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Serum Biochemistry of Broiler Chickens Fed Varying Levels of Cassava Peel Meal Supplemented with Exogenous Enzyme (Natuzyme) as Replacement for Maize

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Abstract: ***The study was conducted to evaluate the effect of feeding graded levels of cassava peel meal supplemented with enzyme (natuzyme) on serum biochemistry of broiler chickens. One hundred and sixty day old Sayeed chicks were randomly allocated to four dietary treatment (T_1 0%, T_2 25%, T_3 50, T_4 75% respectively) groups so that each treatment has a total of forty (40) birds. This was replicated 4 times with ten (10) birds per replicate in a completely randomized design. The parameters studied were Aspartate transaminase (AST), Alanine transaminase (ALT), Alkaline phosphatase (ALP), Potassium (K^+), Sodium (Na^+), Bicarbonate (HCO_3), Chloride (Cl), Cholesterol, Urea and Creatinine. There was no significant (P>0.05) difference observed in all the parameters between the control and the treated (T_1-T_4) birds. The serum metabolites (electrolytes) studied were similar to values for normal chicken. The study thus showed that sundried cassava peel meal can successfully be included in place of maize with enzyme supplementation for good health status of broiler chicken.***

Keywords: Finisher broiler; cassava peel meal (cpm); enzyme (natuzyme)*;* serum biochemistry

1. Introduction

Maize, which is the predominantly used ingredient for energy in poultry feed in Nigeria, is very costly, because of higher demand for it by humans as food and industrial purposes [10, 13]. Therefore, there is an urgent need for an alternative to maize in livestock feeds, to reduce the current pressure on maize as stable food for man [27, 2].

Non-conventional materials like Cassava Peel Meal thus have been discovered as replacement for corn/maize in poultry ration [23, 4, 5]. This is the residue resulting from the processing of cassava roots for human consumption. It is low in protein but high in fibre and has been investigated in various laboratories as alternative energy for poultry [16].

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 [14]. Monogastrics however do not have the wherewithal to digest cellulose but can be aided with enzymes to hydrolyze the cellulose. Microorganisms have been reported to have abilities to produce enzymes in large quantity (22, 25, 9]. These can be added as feed additives to enhance digestibility of the feed ingredient.

The role of enzymes as additive in poultry diet is well established [1, 17, 6]. They observed that enzyme addition to monogastric feed reduced viscosity of the digester in the intestine as opposed to a situation of association with digestion of cereal grain and (by –products) and showed a marked improvement on the various morphological effect of feeding fibrous materials to non- ruminant. Dietary supplementation with microbial enzyme preparations are capable of hydrolyzing endosperm cell walls and resulted in increased performance of broiler chickens receiving cereal based diets [1, 18]. The effect of carbon source replacement of maize in broiler chicken feed is well documented [1, 18, 20].

However, information on the effect of hydrolyzed cassava peel as maize replacement on the haematological parametres and serum biochemical indices are very scanty in literatures; though some have reported on serum biochemistry of broiler chickens [19, 8, 24, 11], see appendices 1 – 4. The blood contains several metabolites which provides useful information on nutritional status and clinical investigation of an individual hence WHO recommended the use of blood parameters for medical and nutritional assessments [28, 12]. Some researchers observed improved blood parameters with enzyme supplementation on poultry chickens [29, 15]. The report of [3] on serum biochemical indices of broilers fed hydrolyzed cassava peel meal revealed a source of concern that they suggested required further investigation. They found increased serum urea as cassava inclusion level increases and that the ALT: AST ratio was greater than one in all the experimental feed trial groups (Appendix 5)

The current study was intended to add further information on the effect of replacing maize with cassava peel meal supplemented with enzyme on the serum biochemical parameters of broiler chickens.

2. Material and Method

The study was carried out at the Teaching and Research Farm, Poultry Unit of the Department of Animal/Fisheries Science and Management. Faculty of Agriculture and Natural Resource Management. Enugu State University of Science and Technology.

2.1 Experimental Diets and Treatment

Four (4) experimental diets were formulated consisting of Treatment (T_1) with 0% inclusion of cassava peel meal as the control while T_2, T_3 and T_4 had 25%, 50% and 75% inclusion of cassava peel meal supplemented with exogenous enzyme (Natuzyme). Table 1 shows the composition of the experimental diet, while Table 2 shows the proximate composition of the cassava peel meal.

Table 1: Composition of finisher diet (5-8 weeks)

Ingredient	T_1(control)	T_2(25%)	T_3(50%)	T_4(75%)
CPM	0	13	26	39
Maize	52	39	26	13
Soyabean meal	16	16	16	16
Groundnut cake	10	10	10	10
Fish meal	3	3	3	3
Wheat offal	13.49	13.49	13.49	13.49
Bone meal	2	2	2	2
Limestone	2.5	2.5	2.5	2.5
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Lysine	0.15	0.15	0.15	0.15
Methionine	0.25	0.25	0.25	0.25
Enzyme	0.01	0.01	0.01	0.01
Total	100	100	100	100
Calculated Analysis				
ME (Kcal/g)	3023.7	2887	2750.2	2613.5
Crude Protein (%)	23.43	22	20.57	19.13
Crude Fibre (%)	3.2	3.65	4.1	4.55

Table 2: Proximate composition of CPM

Nutrients	% Composition
Dry matter	89.23
Crude protein	5.83
Crude fibre	17.93
Ether extract	1.82
Nitrogen free extract	72.01
Gross energy (kcal/g)	3.2
Ash	5.28

2.2 Experimental birds

One hundred and sixty Sayeed (160) day-old chicks were randomly allocated to four experimental diets in a completely Randomized Designed, with four (4) replicates containing (10), birds. Each treatment contains forty (40) birds. Proper brooding as well as vaccination schedule was adopted during brooding.

