Cost Effectiveness of Broiler Chicks Served Boiled Mango (*MangiferaSpp*) Kernel Composite Meal as A Replacement for Maize

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Abstract:

Issues: Cost of feed and animal products' have been a great source of concern; this is so because of the hike in conventional sources of feedstuffs. The incorporation of non- conventional feedstuff into animal nutrition will help ameliorate this problem. **Methods:** A study was carried out to investigate cost effectiveness of broiler chicks served boiled mango (*Mangiferaspp)*kernel composite as a replacement for maize. A total of 180 day old broiler chicks were randomly assigned to four (4) treatments ($T1-T_4$), the experimental design used was CRD (completely randomized design). Each one of the treatments comprised of 3 replicates (fifteen birds per replicate).**Findings:** Feed cost was observed to have decreased as the levels of BMKCM increased in diets. Cost of feed intake was not significantly ($p>0.0\ 5$) affected across the treatment groups. Feed cost/weight gain (g) increased with heavy supplementation with BMKCM. Negative values were observed with feed cost savings per gram meat, for 20% and 10% inclusions, thereby revealing that no savings accrued with supplementation of BMKCM at these levels probably because of the poor conversion ratio. However, profit and RNI tend to increase with heavy supplementation maybe because body weight was not a price determining factor. **Conclusion:** The study concludes that, for profit maximization, 15% of BMKCM should be included in chicks' diets.

Keywords: Broiler chicks, maize, boiled mango kernel, cost effectiveness

1. Introduction

In Nigeria, the cost of feed accounts for about 70-75% of the entire production cost. This is so because of the hike in the prices of conventional energy and protein feedstuffs; maize and soybean, respectively (Afolayan*et al.*, 2012; Abang*et al.*, 2013). This situation led to the quest for non-conventional feedstuffs which are readily available with little or no cost in most cases (Dafwang, 2000; *Abang et al.*, 2015; Gyang*et al.*, 2021; Bishop *et al.*, 2021). Non- conventional feedstuffs according to Dafwang (2000) offer the best alternative in Nigeria for

the reduction of feed cost and cost of animal products. Mango kernel is a bye-product of mango with a high carbohydrate (energy) content of about 58 -80%, fat (6-16%) and protein (6-13%) (*Abang et al.*, 2015). Mango kernel fits into this description because of its' poor usage by humans, high energy, also, its production duration (April-July) rimes with grain critical time of supply.

2. Literature Review

The high cost of conventional feedstuff has already sent a lot of livestock farmers out of business, thus leading to reduction in overall animal protein production and availability for humans' dietary need. The provision of feed alone has been reported to account for 65-75% of total cost of livestock production in developing countries (Abang*et al.,*2023 ;Esonu, 2006). Among these sources, maize is the most widely employed for poultry feed formulation (Afolayan*et al.*, 2012; Vantsava, 2001). This is partly because maize has so many alternative uses and its production has not been able to meet the demand by both man and animals. Within the past three years. Its price has fluctuated between #150.00 and #180.00 per kg while those of non-conventional feed sources like mango kernel remained virtually stable and cheap. Now that all efforts to produce maize in quantities that could meet the country's needs have not been successful, there is urgent need to search for maize substitutes.

3. Objective of the study

The objective of this study was to determine the optimum level of inclusion of BMKCM that is cost effective for the production of broiler chicks.

4. Methods of the Study

Experimental Site: The experiment took place in the same location as described by Abang*et al*. (2018).

Experimental Diets: The total number of diets formulated for the research was 4 (four). Control diet was assigned $T_{1,}$ for 0% BMKCM and T_2, T_3 and T_4 for 10,15 and 20% BMKCM, respectively. The diets were analysed according to the methods of AOAC (2006). Table 1

Table1: Composition of starter diets with BMKCM.

