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CARCASS CHARACTERISTICS OF BROILER CHICKENS FED GRADED LEVELS OF PROCESSED MANGO SEED KERNEL MEAL

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ABSTRACT

The study was conducted at the Poultry Unit of Federal University, Kashere to investigate the effects of incorporating differently processed mango seed kernel meal i.e. toasted mango seed kernel meal (TMSKM) and fermented mango seed kernel meal (FMSKM) as partial replacement for maize in the diets of broiler chicken on carcass composition.. A total of 180 broiler chickens with similar weights were randomly allotted to six dietary treatments. The treatment group are toasted 0, 10 and 20% plus fermented at 0, 10 and 20% levels of inclusion coded as diet 1, 2, 3, 4, 5 and 6 respectively, in a completely randomized design (CRD).At the end of the experiment, two birds were randomly selected from each of the 18 replicates of each treatment to determine the carcass characteristics. Carcass quality was determined by measuring the live weight of representative chicken and then slaughtering to drain the blood and Plucked, eviscerated and carcass weights was determined. De-feathering follows by dipping them in hot water at 80^0C for 10-15 minutes. Then cut-up parts and visceral organs were also weighed. Carcass characteristics such as carcass yield, cut-up parts and guts dimension of broiler chickens were measured to determine the effects of incorporating the differently processed mango seed kernel meal on the carcass characteristics of broiler chicken. Furthermore, organs such as the heart, liver, kidney, spleen, and gizzard were found to be significantly ($p<0.05$) affected. These differences did not follow a regular pattern, suggesting that they were unlikely to be influenced solely by the dietary treatments. Based on the findings, it can be concluded that TMSKM and FMSKM be included in broiler chicken diets up to 20% level without adversely affecting carcass and organ weights. The study recommended 20% level of inclusion of processed mango seed kernel in the diets of broiler chicken and also that further study should employ other processing methods

Keywords: Carcass Characteristics, Mango Seed Kernel, Broiler Chicken, Processing

1.0 INTRODUCTION

Broiler chicken are widely reared for meat production, and their nutrition plays a vital role in achieving optimal performance, (FAO, 2020). It had been established that the principal item in raising poultry is the price of the feed, amounting to about 70 – 80% of the total production cost (Bello *et al*., 2007). Broiler chicken production in Nigeria has seen significant growth over the past few years, as the demand for poultry meat continues to rise in the country. According to a report by the Food and Agriculture Organization (FAO), Nigeria's broiler meat production has increased by an average of 5.6% annually from 2015 to 2019 (FAO, 2020). 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 feedstuffs, for food, feed and industrial raw materials. Mango (*Mangifera indica*) is a tree crop well adapted to all ecological zones in Nigeria and the trees are found all over the country (Sahoo *et al.,* 2012). Mango consists of about 33-85% edible pulp, 9-40% inedible kernel, and 7-24% inedible peel (Berardini *et al*., 2015).Mango seed kernel is a good source of carbohydrates (58-80%), with moderate quantities of protein (6-10%), fat (6-16%) and it is a good source of vitamins and minerals (Ogunsipe *et al.,* 2020).Additionally, the major problem affecting the nutritional value of mango seed kernel is that it contains various anti-nutritional factors. (Dakare *et al., 2012a)* Amongst these factors, tannins are largely responsible for the poor nutritional value of MSK (Dakare *et al., 2012b)*. Using suitable processing methods such as Drying, fermenting, toasting, soaking, and boiling have been reported to be

simple means of detoxifying these feed sources to reduce the presence of anti-nutrients and toxic components (Diarra *et al.,* 2011). If this waste is processed and used in a commercial way, it will produce a very important feedstuff as a source of energy in poultry diets without competition with humans. Interestingly, there is lack of information about usefulness of mango seed kernel as alternative energy source in poultry diet mainly in Nigeria (Sogi and Sadik, 2017). In addition to feed cost, it has been reported that the level of performance of livestock in the livestock production industry have gone down remarkably below expectation due to the high cost of production, mainly arising from the costs of the conventional feed ingredients of protein and energy sources (Dairu and Ogunmodede, 2004). There is therefore the need to explore unconventional/alternative and cheaper energy sources for poultry feeding, these alternative feed resources must be cheap, readily available and less competed for by man and industries (Akinmutimi, 2006).The current study therefore evaluate the carcass characteristics such as carcass yield, cut-up parts and guts dimension of broiler chickens fed graded levels of processed mango seed kernel meal.

