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Effects of Toasted Mango Seed Kernel Meal (TMSKM) and Fermented Mango Seed Kernel Meal (FMSKM) As Partial Replacements for Maize in the Diets of Broiler Chicken on the Haematological and Serum Biochemical Parameters

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Abstract:

Objectives: 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 the haematological and serum biochemical parameters.

Methods: A total of 180 broiler chickens with similar weights were randomly allotted to six dietary treatments. The treatment group were 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).

Results: Haematological parameters such as neutrophils and platelets were significantly ($p<0.001$) affected, while all the parameters of serum biochemistry were not significantly ($p<0.05$) different The haematological and serum biochemical paramerters all fell within normal values for broiler chickens Based on the findings, Blood and serum biochemistry parameters were not affected by the dietary levels and processing method of mango seed kernel meal and most of the parameters obtained in this study fell within the normal range for healthy birds.

Conclusion: Toasted mango seed kernel meal and fermented mango seed kernel meal at 20% level of inclusion in broiler diets had no adverse effects on haematoogical and serum biochemical parameters of broiler chickens.

Keywords: *Mango Seed Kernel Meal; Partial Replacement; Maize Broiler Chicken; Haematological Parameters; Serum Biochemical Parameters.*

1 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 (Kehinde *et al.,* 2006; 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. (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. It had 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). 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). 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). So, 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. 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).

The continued search for unconventional feed resources in livestock production has identified the use of mango seed kernel meal for poultry feeding. Therefore, its utilization could probably solve the problem of feed shortages especially in the critical period of the year (dry season).

Mango seed is readily available in the study area and their non-usefulness could pose the danger of environmental pollution, their use as feed material will help to clean up the environment, (Joshi and Patil, (2018). Mango seed kernel meal is a potential feed resources that could replace costly maize but there are paucity of information on the best processing methods and its level of inclusion for optimum broiler production. (Sogi and Sadiq 2017).

This study was designed to investigate the following;

- The haematological parameters and serum biochemical indices of broiler chickens fed graded levels of processed mango seed kernel meal.

2 Materials and Methods

2.1 Experimental site

This 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 Their 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 opened manually, mango kernel was removed from each half of the seed. The removed kernels were divided into 2 parts for further processing.

2.4 Fermentation of mango seed kernel meal

A portion of the mango seed kernel collected was soaked in water at room temperature and allowed for fermentation for two days (48 hours) rinsed thoroughly with water and sun dried for 7 days, to form fermented mango seed kernel meal (FMSKM).

2.5 Toasting of mango seed kernel meal

The second part was toasted for 30 minutes at l00°C, and milled to form toasted mango seed kernel meal (TMSKM).

2.6 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% for each , with the following treatment diets combinations (0,% FMSKM), (10,% FMSKM), (20%, FMSKM), (05, TMSKM), (10%, TMSKM) and (20%, 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.

2.7 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.

2.8 Data collection

2.8.1 Chemical analysis

Proximate composition of processed mango seed kernel meal, starter and finisher diets was determined by The Standard analytical methods (AOAC, 2005) to determine Dry Matter (DM), Crude Protein (CP), Ether Extract (EE), Crude Fibre (CF) and Nitrogen Free Extract (NFE).

2.8.2 Haematological Parameters and serum biochemical indices

Blood samples were collected at the finisher phase of the study. The samples were collected from one bird per replicate, each picked at random. The blood was collected via the wing vein, the area was disinfected with cotton wool dampened with methyl alcohol swab and by vein puncture; 5mls of blood was drawn and emptied into test tubes and EDTA bottles for serum biochemistry and haematogical parameters determination respectively, (Asaniyan, and Akinduro, 2020). All EDTA bottles and samples test tubes was labeled appropriately before collection. The haematological parameters determined include the following: Erythrocyte sedimentation rate (ESR), Packed cell volume (PCV), Red blood cell (RBC), Haemoglobin (Hb), Lymphocytes (LYM), Neutrophils (NEU), Monocytes (MONO), Basophils (BAS) and Eosinophil (EOS); and the serum components determined include Urea, Alkaline phosphate, Glucose (GLU), Total protein (TP), (Albumin and Globulin).

