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Performance and haematological parameters of broiler chickens fed mango (*mangifera indica*) seed kernel meal as a partial replacement for maize

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ABSTRACT

The study was conducted using a total number of ninety day old Cornish cross broiler birds, to determine the effect of mango seed kernel meal (MSKM) as a partial replacement for maize on growth performance and haematological indices of broiler chickens. The mango seed kernel meal replaced maize at the inclusion levels of 0%(control), 5%, 10%, 15% and 20% in T_1, T_2, T_3, T_4 and T_5 respectively. The birds were randomly assigned to 5 dietary treatments groups with 18 birds each using completely randomized designed (CRD). Each treatment contained 3 replicates with 6 birds each. The study lasted for 8weeks (56days). All routine vaccination and management practices were duly followed throughout the experiment. At the end of the experiment, performance and haematological parameters were examined The results obtained were subjected to analysis of variance (ANOVA) using statistical package for Social Science (SPSS) software. The result on performance showed no significant ($p>0.05$) treatment difference in feed intake, body weight gain, feed conversion ratio and mortality. The results obtained on the blood parameters indicated that significant ($P<0.05$) differences in packed cell volume (PCV), haemoglobin (HB) concentration, Red blood cells (RBC), White blood cells (WBC), Platelet (PLT) , Neutrophils (N), and lymphocytes (L) except Eosinophils (E) and Monocytes (M) which were not significantly ($p>0.05$) affected by the treatments. Based on the observation from this study, it was concluded that broiler birds can tolerate the inclusion level of Mango seed kernel up to 20% as a partial replacement for maize in broiler birds' diet without any adverse effect on the performance and haematological parameters.

Keywords: Performance, haematology and mango seed kernel

INTRODUCTION

Poultry refers to all birds of economic value to man, they are raised for their meat and eggs orfor other purposes. Some of these poultry species include chickens, pigeons, ducks, pheasants, quails, guinea fowls, ostriches, turkeys, all which belong to the zoological class Aves (Payne, 1990). Broiler production involves the raising or keeping of chickens primarily for meat purposes. It is a veritable way of alleviating animal protein problem in Nigeria. The quest for animal protein is on the increase (Obinne and Okorie, 2008). The low cholesterol content also promotes demand for broiler meat requires that efforts be intensified not only to increase the number of broiler but also to improve productivity (Atteh, 2004).

Successful broiler production is dependent upon supplying the birds with feed of the highest achievable quality, in terms of feed ingredients used. In poultry production about 70% of the total cost is attributed to feeding cost (Banson *et al.,* 2015).The major difficulty faced by the poultry production in a developing country like Nigeria is the

skyrocket price of convectional feed ingredients (Diarra and Usman,2008). The increased cost of feeds is due to the high cost of cereal grains such as maize.

Maize is a major source of energy in poultry feeds and it is short in supply and expensive as a result of a stiff competition between man and livestock (Bamgbose *et al.,* 2004). Hence there is need to search for locally available, cheap, safe and nutritionally adequate alternative source of energy that can be substituted for maize in poultry feeding (Dairra and Usman, 2008), which will significantly reduce the cost of production. Alternative feedstuffs do not present major competition with human food and are likely to be available for use at lower cost. One of such alternative source that can be utilized is the mango seed kernel.

Mango (*Mangifera indica*) is an important fruit crop grown in the tropics mostly for its pulp. Mango seeds which represent between 20 – 60% of the fruits has limited food or industrial use in most producing countries and is therefore wasted thus, contributing to environmental pollution (Diarra *and Usman,* 2014).Therefore, using the mango seed which is waste for animal feeds could have an important element to fill the scarcity and competition problem of feed . The alphonso variety of mano kernel contained in the seed (Mango seed kernel; MSK) is a good source of carbohydrate (69.2 - 80%), protein (7.5 – 13%), fibre (2.0 – 4.6%), ash (2.2 –2.6%), calcium (0.21%) and phosphorus (0.22%), which is comparable to that of maize, depending on the variety (Diarra *et al.,* 2010). Mango kernel is reported to contain some tannin which exerts anti-nutritive effects in poultry (Benjamin, 2001).The nutritive value of the mango seed kernel can be improved with several treatment methods such as: Boiling with HCl or NaOH, soaking, leaching and fermentation. This study reports the effect of mango kernel meal as a partial replacement for maize on broiler performance and haematological parameters.

The study investigate the effect of mango seed kernel meal on growth performance and haematological parameters of broiler birds fed mango seed kernel meal as a partial replacement for maize .

MATERIALS AND METHODS

Experiment Location and Duration

The experiment was carried out at the Poultry Unit of the Faculty of Agriculture Research and Demonstration Farm of University of Port Harcourt, Choba Rivers State. It is located on the $4^0$45'N, $6^0$50'E (4.750^0N, 6.833^0E), having an annual average temperature of 26^0C (78.8^0F). The experiment lasted for a period of eight (8) weeks (56 days).

