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Review Article

EFFECT OF REPLACING MAIZE WITH VARYING LEVELS OF CASSAVA GRIT ON THE HAEMATOLOGY AND SERUM BIOCHEMISTRY OF STARTING COCKERELS

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A B S T R A C T

A sixteen week trial was conducted to assess the effect of replacing cassava grit (CG) for maize on the haematology and serum biochemistry of 120 "day old" Harco cockerel chickens. Four experimental cockerel starter and finisher diets were formulated with diet 1 formulated to contain 0% cassava grit while diet 2, 3 and 4 were formulated to contain cassava grit at 33.3, 66.6 and 100% replacement for maize. Chicks were randomly assigned to the four treatment diets in a completely randomized designed (CRD). Haematological indices assayed revealed that Hb, PVC and RBC were significantly ($P<0.05$) influenced with highest value recorded in birds fed the control diet. WBC, Platelet, MPV and PDW were also significantly ($P<0.05$) higher in birds fed 33.3%CG. MCV and MCH were significantly ($P<0.05$) higher among birds fed the control diet. MCHC showed significant ($P<0.05$) variation among birds fed the treatment diet with highest value recorded among birds fed 33.3% CG. Neutrophil was significantly ($P<0.05$) higher in control and Lymphocyte was also significantly ($P<0.05$) higher among birds fed 66.6%CG. Serum biochemical parameters assayed in this study showed no significant ($P>0.05$) variation among birds fed the treatment diets. It is concluded therefore that Cassava grit can replace maize up to 33.3% inclusion level in cockerel starter diet for improved blood quality

INTRODUCTION

The use of maize as the sole energy source in poultry diet formulation is becoming unrealistic on account of the expensive nature, its scarcity and decline in the land cultivated for maize as a result of climatic changes and the use of maize grain as a staple food for humans and other industrial uses Bot *et al.,* (2013); Etuk *et al.,* (2013). This situation has called for investigation into the potentials of other readily available unconventional feed ingredients for poultry feeding. Example of such ingredients is cassava. The world production of cassava was 262.6 million tonnes in 2012, with a steady increase in production over previous years (FAO, 2012). Thailand is the second largest producer of cassava in the world but significantly, most of its production is processed into starch or animal feed, unlike the output from African producers where cassava is an important human food. Cassava chips, grits and pellets are the key cassava products used in animal feeding, which can replace some or all of the cereal grain in diets for poultry (Iji et al., 2011). Several researchers had earlier confirmed the suitability of cassava for animal feeding including poultry and the potential of cassava meal as a feed substitute for maize, for all classes of monogastrics (Aderemi *et.al,* 2006). However, certain precautions need be taken to guarantee satisfactory performance of animals on cassava meal diets. These were reported to include the removal of cyanide through boiling, drying, grating, soaking, fermenting or a combination of these processes to produce final products. Okosun and Eguaoje, (2017) reported that cassava grit at 66.6% with 5% moringa leaf meal supplementation can replace maize for optimum performance without any deleterious effect. Oyewunmi, (2013) also reported that cassava grit can be included in the diet of layers without any detrimental effect on egg quality and blood profile. Ukpanachi *et al.,* (2014) in their report concluded that 30% CBP-mix can be incorporated to the starter and finisher diets of broilers without adverse effect on the carcass characteristics and serum biochemical profile of the birds. Base on this potential of cassava and its by products, this research study was therefore designed to investigate the effect of replacing maize with varying levels of cassava grit on the haematological and serum biochemical responses of Starting cockerels.

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MATERIALS AND METHOD

Location and Duration of the Study

The experiment was carried out at the poultry unit of the livestock section, Teaching and Research Farm, Ambrose Alli University, Ekpoma for a period of sixteen (16) weeks. Cassava for the feeding trial was purchased from a reputable farm in Ekpoma Esan West Local Government Area of Edo State.

Source and Preparation of Basal Diet

The woody part was chopped off, and the cassava was thoroughly washed to reduce the silica level to near zero. It was then grated without peeling screw pressed for about 48 hours to reduce the hydrogen cyanide level to the barest minimum. It was mixed with palm oil to further encapsulate the cyanide in the milled whole cassava. It was thereafter fried, air dried and bagged into product known as the Cassava grit which was used in formulating the experimental diets.

Table 1 Percentage composition of experimental cockerel starter diet

	Inclusion levels of cassava grit (%)			
	0	33.3	66.6	100
	Diets			
Ingredients	1	2	3	4
Maize	40.71	27.15	13.60	0.00
Cassava grit	0.00	13.56	27.11	40.71
Soya bean meal	29.25	29.84	32.84	36.33
Fish meal	0.50	0.50	0.50	0.50
Palm oil	0.00	0.00	0.00	0.00
Wheat offal	25.50	24.35	21.66	18.88
Dicalcium phoshate	2.00	2.00	2.00	20.00
Lime stone	1.20	1.99	1.49	0.96
Premix	0.30	0.30	0.30	0.30
Salt	0.32	0.32	0.32	0.32
Total	100.00	100.00	100.00	100.00
Calculated analysis:				
Crude protein	21.33	21.41	21.74	21.63
ME (Kcal/kg)	2650	2658	2657	2652

