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Growth Performance and Some Blood Variables of Broiler Chickens Fed Raw or Boiled Mango Kennel Meal

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Abstract: In a 63-day experiment the effect of replacing maize with raw or cooked mango kennel meal on the growth and blood parameters of broiler chickens was investigated. One hundred and eighty (180) day-old Anak, 2000 broiler chicks (mixed sex) were randomly allotted to 3 dietary treatments containing 4 replicates of 15 chicks each. The diets consisted of a maize - based (control) diet and 2 other diets containing 20% of either raw (RMK) or boiled mango kernel (BMK) meal as a replacement for maize. Boiling reduced the toxic factor (tannin) content of mango kernel by up to 75.00%. During the starter phase (0-28 days) birds fed the RMK- based diet ate significantly less feed, gained less weight and recorded a poorer feed conversion ratio (FCR) than the control and the BMK - based diets, but there were no significant dietary effects on these parameters during the finisher period (28-63 days). There were no significant dietary effects on the haematological values but serum total protein and globin were markedly reduced on the RMK fed group. From these results it is concluded that 20% of the maize can be replaced with boiled mango kernel meal in the diet of broilers without adverse effects on growth and blood parameters.

Key words: Mango kernel meal, maize, broiler chickens, growth performance, blood parameters

Introduction

The high cost of feed still remains the greatest constraint to poultry production in Nigeria. Maize which has been the main energy source is short in supply and expensive. It is therefore necessary to look for locally available, cheap, safe and nutritionally adequate substitutes for maize in poultry feeding.

Mango (*Mangifera indica* L) is a tree crop well adapted to all ecological zones in Nigeria and the trees are found all over the country. Mango kernel, a by-product of mango pulp is reported to be a good source of starch (Saadanry *et al.,* 1980). In India, mango kernel is consumed by human beings in the form of porridge (Saadany *et al.,* 1980; Opeke, 1982) but in Nigeria it is regarded as waste thus contributing to environmental pollution. There are few reports on the use of mango kernel in livestock feeding but the level of inclusion in poultry diets has been low because of the presence of tannins which have been reported to reduce chick growth (Jansman *et al.,* 1995; Teguia, 1995). Body weight gain and feed consumption of broilers were adversely affected when 20% of dietary maize was substituted with raw mango kernel meal (Teguia, 1995). However, boiling has been reported to be an effective method of tannin reduction. Mbajunwa (1995) reported up to 52% tannin reduction in boiled African oil bean.

The present study reports the utilization of raw or boiled mango kernel meal by broiler chickens in Yobe College of Agriculture Gujba.

Materials and Methods

Source and processing of mango kernel: Mango kernel was collected by children during the month of May, a period which corresponds to the peak of the mango season in the study area. The kernel was processed by two (2) different methods as follows:

1. Raw mango kernel (RMK): The kernel was ground in a hammer mill, sun dried for 72 hours and labeled RMK.
2. Boiled mango kernel (BMK): The kernel was boiled in tap water at 100°C for 30mn, ground, sun-dried for 72 hours and labeled BMK.

A sample each of the raw and boiled mango kernel meals was analyzed for proximate composition (AOAC, 1990) and tannin content using standard method (AOAC, 1980) and used in the formulation of the experimental diets.

Experimental birds and management: One hundred and eighty (180) day-old broiler chicks (mixed sex) were used for the investigation which lasted 63days. At the start of the experiment the chicks were individually weighted and randomly assigned to 3 dietary treatments containing 4 replicates of 15 chicks each. Each group of 15 birds was housed in a floor pen (1.95m^2) with the floor covered with wood shavings as litter material. The birds received vaccination against Newcastle (3 weeks of age) and Gumboro (2 and 4 weeks of age) diseases.

Table 1: Composition of the experimental broiler diets

Ingredient (%)	Starter diets			Finisher diets		
	control	RMK	BMK	control	RMK	BMK
Maize (white)	42.00	33.60	33.60	52.650	42120	2120
RMK	-	8.40	-	-	105.30	-
BMK	-	-	8.40	-	-	105.30
Wheat bran	105.00	105.00	105.00	12.20	12.20	12.20
Soyabean meal	39.35	39.35	39.35	29.00	29.00	29.00
Fish meal	5.00	5.00	5.00	3.00	3.00	3.00
Bone meal	2.40	2.40	2.40	2.40	2.40	2.40
DL-methionine	2.00	2.00	2.00	2.00	2.00	2.00
* Premix	2.50	2.50	2.50	2.50	2.50	2.50
Salt	3.00	3.00	3.00	3.00	3.00	3.00
Total	100.00	100.00	100.00	100.00	100.00	100.00
Analyzed Composition (%)						
Crude protein (CP)	22.80	22.10	22.50	19.89	19.91	19.87
Ether extract (EE)	3.69	3.83	3.85	3.54	3.56	3.60
Nitrogen free extract (NFE)	58.88	58.61	58.91	62.58	62.58	62.59
[1]ME (Kcal/kg)	2897.57	2895.89	2974.22	2931.34	2933.02	2934.41