Experimental Animals, Housing and Management

A total number of ninety (90) day-old Cornish breed ofbroiler chicks were raised together on commercial starter feed for the first three weeks for acclimatization and the experimental diet fed for the next five weeks. A completely randomized design (CRD) was used for the experiment.The birds were individually weighed and randomly assigned to 5 treatment groups having 18 birds each. The treatment groups were denoted as T_1, served as the control diet while the other four were denoted as T_2,T_3, T_4, and T_5. Each group was further divided into 3 replicates containing 6 birds. The birds in each replicate were housedintensively in a deep litter pen with the floor covered with wood shavings as litter material. Routine management practices were adopted, such as vaccination, feeding with experimental diets and clean drinking water and other sanitation practices were provided throughout the duration of the experiment.

Experimental Diets and Procedure

The Alphonso species of mango were collected at the peak of its season from Mango Depot, at Port Harcourt fruit garden during the months of April and May. The seed were obtained by cracking the endosperm manually with the use of knife and stone to extract the kernel. The fresh kernels were then soaked in boiled water at 100^0C for up to 15min and sun-dried until it attained a constant weight without moisture.This was done to reduce the anti nutritional factor present in it. After sun

drying, it was ground in hammer mill and the resulting meal was used in the formulation of the experimental diets. Proximate analysis of mango seed kernel and maize samples were determined at Plant Science and Biotechnology Laboratory, University of Port Harcourt.

The mango seed kernel meal was then incorporated at the graded levels of 0%, 5%, 10%, 15% and 20% in thebroiler diet to replace maize, (Table 1).

Data Collection

Data were collected on performance (feed intake, weight gain, and feed conversion ratio; FCR) and blood parameters (packed cell volume (PCV), haemoglobin (Hb) concentration, red blood cell (RBC) count, white blood cell (WBC) count). A weighed quantity of feed was supplied daily and the left over weighed. Feed intake was determined by obtaining the difference between feed served and the left over. Birds were weighed weekly and weight gain calculated from the 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 finisher phase of the experiment, 2mls of blood was collected through the wing vein of each bird per replicate, into sterile universal bottles containing anti-coagulant (ethylene diamine tetra acetic acid - EDTA). The samples were sent to the laboratory for the analysis of haematological parameters.

Statistical Analysis

They results obtained were subjectedtothe Analysis of variance (ANOVA) using the Statistical Package for Social Science (SPSS) software and significant means were separated using Duncan Multiple Range Test (DMRT).

Table 1: Experimental Diet

Ingredients	**T1 (0%)**	**T2 (5%)**	**T3 (10%)**	**T4 (15%)**	**T5 (20%)**
Yellow maize	52.40	49.78	47.16	44.54	41.92
Soya bean meal	12	12	12	12	12
Bone meal	2.4	2.4	2.4	2.4	2.4
Premix	0.2	0.2	0.2	0.2	0.2
Salt	0.6	0.6	0.6	0.6	0.6
DL methionine	0.2	0.2	0.2	0.2	0.2
Fish meal	4	4	4	4	4
Lysine	0.2	0.2	0.2	0.2	0.2
Palm Kernel cake	13	13	13	13	13
Groundnut cake	10	10	10	10	10
Wheat offal	5	5	5	5	5
Mango seed kernel	-	2.62	5.24	7.86	10.48
Total	**100**	**100**	**100**	**100**	**100**
Analyzed composition (%)					
Crude protein (%)	20.79	20.01	19.82	19.15	18.70
Net energy (kcal/kg)	3200	2900	3050	3000	2950
Crude fibre	4.70	4.65	4.59	4.54	4.49
Ether extract	3.35	3.75	3.98	4.07	4.32
Lysine	0.86	0.88	0.90	0.92	0.94
Methionine	0.42	0.44	0.46	0.49	0.51
Calcium	1.29	1.31	1.34	1.36	1.31
Phosphorus	0.91	0.92	0.94	0.96	0.98

RESULTS

Proximate Analysis of Maize Grain and Mango Seed Kernel

The proximate analysis of mango seed kernel is given in Table 1 which shows that it is low in crude protein (6.8%), crude fibre (2.32%), but high in ash content (2.61%), dry matter content (89.2%), fat and oil (11.54%)and has a close range of carbohydrate (76.73) when comparedwith maize.

Table 2: Proximate Analysis of Maize Grain and Mango Seed Kernel

Parameters %	Sample	Sample
	Maize	Mango seed kernel
Dry matter	88	89.22
Protein	8.60	6.80
Fats and oil	3.82	11.54
Crude fibre	3.20	2.32
Ash content	1.81	2.61
Carbohydrate	80.60	76.73

Effect of Treatment on Growth Performance

The resultof the growth performance parameters of broilers fed with various levels of Mango Kernel Seed Meal throughout the 5 weeks of experiment (35 days) is presented in Table 3.It was observed that the parameters which are body weight gain, feed intake, feed conversion ratio and mortality were not significantly ($P<0.05$) different across the treatment groups, although there were differences in the numerical values.

