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Full Length Research Paper

Carcass and physiological response of broilers fed dry heat treated mango (*Magnifera indica*) kernel based diet

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Abstract

This study examined the replacement of dry heat treated mango kernel at different levels (0, 10, 20 and 30%) in the diet of 120 Anak broiler birds. The birds were allotted to four treatments of 10 birds each and the experiment was replicated 3 times. They were fed *ad libitum* and data were collected on performance [feed intake, weight gain, and feed conversion ratio (FCR)], blood and serum parameters (packed cell volume (PCV), haemoglobin (Hb) concentration, red blood cell (RBC) count, white blood cell (WBC) count total protein and albumin] and carcass parameters (thigh weight, drumstick weight, breast weight, back weight and wing weight). Average final weight and average weight gain were significantly ($p < 0.05$) high in birds placed on 0 and 30% dry heat treated mango kernel, while FCR was significantly low in birds fed with 30% heat treated mango kernel. Birds on 0% heat treated mango kernel had significantly high thigh, drumstick breast, back and wing weights ($p < 0.05$), followed by birds on 30% heat treated mango kernel. PCV and RBC shows significant differences ($p < 0.05$) in favour of birds on 0 and 20% heat treated mango kernel. Total protein and albumin were significantly high ($p < 0.05$) in birds fed with 10% heat treated mango kernel; urea was significantly high in birds fed with 10 and 20% heat treated mango kernel. Alanine transaminase (ALT) also shows high significant difference ($p < 0.05$) in birds fed with 30% heat treated mango kernel, but all values falls within the normal range for broilers. This study reveals that dry heat treated mango kernel can be used in broiler diet up to 30% maize replacement without any adverse effect.

Key words: Mango kernel, heat, broiler, carcass.

INTRODUCTION

Livestock feeds have become very expensive resulting in decrease in livestock production (Bamgbose et al., 2004). Unfortunately, there is also an increasing competition between man and livestock for available feed stuff, for food, feed and industrial raw materials. Bamgbose et al. (2004) reported that maize account for about 45 to 55% of poultry feed. Therefore, any effort to substitute maize in poultry feed will significantly reduce the cost of production.

The most relevant option to arrest the present feed crisis of livestock industry is by-product utilization (Atteh, 1986). The use of these alternative feed stuffs in livestock feed production will cut down feed prices, thus, making them more affordable by livestock farmers. Bamgbose et al. (2004) successfully replaced 40% maize with maize offal/cashew nut meal based diet with no deleterious effects on carcass yield and nutrient digestibility of broilers.

Mango *(Magifera indica L)* is a tree crop well adapted to all ecological zones in Nigeria. Mango kernel, a by-product of mango pulp is reported to be a good source of starch (Saadany et al., 1980). In India, mango kernel is consumed by human beings in the form of porridges (Saadany et al., 1980; Opeke, 1982) but in Nigeria, it is abundant and generally regarded as waste thus, contributing to environmental pollution. Mango kernel needs livestock farmer's attention to be considered as a means of cutting down feed cost in livestock production. Diarra and Usman (2008) reported 20% of maize

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replacement with boiled mango kernel in broiler diet without adverse effects on growth and blood parameters. The present study reports utilization of dry heat treated mango kernel meal by broiler finishers.

MATERIALS AND METHODS

Study area

The study was carried out at the poultry unit of The Polytechnic Ibadan, Saki Campus. Many cultivars of both indigenous and improved mango are produced in large quantities in the area with the peak production in April to May. During this period, mango seed poses a serious environmental problem because it has no food, feed or industrial value in the area.

Source and processing of mango kernel

Mango seeds were collected from the school premises. The seeds were broken to get the kernel. The fresh kernels were sun-dried for a period of 7 days to reduce moisture content of the kernel, after which the kernels were placed inside an oven at 110°C for 6 h to ensure proper drying and prevention of microbial build-up on the kernel. The dry heat treated mango kernel was milled in a hammer mill and used in the formulation of the experimental diet.

