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Blood Profiles, Intestinal Morphometric and Ceaca Micro Flora of Broiler Chickens Fed with Urea Molasses Treated Maize Cob

Olayemi W.A.[1*], Alade A. A.[3], Williams G.A.[2] and Obadare O.O.[1]

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[1]Department of Agricultural Technology, Yaba College of Technology, Yaba, Lagos, Nigeria.
[2]School of Agriculture, Lagos State University Epe Campus Lagos, Nigeria.
[3]Africa Centre of Excellence in Agricultural Development and Sustainable Environment, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria.

ABSTRACT

A 56-day study was conducted to evaluate the effects of urea-molasses treated maize cobs (UMTMC) on blood profile, intestinal morphometric and gut microflora status of broiler chickens. Five experimental diets were formulated consisting of UMTMC at 0, 25, 50, 75 and 100% as replacement for wheat offal at starter and finisher phases. 250-day old unsexed broiler (Cobb) chickens were allotted to five dietary treatments of fifty broiler chicks per treatment and replicated five times with ten chicks per replicate in a completely randomized design. The results showed that UMTMC contained 90.17% dry matter (DM), 11.06% crude protein (CP), 2.17% ether extract (EE), 3.44% crude fiber (CF) while ash and carbohydrate are 2.64% and 71.31% respectively. Moreover, the replacement of wheat offal with UMTMC up to 50% significantly (P<0.05) increased the hemoglobin, red blood cells and white blood cells. Broiler birds fed 25% UMTMC based diet significantly (P<0.05) increased total protein, globulin, creatinine, and cholesterol while 100% UMTMC had highest (P<0.05) values of albumin and uric acid. The gut microflora of the broiler chickens fed 50% UMTMC had reduced (P<0.05) values of total bacteria count, lactobacillus, staphylococcus, salmonella and coliform counts. The dietary treatments significantly (P<0.05) increased the villus height, crypt depth and lamina propria of duodenum, ileum and jejunum segments. The study confirmed that 50% UMTMC can replace wheat offal as a fiber source in the diets of broiler chickens without any compromise in blood profiles, caeca micro flora and gut morphology.

Keywords: Broiler, urea-molasses, maize cob, blood profiles, gut morphometric, caeca micro flora
* Corresponding author.Email: w_ olayemi@yahoo.co.uk, +2348023671812

INTRODUCTION

There are efforts to use maize cobs as animal feedstuff because of the high competing demands with humans for the grain. Estimates of 180 to 200 kg of maize cobs produced per ton of grains (Božović *et al*., 2004) translate to significant quantities of maize cobs available as feed resource. Maize is a staple grain in sub-Saharan Africa and South Africa produced approximately 2.4 million tons of maize cobs during the 2009 through 2010 season while the other major maize producers in sub-Saharan Africa; Nigeria, Tanzania and Malawi produced approximately 1.5, 0.9, and 0.7 million tons, respectively (FAO, 2012). The use of crop residues and agro-industrial by-products as feed resources is predominant with ruminant animals due to their fibrous nature. Among crop residues; maize stover is known for its low protein, low digestibility and high fiber or lignin content (Girma and Arthur, 2009). Its crude protein and neutral detergent fiber contents range from 2.5 - 6.3% and 73.8 - 89.1%, respectively (Smith *et al.,* 1989, Lopez *et al.,* 2005) with about 60 g CP per kg dry matter and metabolisable energy value of about 9 ME MJ/kg dry matter (Hirut *et al.,* 2011), as the crude protein content is below the threshold coupled with fiber contents which limits the feed intake thus rendering the feed to be categorized as a low quality. As characterized by a close intertwining of cellulose (45% to 55%), hemicellulose (25% to 35%), and lignin (20% to 30%) (Deutschmann and Dekker, 2012; Menon and Rao, 2012). Increasing maize cobs' incorporation in diets will have a direct bearing on gut fill and overall digestion of diets. Enhancing the nutritive value of poor-quality feed resources is a major part of feeding management practices. Among the technologies available to improve the nutritive value of low quality crop residues; Urea-ammonia treatment of crop residues has been reported to improve digestibility, milk yield, weight gain and feed efficiency (Djibrillou *et al*., 1998) while molasses increases palatability of diet and readily available source of energy (Sheikh *et al*., 2007).