Ingredients	T 1 0%	T 2 10%	T 3 15%	T 4 20%
Maize	54.00	48.60	45.90	43.20
BMKM	0.00	5.40	8.10	10.80
Soybean	33.03	34.27	34.27	34.27
BDG	5.50	4.26	4.26	4.26
Blood meal	2.97	2.97	2.97	2.97
Bone meal	3.50	3.50	3.50	3.50

Salt	0.25	0.25	0.25	0.25
Lysine	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20
Premix	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**

Analysed Nutrients:

ME(Kcal)	2760.30	2792.02	2807.49	2823.63
CP	23.14	24.48	23.40	23.43
Lysine	1.32	1.32	1.31	1.32
Methionine	0.61	0.61	0.60	0.62
EE	3.94	3.19	4.35	4.50
CF	4.54	4.40	4.73	4.37
Ca	1.40	1.48	1.48	1.43
P	0.80	0.82	0.82	0.80

**Vitamin/mineral premix from Bio-mix Broiler starter supplied per kg of diet: Vit. A,10,000i.u; Vit. D_3, 2000 i.u; Vit.E 3mg; Vit.K, 2 mg; Vit. B_1 (Thiamine), 1.8mg; Vit B_2(Riboflavin), 5.5mg; Vit. B_6 (Pyridoxine), 3mg; Vit. B_{12} 0.015mg; Pantothenic acid 7.5mg; Folic acid 0.75mg; Niacin 27.5mg; Biotin 0.6mg; Choline chloride 300mg; Cobalt 0.2mg; Copper 3mg;Iodine 1mg; Iron 20mg; Manganese 40mg; Selenium 0.2mg Zinc 30mg; Antioxidant 1.25mg; ME= Metabolisable Energy.*

Experimental Design: The experimental design used was completely randomized design (CRD). Each treatment was replicated thricewith ten birds for each replicate. The study duration was8 weeks.

Experimental Animals and Management: The study was carried out with 180day old starter broilers. The chicks were arbitrary selected and distributed to 4 treatments havingthree replicate with 15 birds each. The day old chicks were housed in a brooder pen within brooding guards for a period of four weeks brooding period after which they were moved into the Starter pen. In both the brooding phase and the Starter phase the birds were provided with drinkers and feeders. On the first day of arrival, the birds were given Molvait and Glucose to serve as anti – stress and energy. A strict vaccination schedule was followed. Vaccines were given against Newcastle, Gumboro and Coccidiosis. Also a strict level of hygiene was maintained serving as a preventive measure against infectious disease.

5. Data used

Data collected on performance parameters were; feed conversion, body weight and weight gain. The data were computed using the formulae as described by Abang*et al*. (2021). Data for cost analysis were collected using the methods of Abang*et al*. (2017)

6. Data Analysis

Data obtained were subjected to one way analysis of variance (ANOVA) technique using a statistical software; Minitab as described by Steel and Torrie (1980). Means were compared using Fisher method. Proximate analysis of boiled mango kernel is presented in Table2; cost of feed is presented in Table 3; cost effectiveness Table 4 and return to naira invested per chick Table5.

Table 2: Proximate analysis of boiled mango kernel (%)

Parameters	CP	C F	E E	A S H	N F E	MOISTURE
	5.25	1.32	9.33	2.17	70.60	11.33

Table 3: Cost of feed (Kg/ g (₦))

Treatments	Cost of feeds (₦/kg)	Cost of feeds (₦/g)
0 %	180.65	0.181
10 %	170.95	0.171
15 %	166.67	0.166
20 %	162.39	0.162

Table 4: Cost effectiveness of serving boiled mango kernel composite meal to broiler chicks.

Parameter	0 %	10%	15%	20%
Cost of feed (₦/g)	0.181	0.175	0.172	0.169
Average cost of feed consumed/bird/g	22.76±0.021	21.07±0.021	20.63±0.021	20.18±0.020
Feed conversion ratio	1.23	1.33	1.34	1.39
Cost of feed/g weight gain (₦/g)	27.99	28.02	27.64	28.05
Feed cost saving/g meat (₦/g)	-	-0.03	0.35	-0.06

Table 5: Return to naira invested per chick.