Design and Management of Experimental Birds

In a complete randomized design, one hundred and twenty day old harco cockerels were divided into four groups of thirty chicks containing three replicates of ten chicks each. The replicates were housed in floor pens measured 2.4m^2 with the floor covered with wood shavings as liter material. A plastic trough and drinker were provided in each pen. The birds were vaccinated against Gumboro at 2 and 4 weeks, Newcastle at 3 and 5 weeks, fowl cholera at 6 weeks and fowl pox disease at 9 weeks of age. Four isonitrogenous and isocaloric diets (1, 2, 3 and 4) were formulated to contain 21% and 18% crude protein and 2650 and 2250kcal/kg Energy respectively in the starter marsh as reflected in (Table 1). Cassava grit was included in both the chick and grower mashes at 0.00, 33.30, 66.60 and 100% replacement of maize in diets 1 (control), 2, 3 and 4 respectively. Feed and clean drinking water were provided *ad-libitum* throughout the 16 weeks of the experiment. The chick mash was fed for the first 8 weeks of age and the finisher mash for the remaining 8 weeks of the experiment.

Proximate Composition of Basal Diet

The proximate composition of Cassava grit was analyzed based on the procedures described by AOAC, (2002).

Table 2 Analyzed nutrient composition of cassava grit

Nutrients (%)	Cassava grit
Dry matter	88.03
Crude protein	2.05
Crude fibre	3.85
Ether extract	2.32
Crude Ash	1.24
NFE	78.50
ME* (Kcal/ Kg)	3050

*Metabolizable energy value was calculated using the method 37x %CP + 81x % EE + 35.5 x % NFE for poultry (Fisher and Boorman, 1986)

Haematology and Serum Biochemical Study

For haematology and serum biochemical indices, blood samples were collected through wing veins from the overnight fasted birds per treatment at the 8th week. A set of samples were collected into sterilized tube containing ethylene diamine tetra-acetic acid (EDTA) labeled bottle for Haematological studies while another set of blood samples were collected from the same birds into heparinised tubes for plasma chemistry determination. Packed cell volume (PCV) red blood cell (RBC), while blood cell (WBC) and haemoglobin (Hb) were determined using improved Neubar's haemaetometer after dilution and cyanomethamoglobin methods respectively as described by Dacie and Lewis (1991). Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH), Mean corpuscular haemoglobin concentration (MCHC) as well as serum metabolites such as total protein, albumin, creatinine, and urea were determined by the method of Hyduke (1975), while globulin was estimated by the subtraction of albumin value from serum total protein value (Dacie and Lewis, 1991).

Statistical Analysis

All the data collected were subjected to analysis of variance (ANOVA) and differences between means treatments were determined using Duncan's multiple range test (DMRT) at 5% level of probability. All statistical procedures were according to (Steel and Torrie, 1990) with the aid of SAS (2004) package.

RESULT AND DISCUSSION

Haematological Indices of Starting Cockerel Fed Varying Levels of Cassava Grit

The result of the haematological indices of starting cockerels as affected by the treatment diets are shown in Table 3. Haemoglobin and Packed cell volume values were statistically ($P<0.05$) influenced by the treatment diets with highest values recorded among birds fed the control diet similar to those on diet 4, followed by those on 33.3%CG. The highest value recorded in diet 1 similar to those on diet 4 shows that the animals fed these treatment diets receives nourishment and had better state of health and the significant difference in the value of the PVC is also a pointer to the good health status of the birds. This agrees with the report of Adeyemo and Sanni, (2013) who observed a significant variation ($P<0.05$) in the Hb and PCV values of broilers fed hydrolyzed cassava peel meal. Red blood cell was significantly ($P<0.05$) influenced by the treatment diets with highest value recorded among birds fed the control diet similar to those fed 33.3%CG. . The higher values recorded among birds fed the treatment diets indicate a greater potential of RBC in the transportation of carbon (IV) oxide and oxygen as well as manufacturing of haemoglobin