2.0 MATERIALS AND METHODS

2.1 Study Area

The study was conducted at the Poultry Unit of the Teaching and Research Farm, Federal University of Kashere, Gombe State, Nigeria. Kashere town is situated about 70 kilometers from Gombe town. It lies between latitude 9^0 4;′N and longitude $10^0$57;E, and altitude of 349m above sea level. The average rainfall ranges from 800mm to 900mm per annum. The dry season last for seven months, between October to May, and raining season from May to September. The annual temperature ranges from 32-38^{0}C and experiences relative humidity of 17-90%.

2.2 Experimental Birds and Management

A total of one hundred and eighty (180) day-old broiler chicken ZARTECH (Cobb 500) was used for the experiment. All management practices geared towards successful operation were dully carried out. The day old chicks were housed in a brooder pen within brooding guards for a period of one week brooding period after which they were moved into the experimental unit. The chicks were raised in a standard deep litter system. The poultry house and the necessary equipment were cleaned, fumigated and disinfected using 10% formalin, potassium permanganate and Dettol before the arrival of the birds. The birds upon arrival were given vitalyte and glucose to revive them from stress after the long journey. Vaccination against Newcastle and Gumboro was carried out accordingly. The routine operations carried out under the growing phase were the daily cleaning; sweeping and washing of the experimental pen floor with Izal and the daily administration of feeds and daily feed intake measurement, provision of clean water and the weekly weighing.

2.3 Collection and processing of Mango Seed

Mango seeds were collected from various dumping sites of major markets within Kumo Town. It was cut and open manually, mango kernel was removed from each half of the seed. The removed kernels were divided into 2 parts for further processing. The First portion of the mango seed kernel was soaked in water at room temperature and allowed for fermentation for two days (48 hours) after which it was rinsed thoroughly with water and sun dried for 7 days, to form fermented mango seed kernel meal (FMSKM). The second part was toasted for 30 minutes at l00°C, and milled to form toasted mango seed kernel meal (TMSKM).

2.4 Experimental Diets

Six experimental diets were formulated for both starter phase (23%CP) and finisher phase (20%CP) using two processing methods i.e. fermented mango seed kernel meal (FMSM) and toasted mango seed kernel meal at three different levels of inclusion i.e., 0%, 10% and 20% with the following treatment diets combinations (0, FMSKM), (10, FMSKM), (20%, FMSKM), (0, TMSKM), (10, TMSKM) and (20%,

Table 1: Percentage composition of the experimental diets fed to broiler chicken at the starter phase (1- 4 Weeks)

	Diets					
Ingredients	**1**	**2**	**3**	**4**	**5**	**6**
Maize	41.33	37.19	33.06	41.33	37.19	33.06
FMSM	0.00	4.13	8.26	-	-	-
TMSM	-	-	-	0.00	4.13	8.26
Soya bean(FF)	40.97	40.97	40.97	40.97	40.97	40.97
Wheat bran	10.00	10.00	10.00	10.00	10.00	10.00
Fish meal	4.00	4.00	4.00	4.00	4.00	4.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25
+Premix	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00	100.00
Calculated Analysis						
C. P. (%)	23.18	23.35	23.56	23.18	23.35	23.56
C. F. (%)	3.96	3.98	4.00	3.96	3.98	4.00
Calcium (%)	5.60	6.05	6.52	5.60	6.05	6.52
Phosphoru (%)	0.97	1.47	2.12	0.97	1.47	2.12
Methionine(%)	0.39	0.41	0.43	0.39	0.41	0.43
Lysine (%)	1.38	1.47	1.59	1.38	1.47	1.59
M.E (Kcal./kg)	3071.86	3059.98	3048.45	3071.86	3059.98	3048.45

* ME (Kcal./kg) = 37 × %CP + 81.8 × %CF + 35.5 × %NFE, Pauzenga, *et al.*, 1985;
C. P. = Crude Protein, C. F. = Crude Fibre

Table 2: Percentage composition of the experimental diets fed to broiler chicken at the starter phase (5- 8 Weeks)

	Diets					
Ingredients	**1**	**2**	**3**	**4**	**5**	**6**
Maize	46.26	41.63	37.00	46.26	41.63	37.00
FMSM	0.00	4.62	9.25	-	-	-
TMSM	-	-	-	0.00	4.62	9.25
Soya bean (FF)	33.04	33.04	33.04	33.04	33.04	33.04
Wheat bran	15.00	15.00	15.00	15.00	15.00	15.00
Fish meal	2.00	2.00	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25
+Premix	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10	0.10
Total	100.0	100.00	100.00	100.00	100.00	100.00
Calculated Analysis						
C. protein (%)	20.23	20.27	20.31	20.23	20.27	20.31
C. Fibre (%)	4.05	4.04	3.91	4.05	4.04	3.91
Calcium (%)	5.94	5.45	5.04	5.94	5.45	5.04
Phosphor (%)	0.78	1.81	2.26	0.78	1.81	2.26
Methionine(%)	0.33	0.36	0.51	0.33	0.36	0.51
Lysine (%)	1.12	1.25	2.18	1.12	1.25	2.18
ME (Kcal./kg)	3015.66	3002.42	2989.51	3015.66	3002.42	2989.51