In nutritional studies, examination of blood gives the opportunity to investigate the presence of several metabolites and other constituents and this plays a vital role in the physiological, nutrition and pathological status of an organism (Aderemi, 2004; Doyle, 2006). The gut is responsible for the digestion and absorption of nutrients from the diet. Any changes in its function affect the function of other organs and systems in the organism (Tona *et al.,* 2015). Studies have shown that diets improve intestinal morphophysiology (Eyng *et al.,* 2014; Fazayeli-Rad *et al.,* 2014 and Chegini *et al.,* 2018). Likewise, diets can influence intestinal micro flora and in turn improve the gastrointestinal environment of the host, thus having a positive impacts on colonized beneficial bacterial and growth performance (Jeong and Kim, 2014; Valeriano *et al.,* 2017).The objective of the present study was to evaluate the effect of urea-molasses treated maize cob on blood profile, intestinal morphometric and gut micro flora status of broiler chickens.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at the Teaching and Research Farm of the Agricultural Technology Department, Yaba College of Technology, Epe, Lagos state. The farm is located on 3^0 58^1 E and longitude 6^0 47^1N (Google Earth 2019).

Preparation of Test Material (UMTMC)

Maize cobs were collected from corn starch processing industry, sun dried and milled using 2 mm size sieve and stored in air tight bags. 2kg of urea were dissolved in 100 litres of water and mixed with10kg of molasses. This mixture was sprayed on 100kg of milled maize cob and sun dried according to Reddy (2001).

Experimental Animals and Management

Two hundred and fifty day old unsexed broiler (Cobb) chickens were obtained from a reputable commercial hatchery. The broilers were allotted to five dietary treatments of fifty broiler chicks per treatment and replicated five times with ten chicks per replicate in a completely randomized design (CRD). The brooding was done in a rearing cage system with nipple drinkers and feeding troughs. Feed and water were offered *ad libitum* for 8 weeks of the feeding trial.

Experimental diets

Five experimental diets (Table1 and 2) were formulated consisting of a maize cob free diet (Control) and the other diets with inclusion of the treated maize cob at 25, 50, 75 and 100% as a replacement for wheat offal. Diets were formulated to meet the NRC (1994) requirements for broiler chickens.

Data Collection

Determination of proximate composition of the urea molasses treated maize cob

Dry matter and crude protein (CP) (N × 6.25) of the treated and untreated maize cob samples were analyzed according to the methods of the Association of Official Analytical Chemists International (AOAC, 2000). Crude fat was determined by extraction with petroleum ether following acidification with 4 M hydrochloric acid as described by Wiseman *et al.* (1992).

Hematological Indices

At 56^{th} day 2.5ml blood was collected from 10 birds per treatment into vials containing ethylene diamine tetra-acetic acid (EDTA) as anticoagulant and used to determine the following: packed cell volume (PCV), red blood cell count (RBC), hemoglobin concentration (Hb), total white blood cell count (WBC) and differential counts to determine Neutrophil, Basophil and Eosinophil using standard techniques (Schalms *et al.,* 1975; Coles, 1986).

Serum metabolites

2.5ml blood was collected from 10 birds per treatment into vials without anticoagulants and were allowed to clot. The total serum protein was determined according to the method of Colowick and Kaplan (1955), while serum albumin and globulin was determined using bromocresol purple method of Varley *et al*. (1980).

Table 1: Gross composition of experimental diet (Broiler starter 0-4 weeks)..

Ingredients	**0%**	**25%**	**50%**	**75%**	**100%**
Maize	54.00	54.00	54.00	54.00	54.00
Soy bean meal	30.00	30.00	30.00	30.00	30.00
Vegetable oil	1.00	1.00	1.00	1.00	1.00
Wheat offal	6.00	4.50	3.00	1.50	0.00
Maize cob	0.00	1.50	3.00	4.50	6.00
Fishmeal	3.00	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00	3.00
Limestone	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Determined analysis (%)					
Crude protein	22.43	21.68	21.58	21.50	21.42
Crude fibre	2.05	3.95	3.85	3.76	3.66
Ether extract	3.85	3.68	3.63	3.59	3.54
Ash	3.47	3.78	4.11	4.17	3.25
Calculated analysis (%)					
Calcium	1.78	1.78	1.78	1.78	1.78
Phosphorus	0.46	0.46	0.46	0.46	0.46
Lysine	1.49	1.49	1.49	1.49	1.49
Methionine	0.56	0.56	0.56	0.56	0.56
ME (Kcal/kg)	2838	2838	2838	2838	2838

