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Haemato - biochemical indices of broiler chickens fed molasses treated cassava peel meal-based diet

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Abstract

An 8-week study was conducted to evaluate the influence of molasses treated cassava peel meal (MTCPM) based diet as substitute for maize on haemato-biochemical parameters of broiler chickens. Five experimental diets were formulated to meet nutrient requirement standards of broilers. Diet 1 (0 % MTCPM) served as the control while diets 2, 3, 4 and 5 contained 25, 50, 75 and 100 % MTCPM respectively replacing maize in the diets of birds. A total of one hundred and fifty (150) day-old broiler chicks were randomly allotted into five treatment groups with three replicates of ten birds each. Each group was assigned to the five experimental diets in completely randomized design (CRD). Throughout the experimental period, feed and water were provided ad libitum for all treatment groups. There were no significant differences (P>0.05) in all the haematological parameters measured. The values obtained for packed cell volume (36.21-38.19 %), white blood cell (4.18 - 4.20 x 103/ml), red blood cell (4.48 - 4.86 x 106/ml), haemoglobin (11.96-12.68 g/dl) were similar regardless of MTCPM level in the diet. The results of the serum biochemical indices of broiler chickens fed MTCPM based diet revealed that the serum protein (2.01 – 2.43 mg/dl) level increased (P<0.05) among birds fed 50 % MTCPM based diet compared to others. The dietary inclusion of MTCPM did not significantly (P>0.05) influence the cholesterol (0.92-1.19 mmol/l), glucose (6.40-6.91 mmol/l), and urea (0.69-0.80 mg/dl) compositions of the broilers fed the experimental diets. It was concluded that MTCPM has a high potential as feed ingredient in poultry diets and could be included in the diet of broiler birds without any deleterious effect on health status of the birds.

Keywords: Broiler; Haematology; Serum Indices; Molasses; Cassava Peel Meal

1. Introduction

The largest dietary requirements for poultry are energy and protein [1]. These are predominantly supplied by maize grain and soybean meal in poultry diets, respectively. The high cost of these feed ingredients resulting from diverse usage in human diets as well as industrial applications makes it necessary to search for alternative replacements that are cost effective. Cassava is a major source of calories in developing tropical countries. In 1986, FAO estimated that 35% of the 137.4-million ton world production was produced in African countries. The first step in the processing of these tubers is the removal of the peels which are the two coverings of the tubers, these peels usually end up as waste or sometimes as feeds for ruminants.

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Cassava peels like most agricultural wastes are made up of mainly polysaccharides which are widespread in nature, they account for an estimated 66% of all global bound carbon [2]. Cassava peel has crude protein, crude fibre, ether extract and ash ranges of 3.7 to 5.9 g, 10.3 to 31.8 g, 0.0 to 3.3 g and 3.4 to 8.0 g/100 g respectively [3]. However, the utilization of cassava peel is limited by the presence of hydrocyanic acid (HCN) and high fibre, which may cause chronic toxicity in human and livestock particularly when inappropriately processed [4, 5]. Fermentation technique has been reported to be of tremendous importance in enhancing the nutrient potentials of cassava products such as protein [6] and detoxification of anti-nutrients [7]. Increasing demands for energy by productive animals increased the importance of molasses as an energy supplement with a concentrated source of fermentable sugars and low protein content [8].

Molasses is extensively used in livestock feeding to improve palatability and to reduce dustiness [9]. However, there appears to be limited information on fermenting cassava peels with molasses in order to increase the energy content. Also, information on the effect of molasses treated cassava peel as maize replacement on the haemato-biochemical indices of poultry is very scanty in literatures. The blood contains several metabolites which provide useful information on nutritional status and clinical investigation of an individual, hence, WHO recommended the use of blood parameters for medical and nutritional assessments [10, 11].

The objective of this study was therefore to evaluate the effect of different replacement levels of maize with MTCPM on the haematological parameters and serum biochemistry of broiler chickens.

2. Material and methods

The research was carried out at the Poultry unit of the Teaching and Research Farm of the Department of Animal Science, Federal University, Gashua, Yobe State, Nigeria. It has an area of 772km^2 and Coordinates: 12°52′5″N 11°2′47″E. The hottest months are March and April with temperature ranges of 38-40^{o}C. In the rainy season, June-September, temperatures fall to 23-28^{o}C, with rainfall of 500 to 1000 mm [12].