2.9 Data analysis

All data collected were subjected to analysis of variance using Statistical Package for Social Science version, 23 (SPSS, 2015) and where significance differences among treatment exist, Duncan Multiple Range Test (DMRT), was used to separate them, (Duncan, 1955).

Table 1: Percentage composition of the experimental dies 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
M.E (Kcal./kg)	3071.86	3059.98	3048.45	3071.86	3059.98	3048.45
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

* 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 dies 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
ME (Kcal./kg)	3015.66	3002.42	2989.51	3015.66	3002.42	2989.51
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) = 37 × %CP + 81.8 × %CF + 35.5 × %NFE, Pauzenga, *et al.*, 1985.

3 Results and Discussion

3.1 Results

The test ingredients (Toasted and Fermented mango seed kernel meal) and the experimental diets were analyzed for Dry Matter (DM), Crude Protein (CP), Ether Extract (EE), Crude Fiber (CF) and ash using the proximate analysis method of the AOAC (2000). The N content was analyzed in laboratory by Kjeldhal procedure of nitrogen analysis and Crude Protein (CP) was calculated by the formula CP=N x 6.25. Metabolisable Energy (ME) of ingredients and experimental rations was calculated by indirect methods.

Table 3 revealed the results of the proximate analysis of toasted and fermented mango seed. The results demonstrate that all the experimental materials (fermented and toasted mango seed) have appreciable quanttities of protein, fibre and

carbohydrates which is an added advantage when used in broiler production as these nutrients are much required in broiler production at both starter and finisher phases of production. The proximate composition of 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). The proximate composition 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

3.1.1 Proximate composition of Experimental diets (starter phase)

The proximate composition of experimental diet (starter phase) are summarized in Table 4 The crude protein percentage of experimental diet at different inclusion levels range from 22.18 to 22.98 %. While T1 and T4 contain the higher crude protein of 22.98% at zero inclusion levels which is similar to while treatment T6 that contain that contain 22.18 % crude protein at 20% FMSKM inclusion levels. The crude fibre of a diet range from 8.24 to 8.65 % and. Ether extract 3.14to 3.85% across the treatments. All the above value did not follow any definite pattern.

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

Parameters	T1	T2	T3	T4	T5	T6	T6
Dry matter (%)	92.54	92.6	92.7	92.54	92.94	91.27	93
CrudeProtein (%)	22.98	22.25	22.36	22.98	22.18	21.55	21.65
Ash content (%)	7.29	7.46	6.76	7.29	7.56	6.85	7.61
Ether Extract (%)	3.14	3.41	3.81	3.14	3.15	3.25	3.31
Crude fibre (%)	8.43	8.24	8.43	8.43	8.65	8.33	8.23
ME (Kcal/kg)	3076.2	3067.1	3057.2	3076.2	3060.7	3088.01	3074.8
Ca (mg/kg)	1.25	1.2	1.22	1.25	1.27	1.2	1.09

1 (0%TMSKM), T2 (10%TMSKM), T3 (20%TMSKM), T4 (0%FMSKM), T5 (10%TMSKM), T6 (20%TMSKM).

3.1.2 Proximate composition of experimental diets Finisher Phase

The proximate composition of experimental diet (finisher phase) are summarized in Table 5. The crude protein percentage of experimental diet at different inclusion levels range from 19.98% to 20.54 %. While T1 and T4 contain the higher crude protein of 20.54% at zero inclusion levels. While treatment T6 that contain 19.98 % crude protein at 20% FMSKM inclusion levels. The crude fibre ranged from 9.27 to 9.45 % and. Ether extract 3.11to 3.38% across the treatments. All the above value did not follow any definite pattern.

Table: 5 Proximate Composition of Experimental Diets Finisher Phase% DM.