* Mineral/vitamin premix from bio-organics had the following composition: - Bio-mix starter supplied/kg: Vit A = 4,000,000.00 IU; Vit D_3 = 800,000.00 IU; Vit E = 9,200.00mg; Niacin = 11,000.00mg; Vit B_1 = 720.00mg; B_2 = 2000.00mg; B_6 = 1,200.00mg; B_{12} = 6.00mg; Pantothenic acid = 3,000.00mg; Biotin = 24.00mg; Folic acid = 300.00mg; Choline Chloride = 120,000.00mg; Cobalt = 80.00mg; Copper = 1,200.00mg; Iodine = 400.00mg; Iron = 8,000.00mg; Manganese = 16,000.00mg; Selenium = 80.00mg; Zinc = 12,000.00mg; Anti oxidant = 500.00mg. -Bio-mix Finisher supplied/kg: Vit A = 4,000,000.00 IU; Vit D_3 = 800,000.00 IU; Vit E = 9,200.00mg; Niacin = 11,000.00mg; Vit B_1 = 720.00mg; B_6 = 1,200.00mg; B_{12} = 6.00mg; Pantothenic acid = 3,000.00mg; Biotin = 24.00mg; Folic acid = 300.00mg; Choline Chloride = 120,000. .00mg; Cobalt = 80.00mg; Copper = 1,200.00mg; Iodine = 400.00mg; Iron = 8,000.00mg; Manganese = 16,000.00mg; Selenium = 80.00mg; Zinc = 12,000.00mg; Anti oxidant = 500.00mg. [1].ME= metabolizable energy (Kcal/kg) calculated according to the formula of Ichaponani (1980) as ME= 432 + 27.91 (CP + 2 x EE + NFE). RMK= Raw mango kernel, BMK= Boiled mango kernel

The diets consisted of a control containing maize but no mango kernel meal and 2 other diets containing 20% of either raw (RMK) or boiled mango kernel (BMK) meal (Table1). The diets were analysed for proximate composition according to AOAC (1990). The diets and clean drinking water were supplied *ad-libitum* throughout the duration of the experiment (63 days). The starter diet was fed for the first 28 days and the finisher from day 29 to the end of the experiment.

Data collection and analysis: Data were collected on the growth performance and blood parameters. A weighed quantity of feed was fed daily and feed intake calculated as the difference between the left over and the quantity fed the previous day. The birds were weighed at the start of the experiment and weekly thereafter and daily gain calculated by dividing the weight difference between 2 consecutive weighings by 7 (number of days in the week). Feed conversion ratio was derived as feed consumed: Weight gained. At the end of the experiment 8 birds were randomly selected per treatment (i.e. 2 birds per replicate), fasted over night and used for haematological and serological studies. Haematological samples were collected into sample tubes containing ethylene diamine tetra acetic acid (EDTA) as anticoagulant while samples for serology were collected into anticoagulant - free tubes. Blood samples were analyzed according to routinely available clinical methods as expounded by Bush (1975).

Analysis of variance (Steel and Torrie, 1980) was carried out on data using the SPSS statistical package (SPSS, 2001).

Results

The results of proximate analysis and tannin content of raw and boiled mango kernels are presented in Table 2. The boiled kernel contained less crude protein and ash than the raw kernel. There were 121.00mg/g tannin in the raw kernel and 54.07mg/g in the boiled kernel, representing about 75% reduction by boiling.

The growth performance data are presented in Table 3. During the starter phase (0-28 days) birds fed the raw mango kernel diet ate significantly ($p<0.05$) less feed, gained less weight and recorded a poorer ($p<0.05$) feed conversion ratio (FCR) than those fed the control and the boiled kernel diets. The cost of the feed (N/kg) was numerically reduced on the mango kernel - based diets compared to the control but the feed cost of meat production (N/kg gain) was not affected ($p>0.05$) by the diet. Daily feed intake, weight gain, feed conversion ratio and feed cost of meal production during the finisher phase (28-63days) as well as their overall means (0-63days) were not affected ($p > 0.05$) by the diet. However, birds on the raw kernel diet had a significantly ($p<0.05$) lower final body weight compared to the control and the boiled

Table 2: Proximate composition and tannin content of raw and boiled mango kernel

Constituent (%)	RMK	BMK
Dry meter (DM)	90.85	89.22
Crude protein (CP)	8.75	7.81
Crude fibre (CF)	3.01	2.94
Ether extract (EE)	14.82	15.97
Total ash	3.24	2.21
Nitrogen free extract (NFE)	70.18	71.07
Tannin	12.10	5.47
% tannin reduction	-	54. 7 9

RMK = Raw mango kernel, BMK = Boiled mango kernel.

kernel-based diets which did not differ (p>0.05) from one another.