Starter Premix: Vit. A 10,000,000 (iu), Vit D3, 2,000,000 (iv), Vit. 23,000(mg), Vit.k3 (mg), Vit. B1, 1800 (mg), Vit. B2 5,500 (mg), Niacin 27, 500mg, Pantothenic acid 750mg Vit B6 3,000mg, Vit B12 15mg, folic acid 750mg, biotin H2 60mg, chlorine chloride 300,000 mg, Cobalt 200mg, Copper 300mg, Iodine 1000mg, Iron 20,000mg, Manganese 40,000 (mg), Selenium 200mg, Zinc 30,000mg, Anti-oxidant 1,250mg.

Serum creatinine was determined using the principle of Jaffe reaction as described by Bosnes and Tousslay (1945) while the serum uric acid was determined by the kit (Quinica Clinica Spam) (Wooton, 1964). Serum glucose was determined colorimetrically using the method described by Braham and Trinder (1972). Serum cholesterol was determined by enzymatic end point method as described by Roeschlau *et al*. (1974) while serum enzyme activity (ALT and AST) was determined using the colorimetric method.

Gut Morphometric

About 2 cm of different segments of the intestinal samples (mid-region of the intestinal segments: duodenum from gizzard outlet to the end of the pancreatic loop, jejunum (from the pancreatic loop to Meckel's diverticulum), and ileum from Meckel's diverticulum to the cecal junction) of 2 broilers per replicate were collected and fixed in 10% formalin for one week. The specimens were dehydrated in graded levels of alcohol (70%-100%) in ascending order to remove the water content. After the dehydration, the specimens were cleared in xylene, impregnated with paraffin wax blocked and sectioned at 5 microns thickness using Rotary Microtome (Leica). The sections were floated on a paraffin water bath maintained at a temperature of 2 -3 ^{o}c below melting point of the paraffin wax after which the sections from each segment were dried on a slide dryer to obtain 4μm thick paraffin sections and were stained with hematoxylin and eosin (H&E). The slide was placed on the stage of the microscope, with aid of the eyepieces graticules on the microscope the average measurement of following; villus height, apical width, basal width and lamina propria depth were taken. The villi length was measured from the tip to the villi base, and the crypt depth was measured from the base of the villi to the base of the crypt (Jamroz *et al.,* 2006).

Ceaca microflora

The cecal contents of birds selected were carefully emptied into a sterilized bottle and stored in a refrigerator at –20^{0}C for microbiological analysis. The frozen cecal contents were thawed and removed from storage bottles following standard procedures (Mountzouris *et al*., 2007). Cecal digesta contents were

Table 2: Gross composition of experimental diet (Broiler finisher 5-8 weeks).

Ingredients	0%	25%	50%	75%	100%
Maize	58.00	58.00	58.00	58.00	58.00
Soy bean meal	25.00	25.00	25.00	25.00	25.00
Vegetable oil	2.00	2.00	2.00	2.00	2.00
Wheat offal	7.00	5.25	3.50	1.75	0.00
Maize cob	0.00	1.75	3.50	5.25	7.00
Fishmeal	2.00	2.00	2.00	2.00	2.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	3.00	3.00	3.00	3.00	3.00
Salt	0.30	0.30	0.30	0.30	0.30
Premix	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
Lysine	0.20	0.20	0.20	0.20	0.20
Total	100	100	100	100	100
Determined analysis (%)					
Crude protein	20.33	19.62	19.21	19.11	19.01
Crude fibre	4.08	3.79	3.67	3.56	3.45
Ether extract	3.91	3.62	3.57	3.52	3.68
Ash	3.04	2.97	2.91	2.85	2.75
Calculated analysis (%)					
Calcium	1.77	1.77	1.77	1.77	1.77
Phosphorus	0.44	0.44	0.44	0.44	0.44
Lysine	1.31	1.31	1.31	1.31	1.31
Methionine	0.54	0.54	0.54	0.54	0.54
ME (Kcal/kg)	3100	3100	3100	3100	3100