*ME (Kcal./kg) = 37 × %CP + 81.8 × %CF + 35.5 × %NFE, Pauzenga, *et al.*, 1985

TMSKM) to be tagged as diets 1, 2, 3, 4, 5 and 6 respectively. The broiler birds were fed experimental diet *ad libitum* and water supplied without restriction. Table 1 and 2 showed the experimental diets fed to broiler birds at starter and finisher phases respectively.

3.5 Experimental Design

One hundred and eighty (180) unsexed broiler chicks were used for the experiment, whereby 30 birds per treatment were randomly allotted to six treatment diets that were replicated 3 times of 10 birds per replicate in a completely randomized design (CRD). The experiment lasted for seven weeks.

3.6 Carcass measurements

At the end of the experiment, two birds were randomly selected from each of the 18 replicates of each treatment for carcass analysis. Carcass quality was determined by measuring the live weight of representative chicken and then slaughtering to drain the blood and Plucked, eviscerated and carcass weights was determined. De-feathering follows by dipping them in hot water at 80^0C for 10-15 minutes. Then cut-up parts and visceral organs were also weighed.

3.6.1Carcass Yield

Carcass quality was determined by measuring the live weight of representative chicken and then slaughtering to drain the blood and reweighed again. De-feathering follows by dipping them in hot water at 80^0C for 10-15 minutes. Carcass weight was also measured.

3.6.2 Cut-up parts

Each carcass was divided into the following anatomical parts: shanks, heads, breasts, necks, drumsticks, thighs, wings, backs and thoraxes. Then the weight of individual cut -up parts from each chicken was taken and weighed using electronic sensitive balance and was expressed as percentage (%) of the carcass weight.

3.6.3 Organs and Guts Dimension

The organs and other visceral components such as liver, gizzard, proventriculus, heart, crop and abdominal fat were removed from individual carcasses in all the treatment groups and weighed using electronic sensitive balance to the nearest whole number and was expressed as percentage (%) of the live weights.

3.7 Data analysis

All data collected were subjected to analysis of variance using Statistical Package for Social Science (SPSS, 2000) and where significance differences among treatment exist, Duncan Multiple Range Test (DMRT) was used to separate them (Duncan, 1955).

3.0 RESULTS AND DISCUSSIONS

3.1 Experimental Diets

Table 3 represent the proximate composition of Toasted and fermented Mango seed kernel. Toasted Mango seed kernel contains 7.2% dry matter (DM) 8.4% of crude protein (CP), 2.62% of Ash, 2.90% of crude fibers (CF), and 64.27% of nitrogen free extract (NFE). While that of Fermented Mango seed kernel also contains 11.03% dry matter (DM) 11.04% of crude protein (CP), 2.10% of Ash, 2.40% of crude fibers (CF), 62.06% of nitrogen free extract (NFE).

Table 3: Proximate Composition of Mango Seed Kernel

Parameters	Toasted	Fermented
Dry matter (%)	7.2	11.03
Crude protein (%)	8.4	11.04
Ash content (%)	2.62	2.1
Ether extract (%)	14.6	11.35
Crude fibre (%)	2.9	2.4
NFE	64.27	62.06

Table 4: Proximate Composition of Experimental Diets (Starter Phase.)

Parameters	T1	T2	T3	T4	T5	T6
Dry matter (%)	92.54	92.6	92.7	92.54	92.94	91.27
Crude Protein (%)	22.98	22.25	22.36	22.98	22.18	21.55
Ash content (%)	7.29	7.46	6.76	7.29	7.56	6.85
Ether Extract (%)	3.14	3.41	3.81	3.14	3.15	3.25
Crude fibre (%)	8.43	8.24	8.43	8.43	8.65	8.33
ME (Kcal/kg)	3076.2	3067.1	3057.2	3076.2	3060.7	3088.01
Ca	1.25	1.2	1.22	1.25	1.27	1.2

T1 (0%TMSKM), T2 (10%TMSKM), T3 (20%TMSKM), T4 (0%FMSKM), T5 (10%TMSKM), T6 (20%TMSKM)