Parameters	T1	T2	T3	T4	T5	T6	T6
Dry matter (%)	91.92	91.12	91.88	91.92	91.87	92	93
CrudeProtein (%)	20.54	20.29	20.26	20.54	20.23	19.98	20.67
Ash content (%)	6.19	6.32	6.65	6.19	6.76	6.81	6.85
Ether Extract (%)	3.11	3.28	3.4	3.11	3.22	3.21	3.45
Crude fibre (%)	9.27	9.37	9.45	9.27	9.31	9.33	7.4
ME (Kcal/kg)	3223	3218.4	3203.4	3223	3213	3223	3311
Ca (mg/kg)	1.1	1.06	1.0	1.1	1.03	1.1	1.08

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

3.1.3 Main effects of level and processing methods on the Haematological Parameters of Broiler Chickens

The Haematological Parameters of Broiler Chickens Fed Dietary Levels of mango seed kernel meal are presented in table: 6 The parameters considered include packed cell volume (33.33-35.67), monocytes (5.83-7.0) Esinophilis (0.50-0.83), Basophils (1.67-2.00), HB (10.92-11.17) and the difference between the values were not significant (P<0.05). The mean recorded for Lymphocytes (86.02-90.33), in this study show significant (P<0.05) different as in level of inclusion. While Neutrolphils and platelels, in this study are highly significantly (P<0.01) different. The values ranged from (1.62-3.81) to (1300.33-2008.33), respectively.

Table 6: Main effects of level and processing methods on the Haematological Parameters of Broiler Chickens (%).

	level of inclusion					processing methods			
Parameters	**0**	**10**	**20**	**SEM**	**LOS**	**1**	**2**	**SEM**	**LOS**
PCV	33.33	35.17	35.67	0.59	NS	34.67	35.44	0.59	NS
NEU	3.81^{a}	1.62^{b}	1.8^{b}	0.01	***	2.16^{a}	2.66^{b}	0.02	*
LYM	86.02^{b}	90.33^{a}	90.00^{a}	0.05	*	89.01	88.56	0.76	NS
MON	7.00	6.17	5.833	0.59	NS	6.56	6.11	0.64	NS
EOS	0.83	0.67	0.50	0.75	NS	0.44	0.89	0.23	NS
BAS	2.00	1.50	2.00	0.4	NS	1.78	1.89	0.76	NS
PLAT	1300.33^{c}	2008.33^{a}	1633.33^{b}	0.01	***	1280.22^{b}	2014.44^{a}	0.0001	***
HB	11.067	10.933	10.92	0.98	NS	11.01	10.93	0.91	NS

^{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. 1 = Toasted 2 = Fermented.

3.1.4 Interaction effects of level and processing methods on the Haematological Parameters of Broiler Chickens

The interaction effect of method and level of processing on Haematological Parameters of Broiler Chickens Fed different Dietary Levels of mango kernel Seed Meal are presented in table: 7 The parameters considered include packed cell volume(PCV), monocytes (MON) Esinophilis (EOS), Basophils (BAS), and HB and the difference between the values were not significant (P<0.05). The mean recorded for While platelets (WP) and Neutrolphils (NEU), in this study is highly significant (P<0.01) difference in the interaction effect (level and processing), and all the value are within normal range for healthy broiler chicken. There was no interaction effect between level of inclusion and processing methods.

Table 7: Interaction effects of level and processing methods on the Haematological Parameters of Broiler Chickens (%).