2.1. Preparation of molasses treated cassava peel meal (MTCPM)

The dried cassava peels used for the study were gotten from farmers at cassava market in Minna, Nigeria while the molasses were purchased from the Sugar manufacturing industry in Adamawa, Nigeria. 5 litre of molasses was dissolved in 20 litre of water solution and added to 5 kg of dried cassava peels and mixed thoroughly according to the procedures of [13]. This was done to improve the nutritive value of cassava peels. Samples were then packed in thick jute bags and closed tightly for anaerobic fermentation. Fermentation processes lasted 48 hr. Thereafter, the jute bag was removed and the fermented peels were air dried for three days at 25OC [14]. The peels were later milled using hammer mill with a sieve size of 3mm and samples were taken to the Centre for Biotechnological Research, FUT, Minna laboratory for chemical analysis according to the [15] procedures. Other feed ingredients such as maize, soyabean, wheat offal, maize bran etc were purchased from Gashua market.

2.2. Proximate Analyses and Metabolisable Energy Determination of MTCPM

Samples of the meal were subjected to proximate analysis using the methods described by [15] to determine the following proximate fractions: Moisture content, dry matter (DM), Crude protein (CP), Crude fibre (CF), Ether extract (EE), Ash, Nitrogen free extract (NFE). The metabolisable energy (ME) of the seed meal was calculated, using the methods of [16]. Metabolizable Energy (Kcal/kg) = 37 x % CP + 81.8 x % EE + 35.5 x %NFE.

2.3. Experimental Diets

The experiment was in two phases (starter and finisher), five diets were formulated to meet nutrient requirement standards of broilers [17]. Diet 1 (0 % MTCPM) served as the control while diets 2, 3, 4 and 5 contained 25, 50, 75 and 100 % MTCPM respectively replacing maize in the diets of birds. The gross composition of the experimental diets and their nutrient contents are presented in Table 1.

2.4. Experimental Birds and Design

A total of one hundred and fifty (150) day-old broiler chicks were purchased from a reputable distributor. They were raised on commercial broiler starter diet for one week, after which they were randomly allotted into five treatment groups with three replicates of ten birds each. Each group was assigned to the five experimental diets in completely randomized design (CRD). Throughout the experimental period, feed and water were provided *ad libitum* for all

treatment groups. This was accompanied by necessary prophylactic medication and vaccination. The experiment lasted for a total of eight weeks (56 days).

Table 1 Ingredient Composition of the Experimental Diets

Dietary levels of Molasses treated Cassava peel meal (%)										
	Starter diets					**Finisher diets**				
Ingredients, Kg	**0**	**25**	**50**	**75**	**100**	**0**	**25**	**50**	**75**	**100**
Maize	53.85	40.39	26.92	13.46	0.00	55.85	41.89	27.92	13.96	0.00
*MTCPM	0.00	13.46	26.93	40.39	53.85	0.00	13.96	27.93	41.89	55.85
Soyabean meal	27.15	27.15	27.15	27.15	27.15	24.15	24.15	24.15	24.15	24.15
Maize offal	5.95	5.95	5.95	5.95	5.95	6.80	6.80	6.80	6.80	6.80
Palm kernel cake	6.00	6.00	6.00	6.00	6.00	5.00	5.00	5.00	5.00	5.00
Fish meal (48%)	2.00	2.00	2.00	2.00	2.00	1.50	1.50	1.50	1.50	1.50
Limestone	0.50	0.50	0.50	0.50	0.50	0.65	0.65	0.65	0.65	0.65
Bonemeal	2.50	2.50	2.50	2.50	2.50	3.00	3.00	3.00	3.00	3.00
Palm oil	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00
Common salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
L-Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
**Vit/Min Premix	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Total	100	100	100	100	100	100	100	100	100	100
Calculated analysis (%)										
Crude protein	23.15	23.00	22.83	22.58	22.16	20.94	20.52	20.17	19.84	19.34
Crude fibre	3.22	3.78	4.09	4.51	4.92	3.24	3.56	4.00	4.41	4.95
Energy (Kcal/Kg ME)	2896	2873	2790	2775	2700	3088	3016	2960	2938	2901
Ether extract	5.36	5.33	5.38	5.34	5.37	6.12	6.07	6.11	6.18	6.09
Available P.	0.57	0.58	0.55	0.56	0.54	0.62	0.68	0.64	0.66	0.60