2.3 Experimental Material

Fresh cassava peel meal was collected from garri processing plant in Agbani, Nkanu West Local Government Area of Enugu State. The fresh cassava peel meal were chopped, washed, soaked for a day and dried in the sun The peels were turned regularly to prevent uneven drying and possible decay. When the cassava peel becomes grispy by sun drying, it was milled using a hammer mill to produce the cassava peel meal. Enzymes Natuzyme^R was included in the diet at the rate of 0.01 for T_2, T_3 and T_4.

2.4 Chemical Analysis

The proximate analysis of sun dried cassava peel meal was carried out using the procedure described by A.O.A.C (2002).

2.5 Statistical Analysis

The data collected were subjected to analysis of variance and significantly different means were compared using Duncan's Multiple range Test as described by Obi (1990).

3. Result

The nutrient composition of the experimental diet for finisher phases shown in Table 1 and the proximate composition of cassava peel meal shown in Table 2 revealed that the cassava peel meal contained 5.83% crude protein, 17.93% crude fiber, 1.82% ether extract, 5.28% ash and 72.01% NFE. Hence the nutrient (proximate) compositions of the diets are adequate and within the recommended range for broiler finishers as reported by NRC (1994) and Oluyemi and Robert (2000).

The serum biochemistry of broiler birds fed cassava peel meal supplemented with enzyme is shown in Table 3.

Table 3: Serum biochemistry of finisher broiler chickens fed CPM based diets supplemented with exogenous enzyme (Natuzyme)

Parameter	T_1(control)	T_2(25%)	T_3(50%)	T_4(75%)	
Aspartate transaminase (AST)	50	51	52	50	U/I
Alanine transaminase (ALT)	11	11	12	14	U/I
Alkaline phosphatase (ALP)	811	822	829	873	U/I
ALT:AST	0.24	0.25	0.26	0.34	
Potassium (K^+)	3.5	3.7	3.9	4.1	Mmol/l
Sodium (Na^+)	125	125	125	129	Mmol/l
Bicarbonate (HCO_3)	27	26	26	28	Mmol/l
Chloride (Cl)	98	99	98	98	Mmol/l
Cholesterol	4.5	4.1	4.3	4.2	Mmol/l
Urea	3.3	3	3.1	3.1	Mmol/l
Creatinine	35	38	40	44	Mmol/l

Means within the same row with the same superscripts do not differ significantly (P>0.05)

The serum biochemical values in Table 3 for the Sayeed broilers showed no significant (P>0.05) mean differences between the control and the treated broilers in all parameters studied. Further, there were no significant (P>0.05) mean differences among the treated broilers.

4. Discussion

The AST values in the current study were lower than the values reported by [8] but higher than values reported by [3]; whilst they found significant (P<0.05) differences between the control and treated in their studies, there were no significant (P>0.05) differences found between the control and treated in this study. They found higher significant (P<0.05) difference between treated broilers (from 50 -100% of CPM inclusion) over the control which was however not significantly (P<0.05) different from the 25% CPM inclusion level.

Further, the ALP values in this study were higher than the reported values of [8]. Similarly, the ALT value of the control in this study was higher than the value of the control reported by [3]. However, the values of the treated groups analyzed were lower than the treated groups reported by them.

The electrolyte levels in the current study using Potassium, Sodium and Chloride were similar to values for normal broilers as reported [19]. However, the potassium in this study was lower than the values reported by [11, 24]. The sodium in this study was lower than the values reported by [19] but higher than figures reported by [11, 24]. On the other hand, the Chloride values were similar to works of [19] but lower than those of [11, 24].

The cholesterol values in this study were similar to values reported by [8] but higher than the values reported by [11, 24, 6]. On the other hand, the creatinine values were lower than the values reported by [11, 6]. These differences in values may be as a result of differences in age as [26] suggested that older and younger chickens have lower blood creatinine values compared to mid-aged chickens. This may explain the different values observed for cholesterol.

The similar values of the serum electrolytes to normal values reported by [19] indicated that the feeding of cassava peal meal did not affect the metabolism of the broilers at any level. The enzyme inclusion may have enhanced nutrient utilization and metabolism in the body of the chickens. This is in support of the work of [15] who found improvement in the blood parameters of chickens with inclusion of enzymes. [1, 18] suggested that dietary supplementation with microbial enzyme preparations are capable of hydrolyzing endosperm cell walls which causes increased performance of broiler chickens receiving cereal based diets.

