	0.087
Average cost of feed consumed/bird (g)	39.67±0.70	37.77±0.77	38.85±0.48	36.42±0.79
Cost of feed / g weight gain (₦/g)	170.98	145.04	158.90	166.80
Feed cost saving/g meat (₦/g)	-	29.94	20.08	4.18
Efficiency of feed utilization	4.31±0.33[a]	3.84±0.22[b]	4.09±0.24[b]	4.58±0.33[a]
Mean weekly body weight	280.60±89	291.5 6±92	288.86±94	253.07±81

Different superscripts (a and b) within the same row indicates significance (P<0.05) differences.

Table 3: Return to Naira Invested per broiler chick

Expenditure	0%	10%	15%	20%
Cost of unsexed day old broiler chick	240	240	240	240
Cost of feed/g/chick consumed (1day-4wks)	158.70	151.09	155.26	145.68
Cost of transportation from High level Makurdi to Federal University of Agriculture, Makurdi	3.47	3.47	3.47	3.47
Cost of medication per broiler chick	40.63	40.63	40.63	40.63
Miscellaneous	17.36	17.36	17.36	17.36
Total Cost (TC)	**460.16**	**452.55**	**456.72**	**447.14**
Revenue:				
Sales per broiler chick	730	730	730	730
Sales of manure / broiler chick	12.5	12.5	12.5	12.5
Total Revenue	**742.5**	**742.5**	**742.5**	**742.5**
Profit: (TR-TC)	282.34	289.95	285.78	295.36
RNI $\frac{Profit}{Total\ Cost}$	**0.61**	**0.64**	**0.63**	**0.66**

V. CONCLUSION

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

VI. RECOMMENDATION

Fermented mango (*Mangifera indica*) kernel composite meal (FMKCM) could be used in broiler starter diet as an alternative energy source up to 20% replacement level, however, for maximum profitability, 15% inclusion level is recommended as the optimum where chick's weight is a price determining factor.

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