The blood analysis data (Table 4) showed no significant (p>0.05) treatment differences in the haematological parameters and serum albumin concentration. Serum total protein and globulin concentrations were markedly (p<0.05) reduced on the raw kernel fed group.

Discussion

The reason for the reduced protein content in the boiled kernel was not clear but probably due to some denaturing of protein by heat as reported by Parsons *et al.* (1992) and the leaching of soluble proteins in the processing water. Mbajunwa (1995) also reported the leaching of soluble minerals in water. This may be used to explain the lower ash content of the boiled kernel in this experiment. The maximum reduction of tannin observed in the boiled kernel agrees with the observations of Mbajunwa (1995) and Teguia and Beynen (2005) that cooking is an efficient method of reducing the tannin content of feeds.

The detrimental effects of Tannins on nutrient utilization and chick growth have been reported by Jansman *et al.* (1995) and Teguia and Beynen (2005). This may be used to explain the poor performance observed during the starter phase. The recovery in performance observed during the finisher phase is an indication of compensatory growth and this suggests that chicks are more sensitive to the effect of tannins than adult birds. However, despite the compensation in growth during the finisher phase the final body weight of birds fed the raw kernel was poorer. This was attributed to a carry over effect of the poorer daily gain observed on this group during the starter phase. The reduction in the cost of the feed (N/Kg feed) on the mango kernel - based diets was attributed to the price difference between maize and mango kernel. Mango kernel was not purchased *per se* but a little financial motivation representing about N 2.50kg was given to the children against N41.17/kg of maize at the time of the experiment. The mortality pattern was not traceable to the diet as more birds died on the control than the cooked mango kernel diet.

Table 3: Growth performance of boiled fed raw or boiled mango kernel meal

	Diets			
Parameter	Control	RMK	BMK	SEM
0 -28 days				
Daily feed intake (g/bird)	58.30^{a}	44.64^{b}	57.54^{a}	1.62*
Daily weight gain (g/bird)	20.42^{a}	14.40^{b}	20.31^{a}	1.00*
Feed gain	2.85^{b}	3.10^{a}	2.83^{b}	0.09*
N/kg feed	54.06	50.72	51.03	-
N/kg gain	154.07	157.23	144.41	8.47^{NS}
28 - 63 days				
Daily feed intake (g/bird)	140.14	141.16	139.72	0.20^{NS}
Daily weight gain (g/bird)	50.88	48.68	49.57	0.33^{NS}
Feed gain	2.75	2.90	2.81	0.02^{NS}
N/kg feed	44.14	41.62	43.43	-
N/kg gain	121.39	120.70	121.97	4.90^{NS}
0 - 63 days				
Initial weight (g/bird)	48.73	48.68	48.70	0.01^{NS}
Final weight (g/bird)	2365.98^{a}	1963.88^{b}	2249.92^{a}	59.81*
Daily feed intake (g/bird)	99.82	94.59	98.63	0.61^{NS}
Daily weight gain (g/bird)	35.65	31.53	34.94	0.82^{NS}
Feed gain	2.80	3.00	2.82	0.06^{NS}
N/kg feed	49.10	46.17	47.23	-
N/kg gain	137.78	139.00	133.19	1.82^{NS}
Mortality (number)	2	2	1	-

RMK = Raw mango kernel, BMK = Boiled mango kernel, SEM = standard error of the mean, a, b = means within the row bearing different superscripts are significantly different (p < 0.05), * = significant (p<0.05), NS = not significant (p>0.05), -: not analysed, at the time of the experiment **x**1 = $0.007

Table 4: Some haematological and serum biochemical values of broiler chickens fed raw or boiled mango kernel meal

	Diets			
Parameter	Control	RMK	BMK	SEM
PCV (%)	28.81	28.01	28.78	0.46^{NS}
RBC count (10^6/mm^3)	4.80	4.74	4.79	0.01^{NS}
Hb conc. (g/dl)	9.62	9.58	9.61	0.02^{NS}
WBC count (10^3/mm^3)	24.84	24.91	24.89	0.01^{NS}
Serum protein (g/dl)	4.08^{a}	3.51^{b}	4.01^{a}	0.02*
Serum albumin (g/dl)	1.82	1.80	1.80	0.02^{NS}
Serum globulin (g/dl)	2.26^{a}	1.71^{b}	2.21^{a}	0.02*

RMK = BMK = SEM = standard error of the mean, ^{a,b} = means within the row bearing different superscripts are significantly different (p<0.05), * = significant (p<0.05), NS = not significant (p>0.05).

Tannins have been reported to bind proteins and reduce their availability (Jansman *et al.,* 1995). This may be a reason for the lower serum protein concentration on the raw kernel fed group as blood protein is positively correlated with protein intake (Brown and Clime, 1972; Adeyemi *et al.,* 2000).

Based on these results it is concluded that 20% of dietary maize can be replaced with boiled mango kernel meal in broiler chickens without adverse effects on growth and blood parameters, thus the health of the chickens. Further studies may be conducted to investigate higher levels of replacement.

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