*MTCPM =Molasses treated cassava peel meal **To provide the following per kilogram of feed: Vit. A, 10,000 iu, Vit. D3, 2000 iu, Vit. E, 5iu; Vit.K, 2mg; Riboflavin, 4.20mg; Vit. B12, 0.01mg; Panthotenic acid, 5mg; Nicotnic acid, 20mg; Folic acid, 0.5mg; choline, 3mg; Mg, 56mg; Fe, 20mg; Cu, 10mg; Zn, 50mg; Co.125mg. NFE: Nitrogen Free Extract =100-(%CP+%CF+%EE+%Ash).

2.5. Blood collection

At the end of the study period, 2 ml of blood was collected from two birds per replicate through the wing vein and put into bottles containing Ethylene Diaminetetra- acetic Acid (EDTA) to determine the packed cell volume (PVC), red blood cell (RBC), haemoglobin (Hb), and white blood cell (WBC). Blood sample meant for serum biochemical studies were collected into plane bottles (without Anti-coagulant) to enhance serum separation. The blood serum obtained was used to determine total protein (TP), Albumin, Globulin, Glucose and Urea. All the analysis was done at the General Hospital Laboratory, Gashua according to the methods described by [18]. The blood constants such as mean corpuscular haemoglobin (MCH), mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) were obtained by calculation according to standard formulae as shown below:

$$MCV = \frac{PCV\ (\%)\ x\ 10}{RBC\ count}$$

$$MCH = \frac{Hb\ (g/dl)\ x\ 10}{RBC\ count}$$

$$MCHC = \frac{Hb\ (g/dl)\ x\ 100}{PCV\ (\%)}$$

2.6. Statistical Analysis

Data generated from the study were subjected to one-way analysis of variance (ANOVA) using software [19]. Means were separated with Duncan multiple range test at 5% level of significance.

3. Results and discussion

The proximate/phytochemical composition of MTCPM is shown in Table 2. The percentage composition of proximate fractions on dry matter basis was: crude protein, 5.61; ether extract 1.84 and ash, 5.88. Others were crude fibre, 18.19 and nitrogen free extract, 61.73. The result of the phytochemical analysed was hydrocyanide (2.50 mg/100 g).

Table 2 Chemical Composition of Molasses treated Cassava peel meal (MTCPM)

Nutrients (%)	Concentration
Dry matter	93.27
Crude protein	5.61
Ether extract	1.84
Ash	5.88
Crude fibre	18.19
Nitrogen free extract	61.73
Metabolizable energy (Kcal/kg)	2519.96
Phytochemicals (%)	
*HCN (mg/100g)	2.50

NFE: Nitrogen Free Extract =100-(%CP+%CF+%EE+%Ash). *ME**:** Metabolizable Energy ME (Kcal/kg) = 37 x % CP + 81.8 x % EE + 35.5 x %NFE (Pauzenga, 1985). *HCN= hydrocyanide.

The results of the haematological parameters of broiler chickens fed MTCPM diet is shown in Table 3. There were no significant differences (P>0.05) in all the parameters measured across the treatment groups. Hematological parameters have been associated with health indices and are of diagnostic significance in the routine clinical evaluation of the state of health [20]. Reports also stated that PCV, HB and MCH were major indices for evaluating circulating avian erythrocytes and were very significant in the diagnosis of anemia and also served as useful indices of bone marrow capacity to produce red blood cells as in mammals [21].

Table 3 Effects of Different Dietary Levels of Molasses treated Cassava peel meal (MTCPM) on haematological parameters of Broiler chickens (0-8weeks)

Dietary levels of Molasses treated Cassava peel meal (%)							
Parameters	**0**	**25**	**50**	**75**	**100**	**SEM**	**P-value**
Packed cell volume, %	36.21	38.09	37.97	38.19	37.25	1.69	0.5967
White blood cell, x 103/ml	4.20	4.24	4.30	4.25	4.18	0.12	0.7339
Red blood cell, x 106/ml	4.48	4.86	4.58	4.81	4.80	0.22	0.2256
Haemoglobin, g/dl	12.19	12.11	11.96	12.68	12.07	0.63	0.6697
MCV, fl	81.22	78.39	83.18	79.35	77.68	4.93	0.7862
MCH, pg	27.23	24.93	26.24	26.34	25.15	1.52	0.3860

MCHC, %	33.79	31.84	31.52	33.25	32.43	2.33	0.7383

[ab]means in the same row with different superscripts are significantly different (P<0.05). SEM=Standard error of mean. MCV=Mean cell volume. MCH=Mean cell heamoglobin. MCH=Mean cell heamoglobin concentration.