indicating a better state of health of the birds. This takes credence from the report of Oladunjoye *et al.,(*2010) who reported a significant (P<0.05) variation in the RBC values of broiler chickens fed varying levels of processed cassava peel meal based diet. Red blood cell distribution width values were also similar (P>0.05) among birds fed the treatment diet. The low Mortality recorded is a pointer to the low RDW recorded because a higher RDW would have led to anemia and death of the birds. The values observed were within the range recommended by (Maxwell *et al.,* 1990).White blood cell values also significantly (P<0.05) varied with highest value recorded in birds fed 33.3% CG, followed by those on 100 and 0%CG. The highest WBC value recorded in this study could be related to the nutritional adequacy and safety of the test diet which agrees with the report of (Olabamiji, *et al.,* 2007). Platelet, Mean Platelet Volume and Platelet Distribution width were significantly (P<0.05) influenced by the treatment diets with highest values recorded in birds fed 33.3% CG, followed by 66.6% CG. The significantly (P<0.05) highest value observed could be related to the nutritional adequacy and safety of the test diet. This agrees with the report of (Olabamiji, *et al.,* 2007). Mean corpuscular volume (MCV) and Mean corpuscular haemoglobin (MCH) values were significantly (P<0.05) influenced by the dietary treatments with highest values recorded among birds fed the control diets compare to birds fed other treatment diets. This implies that these birds fed these diets have the ability to withstand adverse weather condition. This agrees with the findings of Mitruka and Rawnsley, (1977) who reported that MCV is an important trait which determines the cell size of the red blood cell (Erythrocyte) and thus an important factor in determining the ability of the birds to withstand Oxygen starvation for a long time. The values obtained for Mean Corpuscular haemoglobin concentration were significantly (P<0.05) different with highest value recorded among birds fed 33.3%CG similar to those on 66.6%CG. The high level of MCHC recorded among birds fed diet 2 point to the fact that there is an indication of microcytic anaemia this agrees with the report of (Adebiyi, 2007 and Post *et. al*., 2007). Neutrophil value was significantly (P<0.05) higher among birds fed the control diet and lowest in diet 2. The higher neutrophil value recorded in the control could be due to the physiological adjustment against negative antigenic effects associated with the diets. Lymphocyte value was significantly (P<0.05) influenced by the treatment diets with increase in the value of neutrophil as the inclusion level of cassava grit increases. The elevated neutrophil values as cassava inclusion level increases could be a physiological adjustment against negative antigenic effects associated with the diets. This lend support from the findings of Adeyemo and Sanni, (2013) who reported a significant variation in the lymphocyte value of broilers fed varying levels of *aspergillus niger* hydrolyzed cassava peel meal based diet.

Table 4 Haematological indices of cockerel starter finisher fed varying levels of Cassava grit.

	Inclusion levels of CG (%)			
	0	**33.3**	**66.6**	**100**
	Diets			
Parameters	**1**	**2**	**3**	**4**
Hb (g/dl)	8.17^{a}±0.24	6.60^{b}±0.36	5.77^{c}±1.58	7.97^{ab}±0.61
PCV (%)	29.23^{a}±0.63	24.33^{b}±0.02	20.70^{c}±0.13	28.10^{ab}±0.11
RBC ($X10^{6}$/ul)	1.25^{a}±0.53	1.21^{a}±1.40	0.79^{c}±0.34	1.11^{b}±0.07
RDW (%)	9.27±0.33	10.20±0.64	9.97±0.38	10.10±1.45
WBC (10^{3}/mm)	60.43^{b}±2.85	67.00^{a}±0.57	54.20^{c}±3.91	66.53^{a}±4.27
Platelet(10^{6}/mm^{3})	23.67^{c}±3.28	65.67^{a}±5.36	40.33^{b}±7.71	18.33^{c}±2.02
MPV	4.87^{a}±0.63	5.10^{a}±0.38	4.17^{b}±0.52	3.27^{c}±0.88
PDW	0.77^{d}±0.67	4.37^{a}±0.57	3.80^{b}±1.29	1.80^{c}±1.70
MCV (fl)	125.97^{a}±3.59	122.40^{c}±4.81	124.60^{a}±2.80	121.73^{ab}±1.84
MCH (pg)	41.80^{a}±1.45	34.93^{b}±0.84	37.93^{ab}±1.33	32.80^{c}±0.63
MCHC (%)	24.80^{b}±2.11	28.07^{a}±0.86	28.03^{a}±0.58	24.80^{b}±0.89
NEUT (%)	12.77^{a}±2.76	5.20^{c}±0.51	8.50^{b}±5.46	8.37^{b}±3.52
LYMPH (%)	59.73^{c}±3.20	63.73^{b}±1.71	65.33^{a}±8.85	63.57^{b}±5.53

abcd: Means in the same row with varying super scripts differ significantly (P<0.05). CG: Cassava grit.

Serum Biochemistry of Cockerel starter Finisher Fed Varying Levels of Cassava Grit

The result of the serum biochemistry parameters which were similar with the control diet implied that Cassava grit can be used with confidence in cockerel diet to provide adequate nutrition. The similarity in serum total protein, albumin, globulin, urea and creatinine, implied that there was normal protein metabolism. This showed that the diets had better nutritional quality, good amino acid balance, thus there was absence of muscle degeneration of birds Banerjee *et al.,* (2009).

Table 5 Serum Biochemistry of Cockerel Finisher Fed Varying Levels of Cassava Grit

	Inclusion levels of CG (%)			
	0	**33.3**	**66.6**	**100**
	Diet			
	1	**2**	**3**	**4**
Total Protein	3.70±0.20	3.60±0.15	2.87±0.20	3.43±0.88
Albumin	0.83±0.15	0.90±0.17	0.97±0.33	1.50±0.22
Globulin	1.80±0.36	1.43±0.23	1.80±0.32	1.93±0.23
Urea	2.33±0.33	2.67±0.33	1.67±0.33	3.33±0.33
Creatinine	0.30±0.58	0.43±0.33	0.40±0.57	0.47±0.34

CONCLUSION

From the result of the study, it is concluded therefore that Cassava grit at 33.3% replacement level for maize improves the blood quality of cockerel chickens.

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