It is instructive to note that the ALT: AST ratio of less than 1 in this study was suggestive of normal metabolism of the internal organs of the broilers unlike [3] who suggested possible distortion in the internal organs of the broilers studied since the ALT:AST ratio was greater than 1 in the treated feeds using the marker enzymes ; Aspartate aminotransferase (AST) and Alanine aminotransferase.

Furthermore, the serum urea levels in the current study were lower than the values reported by [3] at all levels. This may indicate normal functioning of the urea cycle thus ruling out renal dysfunction which is attributable to impairment in the urea cycle [29]. This was indicative of the beneficial effect of the inclusion of the exogenous enzyme in this study. [15] reported reduction in blood uric acid as a result of enzyme supplementation and suggested that the enzyme preparation may have increased nutrient metabolism, particularly protein anabolism of chickens therefore promoting the growth of chickens.

5. Conclusion

The parameters studied indicated good health status of the broiler chickens. It is indicative of the fact that the supplementation of cassava peel meal diets with enzyme as replacement for maize was not deleterious to the health status of the broiler chickens. It is therefore recommended for use by poultry farmers.

Authors' Contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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Appendix 1: Normal values for some electrolytes

Electrolyte	Normal range
$Calcium^{+}$	8.5 – 10.2 mg/dl
$Sodium^{+}$	135 – 145 mEq/l
$Potassium^{+}$	3.5 – 5.0 mEq/l
$Phosphates^{-}$	2.4 – 4.1 mg/dl
$Chloride^{-}$	96 – 106 mEq/l
$Magnesium^{++}$	1.7 – 2.2 mg/dl

Source: Lalhriatpuii and Sudipto, (2012)

Appendix 2: Some serum biochemical values of indigenous Iran and Ross-308 broilers

Parameters	Indigenous		ROSS-308	
	Cock	Hens	Cock	Hens
ALT (IU/L)	7.80 ± 1.62	7.20 ± 1.47	10.20 ± 2.25	7.90 ± 1.91
AST (IU/L)	191±.89	125.20 ± 11.7	198.40 ± 14.06	119.00 ± 13.32
Cholesterol (mg/dl)(x value/38.7 = mmol/l)	167.60 ± 35.68	152.60 ± 28.11[a]	74.50 ± 18.71	181.50 ± 33.22[b]
Magnesium (mg/dl)(x value/2.4 = mmol/l)	1.99 ± 0.27	1.65 ± 0.10	2.15 ± 0.2	1.64 ± 0.16

Source: Bahman, (2011)

Appendix 3: Some serum electrolyte and biochemical values of indigenous Thailand chickens

Parameter	sex		Total	Range
	Male	Female		
Potassium (mmol/l)	4.8 ± 0.5	5.8 ± 0.7*	5.3 ± 0.8	4 – 6
Sodium (mmol/l)	154.8 ± 1.7	157.4 ± 3.4*	155.9 ± 3.1	153 – 159
Chloride (mmol/l)	115.7 ± 2.0	118.0 ± 2.9	116.9 ± 2.7	114 – 120
ALP (U/l)	228.7 ± 53.1	244.0 ± 86.0	35.9 ± 68.6	167 – 305
Cholesterol (mg/dl)(x value/38.7 = mmol/l)	101.7 ± 19.4	103.1 ± 41.0	102.4 ± 30.8	72 – 133

* Mean ± SD with superscript, within row between sex in each parameter differ significantly (P< 0.05)
Source: Simaraks *et al.*, 2005

Appendix 4: Serum Biochemical Values for Male Broilers (MB), Female Broilers (FB) and Male White Leghorn

	Magnessium	Sodium	Potassium	Chloride	cholesterol	
HM	1.03	150	4.74	112	3.23	Mmol/l
HF	1	151	4.83	112	3.13	Mmol/l
MWL	0.95	148	4.41	109	2.93	Mmol/l

Source: Bowes *et al.*, 1989

Appendix 5: Serum Biochemical Parameters Of Broiler Chickens Fed On Maize Replacement Diets By Hydrolyzed Cassava Peel As Main Carbon Source

Sample	A (0 %) Cpm	B (25%) Cpm	C (50%) Cpm	D (75%) Cpm	E (100%) Cpm	S.E.M
Serum urea(mg/dl)	19.82 [a]	24.65 [b]	35.90 [c]	37.85 [c]	54.8 [d]	8.55
Serum total protein(mg/dl)	2.9[a]	2.8[a]	3.1[a]	3.2[a]	2.9[a]	0.74
ALT (µl)	6[c]	15[b]	25[a]	27[a]	29[abc]	2.34
AST (µl)	10[a]	12[a]	19[ab]	20[ac]	26[cd]	2.65
ALT:AST	0.60	1.25	1.32	1.35	1.11	-

a, b, c, d Means within a row with different superscripts differ significantly (p<0.05); AST- Aspartate aminotransferase, ALT- Alanine aminotransferase, Cpm – cassava peel meal, S.E.M -Standard error mean.
Source: Adeyemo *et al.*, 2013