Experimental diet

Four diets in which mango kernel replaced maize at 0, 10, 20, and 30%, respectively were formulated for the experimental birds. Kernel and diet proximate composition were analyzed by method of AOAC (1990). All the four diets (composition in Table 1) were made to contain approximately 19% crude protein and energy ranges between 2895.89 and 2974.22 kcal/kg.

Experimental birds and management

One hundred and twenty (120) Anak broilers raised together on commercial starter mash for the first 4 weeks and vaccinated against Gumboro and Newcastle diseases were used for the study which lasted for another 4 weeks. At the end of starter phase, birds were individually weighed and randomly allotted to four treatments of three replicates (10 birds per replicate). Birds in each replicate were raised in a deep litter house with wood shavings as litter material. The experimental diets in Table 1 and clean water were given *ad-libitum* for 4 weeks of the study.

Data collection

Data were collected on performance (feed intake, weight gain, and feed conversion ratio; FCR), blood parameters [packed cell volume (PCV), haemoglobin (Hb) concentration, red blood cell (RBC) count, white blood cell (WBC) count, serum total protein, albumin and globulin] and carcass weight (thighs, drumsticks, breast back and wings).

A weighed quantity of feed was supplied daily and the left over weighed. Feed intake was determined by difference between feed served and the left over. Birds were weighed weekly and weight gain calculated by difference between two consecutive weighing. FCR was calculated as the ratio of the feed consumed to the weight gained (feed:gain). At the end of the experiment, 2 birds per replicate were randomly selected and fasted overnight . The birds were bled by severing the jugular vein after weighing; blood samples for haematology were collected into sample tubes containing ethylene diamine tetra-acetic acid (EDTA) as anticoagulant, while serological samples were collected in anti-coagulant free tubes. Blood samples were analyzed according to routinely available clinical methods as expounded by Bush (1975). Packed Cell Volume (PCV) was determined by microhaematocrit method; Hb concentration was measured spectrophotometrically using SP6 - 500 ultraviolet (UV) Spectrometer. The RBC and WBC counts were estimated using Haemocytometer as described in Ewuola and Egbunnike (2008). Serum was obtained after the blood was allowed to stand for 45 min at room temperature and centrifuged at 2,000 revolutions per minute (rpm) for 10 min to separate the cells from the serum. Urea was determined by urease method and creatinine by Folin-Wu filtrate method as described by Toro and Ackermann (1975). Total serum protein was determined using Biuret method as described by Reinhold (1953), while albumin was determined using Bromocresol green method as described by Peters et al. (1982). Alanine transaminase (ALT) was determined using spectrophotometric method as described by Rej and Hoder (1983).

Slaughtered birds were scalded in hot water, plucked and eviscerated manually. The eviscerated chickens were dressed by removing the neck and the shanks; the dressed chicken were weighed, some cut-up parts like thigh, breast and drumstick were removed and weighed.

Data analysis

Data collected on growth, blood and carcass parameters were analyzed for variance using the statistical package of SAS (1999).

RESULTS AND DISCUSSION

Table 1 shows the experimental diet with different levels of heat treated mango kernel inclusion. From the analyzed composition of the diet, diet with 30% inclusion had the highest metabolizable energy which may be responsible for the lowest feed intake in birds placed on this diet and this agrees with the report of Jansman et al (1989), that poultry consume feed to meet their energy requirement. The significantly lower ($p < 0.05$) feed intake and significantly high ($p < 0.05$) weight gain in birds fed with 30% mango kernel (Table 2) were the reasons for the significant ($p < 0.05$) improvement in FCR on the 30% inclusion diet.