Table 5: Proximate Composition of Experimental Diets Finisher Phase

Parameters	T1	T2	T3	T4	T5	T6
Dry matter (%)	91.92	91.12	91.88	91.92	91.87	92
Crude Protein (%)	20.54	20.29	20.26	20.54	20.23	19.98
Ash content (%)	6.19	6.32	6.65	6.19	6.76	6.81
Ether Extract (%)	3.11	3.28	3.4	3.11	3.22	3.21
Crude fibre (%)	9.27	9.37	9.45	9.27	9.31	9.33
ME (Kcal/kg)	3223	3218.4	3203.4	3223	3213	3223
Ca	1.1	1.06	1.0	1.1	1.03	1.1

T1 (0%TMSKM), T2 (10%TMSKM), T3 (20%TMSKM), T4 (0%FMSKM), T5 (10%TMSKM), T6 (20%TMSKM)

3.2 Main effects of level and processing of methods of mango seed kernel meal on carcass characteristics of broiler chicken

The Carcass yield, internal organs weight, gut characteristics and cut of parts are presented in Table 6.All the parameters measured were expressed as a percentage of live weight in order to remove the effects of difference in body weight of slaughter birds. The result of carcass parameters measured include: live weight(1.78 to 2.02) plucked weight, (1.68 to 1.85)carcass weight 1.52 to 1.67), head(2.57 to 2.90), drum stick (8.01 to 9.39) , thorac (5.52 to 6.22), wing (6.91 to 8.01), back (7..51 to 8.01) and dressing percentage(81.56 to 82.81%)all the parameters measured were not significance (P<0.05). the percent of cut up parts is presented in table. The parameters considered were shank (3.13 to 3.82) breast (19.91 to 21.36), neck (3.2 to 4.35) and thigh (9.95 to 12.12) all the parameters were affected by inclusion level (P<0.05). Similarly the gut characteristics measured include abdominal fat (0.74 to 1.22), gizzard (3.17 to 6.69) heart (0.52 to 0.62), liver (1.55 to 1.75) spleen (4.77 to 5.22) proventriculus (0.67 to 0.75) the difference between the values were not statistically significant (P<0.05).The result revealed that mango seed kernel meal has a good potential of replacing maize in the diets of broiler chicken. While as in processing methods (Toasted and Fermented) neck (3.61 and 3.71) and gizzard (2.86-5.91) were statistically significant (P<0.05). All other parameters measured were not significant (P<0.05).

Table 6: Main effects of level and processing methods of mango seed kernel meal on Carcass yield, internal organs weight, gut characteristics and cut of parts of broiler chicken

	level of inclusion					processing methods			
Parameters	0	10	20	SEM	LOS	1	2	SEM	POS
live weight	1.84	2.02	1.78	0.22	NS	1.95	1.94	0.95	NS
plucked weight	1.68	1.85	1.78	0.27	NS	1.77	1.78	0.95	NS
carcass weight	1.52	1.67	1.62	0.31	NS	1.61	1.60	0.85	NS
dressing %	82.54	82.81	81.56	0.62	NS	81.75	82.85	0.32	NS
Shank	3.82^{a}	3.46^{ab}	3.15^{b}	0.01	*	3.52	3.46	0.75	NS
Head	2.90	2.88	2.57	0.23	NS	2.80	2.77	0.84	NS
breast	21.36^{ab}	23.41^{a}	19.91^{b}	0.03	*	20.41^{b}	22.73^{a}	0.03	*
Neck	3.40	4.35a	3.23b	0.01	**	3.61	3.71	0.67	NS
drum stick	8.96^{ab}	9.39	8.01^{b}	0.11	NS	8.84	8.73	0.84	NS
Thigh	10.34b	12.12^{a}	9.95^{b}	0.01	**	10.34	11.27	0.09	NS
thorac	6.22	6.18	5.52	0.14	NS	5.61^{b}	6.34^{a}	0.02	*
Wing	8.01^{a}	7.88^{ab}	6.91^{b}	0.08	NS	7.42	7.78	7.78	NS
Back	8.05	7.51	7.78	0.60	NS	7.45	8.1	0.14	NS
Gizzard	3.01	3.17	6.96	0.18	NS	2.86^{a}	5.91^{b}	0.12	*
Heart	0.58^{ab}	0.62^{a}	0.51^{b}	0.04	*	0.60	0.54	0.09	NS
ab fat	0.74^{b}	1.22^{a}	0.99^{ab}	0.04	*	0.86	1.10	0.1	NS
Liver	1.67	1.75	1.55	0.15	NS	1.59^{a}	1.73^{b}	0.11	*
provent.	0.75	0.74	0.67	0.51	NS	0.71	0.73	0.69	NS
Spleen	0.9	0.13	0.08	0.6	NS	0.12	0.09	0.46	NS
intestine	5.17	4.77	5.22	0.38	NS	4.87	5.24	0.2	NS

a,b,c = Means on the same row with different superscripts differ significantly (P<0.05).
SEM = Standard error of the Means. LOS = Level of Significance. 1 = Toasted 2 = Fermented.