Finisher premix-vit. a 5,500,000 (iu), vit d3, 1500,000 (iv), vit. 10,000 (mg), vit.k3 1,500 (mg), vit. b1, 1,600 (mg), vit. b2 24,000 (mg), niacin 20,000mg, pantothenic acid 5,000mg vit b6 1,500mg, vit b12 10mg, folic acid 500mg, biotin h2 750mg, chlorine chloride 175,500 mg, cobalt 200mg, copper 300mg, iodine 1,000mg, iron 20,000mg, manganese 40,000 (mg), selenium 200mg, zinc 30,000mg, anti-oxidant 1,250mg.

then aseptically emptied into new sterile bottles and immediately diluted using a tenfold dilution method till 10^{-9} with sterile ice-cold anoxic phosphate-buffered saline (0.1 M, pH 7.0). Dilutions were subsequently plated on selective agar media in triplicate for the enumeration of Total bacteria, Coliforms, Clostridium, Bacillus, Lactobacillus, Salmonella, Staphylococcus counts using nutrient agar; MacConkey agar, Rogosa agar, Beerens agar, and Azide agar following standard procedures (Tuohy *et al.,* 2002). Plates were then incubated at 39^0C for 24 to 72 h aerobically or 48^0C to 120 h anaerobically and colonies were counted. Results were expressed as log10 cfu/g cecal content.

Statistical analysis

Data obtained from the study were subjected to one-way analysis of variance (ANOVA) in a completely randomized design using the GLM procedure of statistical analysis software SAS® version 2000. Significant differences among treatment means were determined using Duncan Multiple Range Test (DMRT) as contained in the SAS® software.

RESULTS

The proximate composition of urea molasses treated and untreated maize cobs is shown in Table 3. The crude protein and ash content of the corn cob are significantly (p<0.05) increased while the carbohydrate was decreased (p<0.05) after urea molasses treatment.
The results of the hematological parameters of broiler chickens fed diets containing urea molasses treated maize cobs is shown in Table 4. It was observed that hematological parameters were significantly (P<0.05) affected by the dietary treatment, while packed cell volume, lymphocytes, eosinophils, and basophil were not affected by the dietary treatment.
The result of serum indices of broiler chickens fed urea molasses treated maize cob is shown in Table 5. It can be seen from the table that the dietary treatments had a significant (P<0.05) effect on serum indices of broiler chickens. Total protein value was the highest at 25% replacement (14.60) while the lowest value (7.20) was recorded at 100%, Globulin, albumin, and creatinine values followed same trend.
Effect of urea molasses treated maize cobs based diets

Table 3: Proximate composition of treated and untreated maize cob.

Parameters (%)	Untreated	Treated	SME	P-value
Dry matter	91.1	90.17	0.37	0.24
Crude protein	7.7^b	11.06^a	0.76	<.0001
Ether extract	2.35	2.17	0.05	0.09
Crude fiber	3.53	3.44	0.07	0.57
Ash	2.07^b	2.64^a	0.13	0.00
CHO	75.36^a	71.31^b	0.04	0.02

Means on the same row with different superscript are significantly different (p<0.05)

Table 4: Hematological parameters of broiler chicken fed urea molasses treated maize cobs.

Parameters	0%	25%	50%	75%	100%	SEM	P value
Packed cell volume (%)	28.00	35.00	34.0	33.00	29.00	1.10	0.16
Hemoglobin (g/dl)	9.40^c	11.83^a	11.50^{ab}	11.10^b	9.70^c	0.27	<.0001
Red blood cell $x10^{12}/l$	2.06^d	2.84^a	2.70^b	2.34^c	2.29^c	0.08	<.0001
Whiteblood cell $Cumm^3$	13.100^d	15.10^a	14.03^b	13.40^c	11.03^e	0.36	<.0001
Heterophils (%)	37.00^b	38.00^b	39.00^b	40.00^{ab}	43.33^a	0.76	0.05
Lymphocytes (%)	60.00	59.00	57.00	56.00	56.00	0.75	0.34
Eosinophils (%)	3.00	2.00	4.00	3.00	3.00	0.37	0.63
Monocytes (%)	0.00^b	1.33^a	0.00^b	1.33^a	1.00^a	0.18	0.0013
Basophils (%)	0	0	0	0	0	0	0

a,b,c,d Mean on the same row having different superscript are significantly (p<0.05) different SEM- Standard error of mean, n = 5

Table 5: Serum indices of broiler chickens fed urea molasses treated maize cob.