Table 3 presents the carcass and organ characteristics of broiler finishers fed graded levels of heat treated mango kernel. The table shows significant variation ($p < 0.05$) in the dressed weight among the four treatments with the control (0.0% replacement) having the highest mean value of 1.325 kg followed by the 30% replacement with mean value of 1.318 kg. There exists no significant difference ($p > 0.05$) between the control diet and the 30% replacement diet. The prime cut, (thigh, drumstick and breast) exhibit significant variation ($p < 0.05$) across the four treatments with the control having the highest mean values followed by the 30% replacement diet except in the drumstick where 20% replacement diet outweigh 30% diet replacement. Internal organ weight in

Table 1. Experimental diet.

	Treatments			
Variable	**0%**	**10%**	**20%**	**30%**
Maize	50.00	45.00	40.00	35.00
Mango kernel	-	5.00	10.00	15.00
Soya bean meal	12.00	12.00	12.00	12.00
Groundnut cake	13.00	13.00	13.00	13.00
Palm kernel cake	13.00	13.00	13.00	13.00
Wheat offal	5.00	5.00	5.00	5.00
Fish meal	3.00	3.00	3.00	3.00
Bone meal	2.00	2.00	2.00	2.00
Oyster shell	1.00	1.00	1.00	1.00
Premix	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Salt	0.50	0.50	0.50	0.50
Total	100	100	100	100
Analyzed composition (%)				
Crude protein (%)	19.00	18.94	18.75	18.71
Net Energy (kcal/kg)	2938.22	2895.89	2905.45	2974.28
Nitrogen free extract	60.71	59.62	59.05	50.19
Ether extract	11.25	12.14	12.42	13.01

Table 2. Growth performance of broilers fed different levels of dry heat treated mango kernel.

	Treatments				
Variable	**0%**	**10%**	**20%**	**30%**	**SEM**
Mean initial weight (g/bird)	545.55	545.49	545.40	545.84	0.00
Mean final weight (g/bird)	1700.00^{b}	1500.21^{d}	1610.44^{c}	1710.13^{a}	0.16
Mean daily feed intake (g/bird)	136.92^{b}	133.23^{c}	138.42^{a}	130.36^{d}	0.06
Mean daily weight gain (g/bird)	53.25^{a}	52.08^{b}	52.30^{b}	54.03^{a}	0.01
Fed conversion ratio (FCR)	2.36^{c}	3.00^{a}	2.88^{b}	2.07^{d}	0.31

SEM, Standard error of the mean. Within a row, values with different superscripts differs significantly ($p < 0.05$).

Table 3 also reveals significant ($p < 0.05$) difference with the control having the highest mean value followed by the 30% replaced diet. This result shows that heat treated mango kernel can compete favourably with maize in broiler finisher diet for muscle build-up. Haematological and serum biochemistry analysis results are presented in Table 4. The haematological indices are the reflection of the effect of dietary treatments on the birds. PCV was significantly higher ($p < 0.05$) in the control birds (0% mango kernel) and birds placed on 20% replacement diet, though all the values across the four diets were within the normal range (21 to 45%) reported by Mitruka and Rawnslay (1977). RBC from Table 4 shows significant ($p < 0.05$) variation across the treatments with the control and 20% replacement having higher values of 2.425 and $2.52510^{6}/mm^{3}$, respectively. All the RBC mean values across the treatments falls within the normal range (1.58 to 3.82) reported for broilers by Mitruka and Rawnsely (1977). This means bird placed on heat treated mango kernel were not anemic nor show sign of polycythemia. This may probably be as a result of the beneficial effects conferred on the birds by heat treated mango kernel meal which favours the haematological indices of the birds. All the haematological parameters analyzed were comparable to values reported in literature as normal for chickens (Awoniyi et al., 2000; Faniyi, 2002). This similarity in the blood parameters between treatments and their normal values are indications of nutritional adequacy of all the diets, since blood profile offers a valuable investigation and explanatory tool in nutritional assessment and health implications (Olorede et al., 1995; Odunsi and Longe, 1995).

Table 3. Carcass characteristics of broilers fed with different levels of dry heat treated mango kernel.