	Toasted			Fermented				
Parameters	**0**	**10**	**20**	**0**	**10**	**20**	**SEM**	**LOS**
PVC	33.67	35	35.33	35	35.33	36	0.93	NS
NEU	2.69^{b}	1.5^{c}	2.3^{b}	4.93^{a}	1.73^{c}	1.3^{c}	0.001	***
LYM	87.03	90	90	85	90.67	90	0.73	NS
MON	7.67	6.33	5.67	6.33	6.00	6.00	0.77	NS
EOS	0.67	0.33	0.33	1.00	1.00	0.67	0.9	NS
BAS	1.67	1.67	2.00	2.33	1.33	2.00	0.52	NS
PLAT	1140.7^{c}	2106.7^{b}	1593.33^{bc}	2460^{a}	1910^{b}	1673.33^{b}	0.001	***
HB	11.17	10.93	10.93	10.97	10.93	10.93	0.99	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

3.1.5 Main effects of level and processing methods on the serum Biochemical Parameters of Broiler Chickens

The serum Biochemical Parameters of Broiler Chickens Fed Dietary Level of mango Seed kernel Meal obtained in this study are presented in table: 8 below, there were no significant (P<0.05) difference among treatments, with respect to total protein (5.3-5.5.8), albumin (3.7-3.83), globulin (2.17-2.2), Alkaline phosphate (20.17-22), urea (1.1-1.7). While there is significant (P<0.05) difference among treatments, with respect to Alanine transaminase (31.33- 41.7). While in processing

method, (toasted and fermented) there were no significant (P<0.05) difference among treatments, with respect to total protein (5.4-5.), albumin (3.74-3.91), globulin (2.1-2.13), Alkaline phosphate (20.17-22), urea (1.1-1.7). there was significant (P<0.05) difference among treatments, with respect to Alanine transaminase (35.67-41.5), and there is significant (P<0.05) difference among processing methods (Toasted and Fermented), and all the value are within normal range for healthy broiler chicken.

Table 8: Main effects of level and processing methods on the serum Biochemical Parameters of Broiler Chickens.

	level of inclusion					processing methods			
Parameters	**0**	**10**	**20**	**SEM**	**LOC**	**1**	**2**	**SEM**	**LOS**
TP	5.52	5.32	5.51	0.62	NS	5.54	5.4	0.54	NS
ALT	31.33[a]	35.57[b]	41.7[c]	0.02	*	41.5[b]	35.67[a]	0.04	*
ALB	3.88	3.75	3.85	0.72	NS	3.91	3.74	0.25	NS
GLB	2.17	2.13	2.20	0.35	NS	2.10	2.13	0.74	NS
ALP	20.17	22	21.33	0.3	NS	27.81	32.33	0.07	NS
UREA	1.10	1.70	1.42	0.34	NS	1.30	1.51	0.52	NS

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. 1 = Toasted 2 = Fermented.

3.1.6 Interaction effects of level and processing methods on the serum Biochemical Parameters of Broiler Chickens

The serum Biochemical Parameters of Broiler Chickens Fed Dietary Level of mango kernel Seed i.e. Interaction effect (level and processing methods) Meal obtain in this study are presented in table: 9 below, there were no significant (P<0.05) difference among treatments, with respect to all the parameters measured, and all the value are within normal range for healthy broiler chicken. There was no interaction effect.

Table 9: Interaction effects of level and processing methods on the serum Biochemical Parameters of Broiler Chickens (g/l).

	Toasted			Fermented				
Parameters	**0**	**10**	**20**	**0**	**10**	**20**	**SEM**	**LOS**
TP (g/dl)	56.67	53.33	56.33	53.67	53	53	0.88	NS
ALT	94.67	89.67	88.67	106	87.33	99.67	0.13	NS
ALB	38.67	38.67	40	39	36.33	7	0.59	NS
GLB	20.67	22.33	20	19.67	21.67	22.67	0.28	NS
ALP	28.67	25.67	29.1	33.33	29.33	34.33	0.96	NS
Urea	1.27	1.60	1.03	0.93	1.80	1.80	0.39	NS