The results showed that body weight gain and feed intake were not significantly affected by the dietary treatment. The result further reveals the numerical values of body weight gain for treatment 1, 2, 3, 4 and 5 as 361.67g, 333.75g, 321.50g, 300.67g and 305.75g weights respectively. The average feed intake was 880.25 for control and ranges from 797.25 to 847.25 for mango seed kernel meal treated birds.

Feed conversion and mortality had no significant difference across the group; the numerical values obtained from feed conversion ratio are 2.56, 2.84, 3.10, 3.26 and 2.79 respectively in treatment 1, 2, 3, 4 and 5.Mortality was only seen in treatments 5 with the value of (0.83).

Table 3: Effect of Treatment on Growth Performance

	DIETARY TREATMENT				
PARAMETERS	**T1 (0%)**	**T2 (5%)**	**T3(10%)**	**T4(15%)**	**T5(20%)**
Body weight gain (g/bird/week)	361.67	333.75	321.50	300.67	305.75
Feed intake (g/bird/week)	880.25	797.25	844.25	843.25	847.25
Feed conversion ratio	2.56	2.84	3.10	3.26	2.79
% Mortality	0.00	0.00	0.00	0.00	0.83

Effect of Treatment on Haematological Parameters

The haematological parameters shown in Table 4, was observed that there was significant difference (P<0.05) in Packed Cell Volume, Haemoglobin, Red Blood Cell, White Blood Cell, Platelet, Neutrophilswhile Eosinophils and Monocytes were not significantly affected (P>0.05) among the treatment groups. The significant difference (P<0.05) in the Packed Cell Volume was observed with treatment 5 and 1 having the highest mean of 35.33 and 31.33 respectively, followed by treatment 4 (29.67) and treatment 2 (28.33). It was revealed from the table that there was significant difference in the haemoglobin with treatment 5 and 1 having the highest mean of 11.80 and 10.43 respectively, followed by treatment 4 and 2 which had 9.87 and 9.43. The significant difference in the red blood cell was observed with treatment 5 and 1 having the highest mean of 5.33 and 4.53 respectively; followed by treatment 4 (4.43) and treatment 2 (4.17). The least Red Blood Cell was seen in treatment 3 (3.93). The significant difference in platelet was observed with treatment 4 and 5 having the highest mean value of 348.00 and 343.33 respectively, followed by treatment 3 (298.33) and treatment1 (291.00) respectively, while the least platelet was seen in treatment 2 (12.73). The

The significant difference observed in the White Blood Cell was observed with treatments 5 and 4 having the highest mean at 18.57 and 16.23 respectively, followed by treatments 2 and 3 at 12.73 and 12.67. The least value of white blood cell was seen in treatment 1 (9.40).

Neutrophils value were significantly (P<0.05) higher on treatment 4 (37.67) than treatment 2 (25.67) which shows the least. Lymphocytes revealed significant higher value on treatment 2 (68.33) and the least value in treatment 1 and 4 with the same numerical values (56.67) respectively.

The effect in Eosinophils shows no significant (P>0.05) variation. It was observed thattreatment 1 and 2 had the highest number with the same value (2.00) while the lowest value (0.00) was seen in treatment 5. Monocytes showed no significant variation (P>0.05). The highest value was observed in treatment 1 (5.67) while the lowest value in treatment 5 (2.67).

Table 4: Effect of Treatment on Haematological Indices

Parameters	T1(0)%	T2(5)%	T3(10)%	T4(15)%	T5(20)%	SEM
PCV (%)	31.33^{ab}	28.33^{b}	27.00^{b}	29.67^{b}	35.33^{a}	1.01*
HB (g/dL)	10.43^{ab}	9.43^{b}	9.00^{b}	9.87^{b}	11.80^{a}	0.34*
RBC($x10^{12}$/L)	4.53^{ab}	4.17^{b}	3.93^{b}	4.43^{b}	5.33^{a}	0.16*
WBC ($x10^{9}$/L)	9.40^{c}	12.73^{b}	12.67^{b}	16.23^{a}	18.57^{a}	1.07*
Platelet ($x10^{9}$/L)	291.00^{ab}	230.00^{b}	298.33^{ab}	348.00^{a}	343.33^{a}	14.18*
N (%)	35.67^{ab}	25.67^{c}	30.33^{bc}	37.67^{a}	35.67^{ab}	1.41*
L (%)	56.67^{b}	68.33^{a}	64.33^{ab}	56.67^{b}	61.67^{ab}	1.67*
E (%)	2.00	2.00	1.67	1.00	0.00	0.30^{NS}
M (%)	5.67	4.00	3.67	4.67	2.67	0.61^{NS}

a, b, c, means the different superscripts in the same row differ significantly (P>0.05). Hb = Haemoglobin, PCV = Packed Cell Volume, WBC = White Blood Cell, RBC = Red Blood Cell, N = Neutrophil, L = Lymphocytes, E = Eosinophils, M = Monocytes .SEM = Standard Error of Mean; NS = Not Significant (P>0.05); * = Significant (P<0.05).