3.3 main effects of level and processing methods of mango seed kernel meal on carcass characteristics of broiler chicken

The live weight, dressed weight, drum stick, thigh, thorac, breast, and carcass weight were not significant (P<0.05) while dressing percentage is significantly (P<0.05) affected by varied levels and processing of mango seed kernel in interaction effect i.e level by processing Table: 7 below. Internal organs such as heart and gizzard, abdominal fat, spleen and intestine were not significantly (P<0.05). Liver is significance (P<0.05). And proventiculusis significantly (P<0.05)

The dressing percentage obtained in this study ranges from 81.56 to 82.81 %. The values obtained were similar with the findings of Bangar *et al.* (2021) who reported values between 80.49 and 83.07 % who fed broiler chickens with diets containing mango seed kernel meal and also concurred with the findings of Das *et al.* (2019) in their study with broiler chickens fed dietary levels of mango seed kernel meal. The similarities could be attributed to use of similar feed ingredients in the formulation the diets. But in contrast and lower the findings of Babawuro and Muhammad (2018) who reported values between 68.50 and 72.50 % in their study with broiler chickens fed diets containing groundnut cake and full fat soya bean.

Table 7: Interaction effects of level and processing methods of mango seed kernel meal on Carcass yield, internal organs weight, gut characteristics and cut of parts of broiler chicken.

Interaction	level	and	processing methods				
	Toasted			Fermented			
Parameters	0	10	20	0	10	20	SEM	LOS
live weight	1.73	2.1	2.01	1.94	1.93	1.95	0.21	NS
plucked weight	1.57	1.93	1.82	1.8	1.78	1.78	0.11	NS
carcass weight	1.38	1.76	1.65	1.67	1.58	1.58	0.06	NS
dressing %	79.49^{b}	83.74^{a}	82.04a	85.59^{a}	81.89^{a}	81.08^{a}	0.01	*
Shank	3.87^{a}	3.86^{a}	2.82^{a}	3.77^{a}	3.13^{a}	3.48^{a}	0.01	*
Head	2.9	3.06	2.45	2.91	2.71	2.7	0.4	NS
Breast	20.98	21.49	18.76	21.77	25.35	21.06	0.47	NS
Neck	3.85^{a}	4.07^{a}	2.9^{b}	2.96^{b}	4.63^{a}	3.56^{b}	0.02	*
drum stick	9.58	9.64	7.3	8.34	9.15	8.72	0.13	NS
Thigh	10.67	11.39	8.96	10.02	12.86	10.94	0.13	NS
Thorac	6.22	5.5	5.12	6.23	6.86	5.93	0.22	NS
Wing	8.3	7.58	6.39	7.73	8.17	7.45	0.26	NS
Gizzard	3.24	3.08	2.26	2.79	3.26	11.67	0.08	NS
Heart	0.56	0.53	0.53	0.6	0.71	0.49	0.06	NS
ab fat	0.73	0.86	1	0.75	1.59	0.98	0.07	NS
Back	8.1	7.24	7.02	8.00	7.78	8.54	0.32	NS
Spleen	0.11	0.17	0.07	0.09	0.08	0.1	0.44	NS
intestine	5.2	4.79	4.61	5.15	4.74	5.83	0.14	NS
Liver	1.75^{a}	1.57^{a}	1.45^{b}	1.59^{b}	1.94^{a}	1.65^{b}	0.04	*
provent.	0.89^{a}	0.67^{a}	0.57^{b}	0.62^{b}	0.81^{a}	0.77^{a}	0.01	**

a,b = Means on the same row with different superscripts differ significantly (P<0.05).
SEM = Standard error of the Means. LOS = Level of Significance

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusions

Conclusively, the study suggest that broiler chickens can tolerate up to 20 % Toasted and Fermented mango seed kernel meal without compromising performance. Feeding broiler chickens at 20 % Toasted and fermented mango seed kernel meal has no any adverse effect on carcass yield and organ characteristics.

4.2 Recommendations

Based on the result of this experiment the following recommendations were made:

i. Toasted and fermented mango seed kernel meal can be included at 20 % level in broiler diets with concomitant reduction in feed cost.
ii. Further studies should be conducted using other processing methods such as boiling and soaking.

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