Nutrition also has a strong influence on the hematological traits and values of these traits are indicators of nutritional status of the animals [22, 23]. [24] also reported that hematological constituents reflect the responsiveness of the animal to its environments which includes feed and feeding. In this study, the value of haematological parameters such as PCV (36.21-38.19 %), WBC (4.18-4.30 x 103/ml), RBC (4.48-4.86 x 106/ml), Hb (11.96-12.68 g/dl) all fall within the normal ranges earlier reported by [25]. Our values also compared favourably with the haematological values reported by [26] for broiler chickens fed Aspergillus niger hydrolyzed cassava peel meal based diet and [27] for broiler chickens fed Doum Palm (Hyphaene thebaica) Seed Meal based diet. [28] however observed significant differences in haematological values of broiler chickens fed African Star Apple (Chrysophyllum albidum) kernel meal based diet.

The results of the serum biochemical indices of broiler chickens fed MTCPM diet is shown in Table 4. There were no significant differences (P>0.05) in the serum indices measured except the serum globulin, albumin and total protein, which were highest among birds fed 50% MTCPM. The dietary inclusion of MTCPM did not exert any adverse effect on the cholesterol (0.92-1.19 mmol/l), glucose (6.40-6.91 mmol/l), and urea (0.69-0.80 mg/dl) compositions of the broilers fed the experimental diets. Cholesterol, a high molecular weight sterol is used in the body as raw material for the therapeutic process [23] useful in the normal role of the brain and it is an essential constituent of the cell membrane including organelles inside the cell.

The present study shows the effect of MTCPM inclusion levels on cholesterol level, fall within the normal range reported for healthy chicken [27]. This implies that the test feedstuff contains adequate oil to meet the requirement of the experimental birds [11]. [28] observed that high blood urea levels in birds are associated with poor utilization of protein in the diets. Significant differences were however observed in serum globulin and albumin, which give important information of blood protein. [29] reported that very low concentration of blood protein could result in high mortality rate.

Also, [30] reported that albumin concentration in serum is predicated on factors that are independent of nutrition such as infections, liver function, kidney disease, trauma and hydration status which the result of this study clearly shows that none of these extra- nutritional factors had considerable effects on the birds.

Table 4 Effects of Different Dietary Levels of Molasses treated Cassava peel meal on serum biochemical indices of Broiler chickens (0-8weeks)

Dietary levels of Molasses treated Cassava peel meal (%)							
Parameters	**0**	**25**	**50**	**75**	**100**	**SEM**	**P-value**
Total protein, mg/dl	2.06^{b}	2.12^{b}	2.43^{a}	2.16^{b}	2.10^{b}	0.09	0.0029
Albumin, mg/dl	1.08^{bc}	0.99^{c}	1.22^{a}	1.06^{bc}	1.13^{ab}	0.06	0.0080
Globulin, mg/dl	0.98^{bc}	1.13^{ab}	1.20^{a}	1.10^{ab}	0.88^{c}	0.09	0.0113
Glucose, mmol/l	6.82	6.95	6.40	6.76	6.91	0.48	0.7906
Cholesterol, mmol/l	1.13	0.98	0.92	1.09	1.19	0.15	0.1152
Urea, mg/dl	0.74	0.69	0.80	0.71	0.74	0.05	0.4523

[ab]means in the same row with different superscripts are significantly different (P<0.05). SEM=Standard error of mean

4. Conclusion

The findings from this study showed that MTCPM has a high potential as feed ingredient in poultry diets and could be included in the diet of broiler birds. Generally, the values obtained for haemato-biochemical parameters were within the normal range. Therefore, inclusion of MTCPM in the diet of broiler chickens did not affect health status of the birds.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors hereby declare that there's no conflict of interest and that the paper should be published.

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