DISCUSSION

The proximate analysis of Mango (*Magnifera indica*) seed kernel in this study shows (6.8%) crude protein,(2.32%) crude fibre, (2.61%) ash content (11.54%) fat and (76.73) carbohydrate. This result is in close range with Fowomola, (2010) who reported10.6% Crude Protein, 2.40% crude fibre, 14.08% crude fat, 2.62% Ash and 70.12% carbohydrate. Kansci *et al.,* (2008) reported that mango (*Magnifera indica*) kernel composition varies greatly, it may therefore be normal to have differences among different reports. The result of this study on growth performance parameters revealed that body weight gain had no significant effect on the dietary treatment and this was in accordance with Abullahi (2012) and Dairra and Usman (2008) but this contradicted with Odunsi (2005) who reported significant effect on body weight gain. Feed intake had no significant difference across the treatment group. This finding agrees with the observation of Rafiu *et al.,* (2014) and Abdullahi, (2012) but it was contrary to Amao and Siyanbola (2013) who reported significant difference on feed intake. The non-significant difference in feed intake in this study may indicate that the experimental diet did not pose any nutritional stress on the birds, which also means that the various treatments were not affected by the mango kernel meal diet The similarities in feed intake of birds in T1 (0%) control diet and the mango seed kernel meal diet indicated that processing might have reduced the anti nutritional factors in the kernel thereby making the feed palatable to the broiler birds, (Elijah and Alisha ,2019).

The study shows that all the dietary level of Mango seed kernel meal had no significant effect on feed conversion ratio and mortality throughout the experiment, these findings is in line with Joseph and Abolaji (1997).The mortality pattern in this study was not traceable to the diet as treatment 5 had a low rate of mortality while no mortality was recorded in other treatment.

Haematology is the study of the morphology and physiology of blood. Haematological values are indirect pointers to health of livestock and are further modified by several factors including diets (Talebi *et al.,* 2005).

The results on haematological parameters revealed that haemoglobin showed significant differences across treatment groups and this agrees with the findings of Odunsi (2005); Amao and Siyanbola (2013) who reported significant increase in haemoglobin levels of broiler birds fed mango seed kernel meal (MSKM).but disagrees .with Mbunwen *et al.* (2015) who conducted an experiment on Anak chickens by feeding different levels of MSKM and observed no significant (P>0.05) differences in haemoglobin count.

The result of the study showed no significant differences in packed cell volume, this agrees with Diarra and Usman (2008) who found no significant influence in packed cell volume, but disagrees with the findings of Amao and Siyanbola, (2013). The higher values of packed cell volume in this study showed that mango seed kernel has enhancing effect on the blood profile of broilers. It may also reveal that the birds were well nourished.

The present study showed significant difference on total white blood cells and the differential count of white blood cells which includes Neutrophils and Lymphocytes. This finding was contrary to (Abdullahi,2012) who observed no significant difference in white blood counts. The present study further revealed no significant effect on Eosinophils and Lymphocytes across the treatment, this shows that the Mango Seed Kernel Meal treated birds were not battling with allergic disorders during the experiment by nutritional or environmental factors, this implies that Mango Seed Kernel Meal is not poisonous and does not contain an irritant, this conformed with Dairra *et al.,* (2010). White blood cell counts were within the normal range of Mitruka and Rawnsley (1977), the significant increase in white blood cells in this study reflects good immune response which could be due to the presence of some bioactive phenolic compound in mango seed (Ejiofor *et al.,* 2018) The results of red blood cell and platelet were significantly affected which was in line with Amao and Siyanbola (2013) who also observed significant effect on red blood cells, but the result did not conform with Abdullahi (2012). Red blood cells and platelets were within the normal range as established byMitruka and Rawnsley(1977). The observed increment in the value of platelets demonstrated how well the test birds handled the mango seed kernel mealin their diets. The significant higher value of red blood cells, in this present study indicates that birds placed on mango seed kernel were not anaemic or showed signs of polycythemia, it further shows that the bone marrows of the birds were functioning normally.

In conclusion,, the results obtained in this study showed that mango seed kernel meal has high potentials as feed ingredient in broiler birds' diets. Considering the performance and haematological parameters, at 15 % inclusion rate , the birds can tolerate the mango seed with good health status

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