Parameters	0%	25%	50%	75%	100%	SEM	P-value
Total Protein (g/l)	11.80^c	14.60^a	13.33^b	9.60^b	7.20^e	0.71	<.0001
Globulin (g/l)	7.40^c	9.60^a	8.30^b	4.70^d	4.03^e	0.57	<.0001
Albumin (g/l)	4.40^b	5.03^b	5.23^a	4.30^b	3.20^a	0.19	<.0001
Uric acid (mg/dl)	1.43^b	1.43^b	0.91^d	1.17^c	1.51^a	0.06	<.0001
Creatinine (mg/dl)	2.03^{bc}	2.70^a	1.70^{cd}	1.50^d	2.30^{ab}	0.13	0.0010
Glucose (mg/dl)	121.90^a	112.23^c	70.40^e	82.80^d	120.33^b	5.61	<.0001
Triglycerol (mg/dl)	61.33^a	58.40^b	43.16^e	50.20^d	57.43^c	1.76	<.0001
Cholesterol (g/l)	153.40^b	161.70^a	123.23^e	150.43^c	143.76^d	3.47	<.0001
Alanine transferase (iu/l)	215.70^a	174.60^c	144.56^e	153.36^d	205.76^b	7.49	<.0001
Aspartate transferase (iu/l)	195.40^b	179.23^c	156.83^d	154.36^e	212.23^a	5.94	<.0001

a, b, c, d: Mean on the same row having different superscripts are significantly (p<0.05) different, SEM- Standard error of mean, n = 5.

on gut micro flora is shown in Table 6. It can be observed that the dietary treatments had significant (P<0.05) effect on the intestinal health of the birds. Total bacteria counts (4.30 $x10^6$cfu/ml) in birds fed control diet was the highest while least value (2.03 $x10^6$cfu/ml) was recorded in birds on 25% replacement level. It was observed that inclusion of urea molasses treated maize cobs in the diets encouraged proliferation of beneficial flora. Staphylococcus, Salmonella and coliform and Clostridium values increased with increase in the level of urea-molasses treated maize cob in the diets.

Effect of dietary inclusion of urea molasses treated maize cobs (UMTMC) on gut morphometric (duodenal, ileum and jejunum) is shown in Table 7. The villus height, crypt depth as well as lamina propria of the different intestinal segments were significantly (P<0.005) affected by the dietary treatments. Villi height and crypt depth values relationship is better at 50% level of urea-molasses treated maize cob inclusion

Table 6: Ceaca micro flora of broiler chickens fed urea molasses treated maize cob.

Parameters ($x10^6$cfu/ml)	**0%**	**25%**	**50%**	**75%**	**100%**	**SEM**	**P-value**
Total bacteria counts	4.30^a	2.03^d	2.70^c	3.50^b	3.30^b	0.21	<.0001
Lactobacillus counts	0.30^b	1.03^a	0.40^b	0.30^b	0.20^b	0.09	0.0002
Staphylococcus counts	1.03^a	0.60^b	0.50^b	1.40^a	1.43^a	0.11	0.0009
Salmonella counts	1.03	0.20	0.40	0.50	0.30	0.08	<.0001
Coliform counts	1.43^a	0.13^c	0.20^c	0.30^{bc}	0.50^b	0.13	0.0010
Bacillus counts	0.30^c	0.50^c	0.70^{bc}	0.80^b	1.22^a	0.09	<.0001
Clostridium counts	0.60^c	0.60^c	0.80^{bc}	1.03^a	1.20^a	0.07	0.0014

a,b,c,d Mean on the same row having different superscript are significantly ($p<0.05$) different, SEM-Standard error of mean,. n = 5.

Table 7: Effect of urea molasses treated maize cob on gut morphometric of broiler chickens.