	Treatments				
Parameter	**0%**	**10%**	**20%**	**30%**	**SEM**
Live weight (kg)	1.700^{a}	1.560^{b}	1.160^{c}	1.700^{a}	0.300
Dressed weight (kg)	1.325^{a}	1.150	1.200	1.318	0.059
Thigh (kg)	0.300^{a}	0.200^{b}	0.200^{b}	0.200^{b}	0.014
Drumstick (kg)	0.300^{a}	0.200^{b}	0.250^{b}	0.200^{c}	0.014
Breast (kg)	0.425^{a}	0.300^{b}	0.275^{b}	0.325^{b}	0.019
Back (kg)	0.350^{a}	0.275^{b}	0.225^{c}	0.300^{ab}	0.022
Wings (kg)	0.200^{a}	0.150^{b}	0.175^{ab}	0.175^{ab}	0.010
Gizzard (g)	91.220^{a}	84.84^{a}	73.190^{b}	69.935^{b}	3.529
Liver (g)	46.260^{a}	36.250^{b}	33.075^{b}	37.195^{b}	1.688
Spleen (g)	2.754	2.625	2.770	2.230	0.364
Pancreas (g)	5.405^{a}	4.760^{ab}	4.975^{bc}	3.765^{c}	0.257
Heart (g)	11.910^{a}	8.400^{b}	9.270^{b}	8.900^{b}	0.000

SEM, Standard error of the mean. Within a row, values with different superscripts differs significantly ($p < 0.05$).

Table 4. Haematological and serum biochemistry of broilers fed with different levels of dry heat treated mango kernel.

	Treatments				
Parameter	**0%**	**10%**	**20%**	**30%**	**SEM**
PCV (%)	27.630^{a}	23.285^{b}	27.150^{a}	22.460^{b}	0.60
RBC count (10^{6}/mm^{3})	2.425^{a}	2.075^{b}	2.525^{a}	2.070^{b}	0.00
HB concentration (g/dl)	15.95^{b}	10.85^{c}	16.90^{a}	10.20^{d}	0.00
WBC count (10^{3}/mm^{3})	25.84	25.89	25.91	25.79	0.020
Total protein (g/dl)	3.270^{b}	4.340^{a}	3.190^{b}	2.630^{b}	0.265
Albumin (g/dl)	2.135^{ab}	2.625^{a}	1.965^{bc}	1.472^{c}	0.168
Urea (mg/dl)	4.900^{b}	6.300^{a}	6.301^{a}	5.850^{b}	0.362
ALT (γl)	6.000^{b}	4.000^{c}	4.000^{c}	8.000^{a}	0.577

SEM, Standard error of the mean. Within a row, values with different superscripts differs significantly ($p < 0.05$).

Adedeji (1992) reported serum protein as a source of replacement of tissue proteins, buffer in acid-base balance and as transporter of constituents of blood such as vitamins, iron, copper, hormones, lipids and enzymes. Total protein and albumin shows significant ($p < 0.05$) difference with birds on 10% replacement showing higher values. This agrees with the findings of Diarra and Usman (2008) who reported serum protein for broilers ranging between 3.0 and 4.08. Mean values for urea shows significant difference ($p < 0.05$) with values ranging between 4.90 and 5.85 which falls between the normal values (1.50 to 6.30) reported by Mitruka and Rawnsley (1977), this shows adequate excretion of urea from the kidney.

ALT is more specific to the liver and is thus a better parameter for detecting liver injury (Moss and Butterworth, 1974). Mean values for ALT shows significant difference ($p < 0.05$) and shows no injury to the liver since values are within normal range (9.50 to 37.20) (Mitruka and Rawnsley, 1977).

Conclusion

Replacement of maize by dry heat treated mango kernel up to 30% of maize in broiler diet is not deleterious as revealed from the serum biochemistry of the birds. Likewise the carcass parameters especially the prime cuts were favoured. Higher level of replacement and histopathological effect on the gut should be studied.

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