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

3.2 Discussion

3.2.1 Haematological Parameters of Broiler Chickens fed Mango seed kernel meal based Diets

The Haematological Parameters of Broiler Chickens Fed mango seed kernel meal revealed that the packed cell volume (PCV) recorded in this research ranges from 33.33 to 36.00 % were below the reference value of 35.90 to 41.00 % reported for chickens by (Wikivet, 2013). The result also fell within the range 30.00 to 36.0 % reported by (Alamuoye, 2014). The haemoglobin (Hb) recorded in this study ranges from 10.93 to 11.17 g/dl which fell below the reference value range of 11.60 to 13.68 g/dl reported by (Wikivet, 2013). The Hb values were in conformity with the findings of Jain (1993) who reported values between 7.00 and 13.00 g/dl in his book essentials of veterinary haemotology and similar with the report of Uchegbu *et al.* (2010) who reported values between 9.97 and 10.70 g/dl in their research with broiler chickens fed diets containing yam peels and higher than the values 6.30 to 6.83 g/dl reported by Etuk *et al.* 2014 in their research with broiler chickens fed diets containing bread fruit. (NEU, LYM, MON, EOS, BAS, PLAT) values of broiler chicken fed MSKMC meal were within normal reference values implying that the presence of the test ingredient in the diets did not induce anaemia in the experimental animals. Neutrophils value of 0.00 - 5.20% were within the normal reference range reported by (Abdullahi *et al*., 2017) for

healthy chicken. High neutrophils (neutrophilia) indicate the presence of microbial infection. The normal neutrophils values observed in this study show that the MSKMC did not compromise any immunity of the animals. (Kumar *et al*., 2010; Gbawuan, 2011; Abang*et al*., 2023), and all the value were within normal range for healthy broiler chicken.

3.2.2 Biochemical Parameters of Broiler Chickens Fed Dietary Levels of Full Fat Mango seed kernel meal

The total protein values obtained in this study ranged from 5.3-5.5.8 g/dl and were in contrast with Adeyemo and Sani (2013) and Obikaonu *et al*. (2011) findings who reported values between 2.80 and 3.10 g/dl and 2.70 and 3.20 g/dl. The values were in agreement with Garba *et al* (2024) who reported values ranging from 5.0 to 5.6 g/dl. The albumin values recorded in this study ranged from 3.7-3.83 the values were in agreement with the findings of Garba *et al*. (2024) who reported 3-4 g/dl and were in contrast with the findings of Obikaomu *et al*. (2011) who reported 1.03 to 1.47 g/dl, and Esonu *et al*. (2012) whose values ranges from 2.20 to 2.80 g/dl. The globulin values obtained in this research ranges from 2.17-2.2 g/dl and were within the values reported by Esonu *et al*. (2012) who reported values between 1.60 and 2.20 g/dl, but were in contrast with findings of Anaimashahun and Omoikhoje (2014) who reported values between 2.60 and 3.70 g/dl. The values obtained were higher than those values 1.15 to 1.53 g/dl reported by Wikivet (2013). The Alanine transaminase values obtained in this study ranged from 31.33- 41.7IU/l were in agreements with the report Garba *et al*. (2024) who reported 31.33- 42.7IU/l. however, were in contrast with the result reported by Wikivet (2013) who reported (44.10 to 45.50 IU/l). The urea values obtained in this study ranged from 1.1-1.7 mmol/l and were in agreements with the report of Uchegbu *et al*. (2010) and reported 1.90 to 12.5 mmol/l respectively. However, there were in contrast within result reported by Obikaomu *et al*. (2011) who reported 2.70 to 3.05mmol/l, and all the value are within normal range for healthy broiler chicken.

4 Conclusions and Recommendations

4.1 Conclusion

Blood and serum biochemistry parameters were not affected by the dietary levels and processing method of mango seed kernel meal and most of the parameters obtained in this study fell within the normal range for healthy birds. Toasted mango seed kernel meal and fermented mango seed kernel meal at 20% level of inclusion in broiler diets had no adverse effects on haematological and serum biochemical parameters of broiler chickens and therefore did not affect the health of the birds

4.2 Recommendations

1 Toasted and fermented mango seed kernel meal can be included at 20 % level in broiler diets without adverse effects on haematological and serum biochemical parameters.

11 Further studies should be conducted using other processing methods such as boiling and soaking.

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