Parameters(μm)	**0%**	**25%**	**50%**	**75%**	**100%**	**SEM**	**P.value**
Duodenum							
Villus height	700.00^b	750.00^b	1100.67^a	1166.67^a	800.00^b	53.11	<.0001
Crypt depth	63.33^a	50.00^c	56.67^b	38.33^d	40.00^d	0.95	0.0003
Lamina Propria	200.00^b	200.00^b	176.67^b	300.00^a	200.00^b	12.03	<.0001
Ileum							
Villus height	700.00^d	800.00^c	1000.00^b	1250.00^a	1000.00^b	51.46	0.0001
Crypt depth	70.00^b	71.99^b	70.00^b	40.00^c	80.00^a	0.73	0.0009
Lamina Propria	120.00^c	200.00^a	200.00^a	200.00^a	160.00^b	8.91	<.0001
Jejunum							
Villus height	850.00^a	826.67^a	800.00^a	600.00^b	600.00^b	30.69	<.0001
Crypt depth	50.00^c	30.00^d	73.33^b	90.00^a	70.00^b	4.54	0.860
Lamina Propria	120.00^c	220.00^a	100.00^c	200.00^{ab}	180.00^b	12.73	<.0001

a,b,c,d Mean on the same row having different superscript are significantly ($p<0.05$) different, SEM-Standard error of mean, n = 5.

in the diets if compared with other treatments.

DISCUSSION

The nutritional value of the maize cobs increased as a result urea-molasses treatment. This result confirmed the report of (Abera, 2018) that urea-molasses treatment increased the crude protein content of the stover by about 69.5% and also in agreement with previous studies (William *et al.,* 1984; Dias da-Silva *et al*., 1988; Taiwo *et al*., 1992; Amaefule *et al*., 2003) that urea ammunition increases the crude protein content of feed materials. It was observed that the crude protein value obtained with urea –molasses treatment was higher than values reported by (Akinfemi, 2010; Tona *et al.,* 2015) using fungi and rumen fermentation respectively. The fiber value reduced in urea- molasses treatment when compared with results obtained from other studies (Akinfemi, 2010; Tona *et al.,* 2015).The observed differences could be due to the composition of maize cob as it is affected by stage of maturity, cultivar, climate, soils and production method (Szyszkowska *et al.,* 2007) as well as urea dose, moisture content of the cob, temperature and treatment time which are responsible for the effectiveness of urea treatment (Abera *et al.,* 2018).

Haematological values could serve as baseline information for comparison in conditions of nutrient deficiency, physiology and health status of farm animals (Daramola *et al.,* 2005). Obtained results across the dietary treatments fell within values recommended for normal chickens (Mitruka and Rawnsley, 1977), meaning adequate nutrition and absence adverse response from the test ingredient. As hemoglobin physiological function in transporting oxygen to animal tissues for oxidation of ingested feed to release energy for the other body functions as well as transport carbon dioxide out of the body of animals. The present study agreed with the findings of Bamidele and Adejumo (2012) with PCV and hemoglobin ranges of 18-27.50 and 5.98-9.22 g/dl respectively. The ranges in WBC values could be related to increase in immunological and adaptive capacity at mature age compared to juvenile age (Soetan *et al.,* 2013). The white blood cells have the ability to fight against antibodies (diseases) by the process of phagocytosis. The inclusion of urea-molasses treated maize cobs at varying levels in the feed had no significant ($p>0.05$) effect on lymphocyte, eosinphils, basophils values. This was contrary to Akpet and Ibekwe (2018) as they observed a significant ($p<0.05$) reduction of lymphocyte and other haematological parameter in broiler chicks fed diets with graded levels of rice offal**.** However, the values obtained were within the normal range for healthy birds (Mitruka and Rawsley, 1977; Archetti *et al.,* 2008). Thus, indicating that the immune system of the birds were not compromised by the dietary treatments. The low values of monocytes and basophils agreed with the statement that basophils and monocytes are normally present in small to moderate number in the blood system (Olumide *et al.,* 2018). The urea molasses treated maize cob inclusion has no adverse effects on indices recorded as the result of this study fell within the range of hematological parameters for birds (Blood and Studdert, 1999).