Expenditure	0 %	10 %	15 %	20 %
Cost of unsexed day old broiler chick	160	160	160	160
Cost of feed consumed/broiler starter (g)	22.76	21.07	20.63	20.18
Cost of transportation from Wurukum to Federal	6.66	6.66	6.66	6.66
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Cost of medication/Broiler chicks	2.61	2.61	2.61	2.61
Miscellaneous	5.92	5.92	5.92	5.92
Total variable cost (TVC)	197.95	196.26	195.82	195.37
Revenue:				
Sales per broiler Starter	700	700	700	700
Total revenue	700	700	700	700
Profit: (TR-TVC)	502.05	503.72	504.18	504.63
RNI=$\frac{profit}{total\ variable\ cost}$	2.54	2.57	2.57	2.58

Results and Discussion

Proximate composition of BMKCM is represented in Table 2. Results of Proximate fractions were: 11.33%, 5.25%, 1.32%, 9.33%, 2.17% and 70.60% for moisture, crude protein (CP), crude fibre (CF), etherextracts (EE), ash and nitrogen free extract (NFE), respectively. The result revealed that mango kernel contains high amount of carbohydrates and little quantity of crude protein.This justifies the use of mango kernel as energy source. The CP (5.25%) for this current work was less than a CP of 7.00% and 11.38% reported for SMKM and FMKCM byAbang*et al.*, 2016; 2018, respectively. The CP recorded by Abang*et al.*, 2016 and Abang*et al.*, 2018 were higher probably as a result of the different processing methods employed. Heat is said to denature protein, this could have accounted for the lower value of CP for BMKCM.

Cost effectiveness of feeding BMKCM to broiler chicks is presented in Table 4 and Return to Naira Invested in Table 5. Feed cost reduced with inclusion levels of BMKCM across the treatments. Broiler chicks fed 20% BMKCM recorded least values. The observations were similar to the reports of Abang*et al*. (2016) and Abang*et al.* (2018) who noticed a reduction in feed cost with heavy inclusions of sun-dried mango kernel meal and fermented mango kernel composite meal in the diets of growing Japanese quail (*coturnixcoturnix japonica*) and broiler chick across the treatments, respectively.Feed cost per gram weight gain increased with inclusionsof BMKCM in the diets resulting in negative values in cost savings per gram meat. This was in contrast with the reports of Abang*et al.,*2016;2018who observed a reduction in feed cost per gram weight gain with supplementation across the diets leading to negative values in cost savings per gram meat when FMKCM and SMKM was served to growing quail and broiler chicks, respectively.

The result of average cost of feed intake was not significantly (P>0.05) different across the treatment group. Similar observation was made by Abang*et al.* (2018) when FMKCM was served to chicks. The observation contradicts the reports of Abang*et al.* (2016) who recorded significantly (p<0.05) lower values in the costof feed consumedwith heavy supplementation of SMKMacross the treatments. The different processing methods adapted; sun-drying, was unable to reduce the anti-nutrients such as; tannins, saponins, pyhtatesto a more tolerable level. These anti-nutrients would have reduced the palatability of the feed thereby, resulting in less consumption and subsequently reduced cost of feed intake by the quails.

Negative values were observed with feed cost savings per gram meat for 20% and 10% inclusions, thereby, revealing that no savings accrued with supplementation of BMKCM at these levels. However, Profit and RNI tend to increase with heavy supplementation of BMKCM probably, because body weight was not a price determining factor when chicks were sold. This trend was similar to the pattern of Abang*et al.,* 2016 and 2018 when SMKM and FMKCMwere fed to quails and chicks, respectively.

6. Conclusions

The study concluded that chicks' diets could contain up to 20% BMKCMin place of maize, but for profit maximization, 15% replacement is recommended.

Declarations

Ethical Approval

All authors hereby declared that "The University Committee on Ethical Matters Examined and Approved all the Experiments".

Conflict of Interests

It was declared by the authors that there is no conflict of interest.

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