Serum proteins are important in osmotic regulation, immunity and transport of several substances in the animal body (Jain, 1986). The values of serum protein and globulin were significantly influenced by the dietary treatments. This could be as a result of iron, copper and zinc in molasses (Ezihe and Dagih, 2019) which could have possibly elevated the serum protein values. Other study Emilola *et al.,* 2013 recorded improvement in serum protein in broilers birds fed heat treated mucuna beans as indicated by a rise in amino acid absorption and utilization. The increase in values of Alanine aminotransferase (ALT) and Aspartate aminotransferase (AST) might be due to dietary treatments. Ekpeyong and Biobaku (1986) reported that serum AST and ALT under normal circumstances are low, but might become high when the plane of nutrition is low or there is hepatocellular damage. However, values ranged within the normal values reported by Mitruka and Rawnsley (1977), which implied no impairment on heart and liver in the broiler chickens. The uric acid values (0.91 – 1.51 mg/dl) were normal as values obtained fell below values (2.22 – 4.31mg/dl) reported by Marcos *et al*. (2012) which guarantee adequate protein intake, good absorption and better liver functioning. Creatinine values showed significance difference between treatments and values recorded (1.5- 2.30mg/dl) for creatinine in this study were within the normal (0.4 – 1.41mg/dl). This suggests that increase in levels of UMTMC did not likely have deleterious effects on the broiler chickens. Cholesterol and glucose values (123.23-153.40mg/dl and 70.40-121.90 mg/dl obtained were within the normal range (100.72-146.30mg/dl and 234.94-309.12 mg/dl) reported by Marcos *et al*. (2012) except for blood glucose which could be attributed to urea treatment as reported by Ayyat *et al*. (2007) that supplementation of readily available carbohydrates with non-protein nitrogen (NPN) increased the level of blood glucose.

The host-micro flora have effect on growth performance, intestinal morphology as well as nutrient absorption. The composition and function of these communities has been shown to vary depending on the age of the birds, location in the GI tract and on the dietary components (Oakley *et al.,* 2014). In the present study, the population of Lactobacillus (0.3-1.03 x10^6cfu/ml) and that of Bacillus (0.3- 1.22 x10^6cfu/ml) were similar to (Cheng-Liang *et al*., 2019). It has been established that Lactobacillus provides nutrients to the host and defends against opportunistic pathogens (Huang *et al.,* 2018). This reflect in the decreased population of Salmonella*,* Coliform and Staphylococcus counts in the present study. Cheng-Liang *et al.* (2019) also illustrated that dietary treatment with probiotic can regulate the intestinal bacterial flora by increasing the quantity of beneficial bacterial such as lactobacilli and decreasing the number of harmful bacterial like coliform, salmonella etc.

Morphometric analysis of the duodenal, ileum and jejunal shown a significant effect of the dietary treatment on villi height, crypt depth and Lamina propria of chicken guts. In the present study the average values of the absorptive surface areas of the duodenal villi (height and crypt depth) were comparable to previous studies (Oso *et al.,* 2019; Lovita *et al.,* 2019). The changes in intestinal morphology as a result of urea-molasses treated maize cob in the diet may provide further information on possible benefits to the digestive tract. It was observed that broiler fed 50% UMTMC had similar duodenal villi height with birds on (0%). Increased villi height/crypt depth ratio can be termed increased digestive capacity. Montagne *et al.* (2003) reported that villus height/crypt depth ratio is a useful criterion in estimating digestive capacity of the small intestine. The ratio of villus height and crypt depth (VH: CD) at the ileum significantly increased as the level of urea-molasses treated maize cob increase in the diet which is an indication that the absorptive function in the ileum was higher compared with control treatments. Ghosh *et al.* (2007) reported that villus height differed significantly in Japanese quail due to prebiotics (MOS) supplementation. As observed, reduced growth of pathogenic bacteria reduced intestinal infections thus giving rise to improved villus height and crypt depth as well as digestion and absorption of nutrients.

The trend noticed in the jejunum is vital since majority of absorption fat, starch, and protein are completed in the jejunum. A decreased in jejuna villi height at 75% and 100% suggests a decreased surface area meaning lower absorption of the available nutrients. Studies (Iji *et al.,* 2001; Maneewan and Yamauchi, 2004; De Los Santos *et al.,* 2007) revealed that intestinal villi conformation has been linked with growth performance as this play a great role in nutrient absorption; the longer villus height and higher crypt depth ratio, the greater the epithelial turnover. This may explain the better performance in broilers fed on urea-molasses treated maize cob ration at 50% inclusion.

CONCLUSION

In conclusion, the present study confirmed the ability of urea-molasses treated maize cob to replace wheat offal as a fiber source in the diet of broiler chickens at 50% inclusion level without any compromise in blood profiles, caeca micro flora and gut morphology. This could be linked with proximate composition of treated maize cob, urea that increase crude protein level couple with iron, zinc and copper in molasses that boost blood profile as well as the carbohydrate and fiber source which improve the gut health and integrity.

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