HAEMATOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF BROILERS FED GRADED LEVELS OF DRY DISTILLED CASSAVA WITH SOLUBLE

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ABSTRACT
The haematological and biochemical characteristics of broilers fed graded levels of Dry Distilled Cassava with Soluble (DDCS) were investigated in a 28 day study. One hundred and forty four (144) 5-week old un-sexed Arbor Acre strain broiler chicks of similar average weight were randomly allocated to four dietary treatments. Each treatment had 2 replicates of 18 birds each. Four experimental diets with 0, 4, 8 and 12% inclusion of DDCS were formulated. Feed and water were supplied *ad libitum*. Four birds from each treatment were randomly selected and blood sample collected for haematological and biochemical evaluation at the termination of experiment. The analysis of blood components, red blood cell (RBC), white blood cell (WBC), packed cell volume (PCV), Mean cell volume (MCV), Mean corpusclar haemoglobin concentration (MCHC) and Mean cell haemoglobin (MCH) showed no significant ($P>0.05$) differences among the broilers fed with experimental diets. There were no significant ($P>0.05$) differences in the biochemical analysis of the broilers fed different levels of DDCS. It was concluded that DDCS can be included in the diets of broilers up to 12% without any deleterious effect on the haematological and serum biochemical characteristics.

Keywords: Haematological, Biochemical, Dry Distilled Cassava with Soluble, Broiler chicks.

INTRODUCTION
In recent times as Nigeria advocates the use of alternative and sustainable fuel source, it is important to proactively research into the potential use of the waste product that will result from this industry. While emphasizing the need to research into alternative and sustainable livestock feed for ultimate performance, improved productivity and general carcass quality; it is essential to also consider the effects these unconventional feeds such as DDCS – a waste product from the fermentation and distillation process of cassava in ethanol production will exert on the blood and serum characteristics of the animals (Mahmud *et al.*, 2016). Dry distilled product with soluble is obtained from the fermentation process of alcohol distillation, from raw materials rich in carbohydrates and sugars such as cassava, molasses or juices of sugarcane, maize, beet, among others, and with the usage of yeasts (Robertiello, 1981 and Trautwein *et al.*, 2008). Adenkola *et al.* (2011) have reported that dietary constituents have measurable effects on blood components and blood constituents are widely used in nutritional evaluation and survey of animals. Hence, this study was designed to evaluate the effect of graded levels of DDCS on the haematology and biochemical profiles of broiler of chickens.

MATERIALS AND METHODS
The experiment was conducted at the poultry section of the Bioresources Development Centre (BIODEC), Ogbomoso and lasted for 4 weeks (28 days). The DDCS used in the study was obtained from Bio-ethanol Production Section of the Centre. The DDCS sample was collected from the storage tank of the production plant using the outlet faucet (hose) of the tank. It was collected in new jute bags and allowed to drain out. It was sun-dried for two days, air dried until dry matter was above 85% and stored in a sack at room temperature prior to incorporation in the experimental diets. Four dietary treatments were formulated with 0, 4, 8 and 12% DDCS inclusion as substitute for wheat offal (Table 1). One hundred and forty four (144) 5 week un-sexed Arbor Acre strain broiler chicks were used. The birds were randomly allotted to four dietary treatments in a completely randomized design. Each treatment had 2 replicates of 18 birds each.

At the end of the feeding trial, the chicks were starved overnight so as to empty the crop and the chicks weighed and sacrificed first by stunning followed by severing the jugular vein of four birds randomly selected from each treatment group to assess blood profile of the birds. The blood was then allowed to flow freely into labelled bijou bottles one of which contained a speck of EDTA while the others were without EDTA. The blood in the EDTA-containing bijou bottles was processed for haematology while those in bottles without EDTA were processed for biochemical analysis.

The blood samples immediately after collection were taken to the laboratory in the Department of Chemical Pathology, Ladoke Akintola University of Technology (LAUTECH) Teaching Hospital Ogbomoso for the determination haematological and biochemical characteristics. Packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC) counts, Mean cell volume (MCV), Mean corpusclar haemoglobin concentration (MCHC) and Mean cell haemoglobin (MCH) were determined (Baker and Silverton, 1976). Blood samples for serum analysis after clotting, was centrifuged at 3,500 rpm in the laboratory using Gallenkamp laboratory centrifuge in order to obtain the serum. The centrifugation was carried out according to Mitruka and Rawnsley (1977) procedure. The serum obtained was used in determining creatinine, total protein, glucose, bilirubin, alkaline phosphatase, cholesterol, albumin and urea according to Randox procedure of chemical analysis (2010). Data obtained were subjected to analysis of variance (ANOVA) using SAS Statistical Package, SAS (2008). The means were separated using Duncan multiple range test.

RESULTS AND DISCUSSION

The composition and chemical composition of experimental diets with different inclusion levels of DDCS are shown in Table 1 and 2, respectively. The crude protein and crude fibre content increased with increase in the inclusion level of DDCS. The crude protein range was 25.81-26.25%. The results of the haematological parameters of broilers fed different levels of DDCS are presented in Table 3. The analysis of haemological parameters showed that there were no significant (P>0.05) differences among the broilers fed experimental diets. In this study, the values obtained for WBC were within range of 9-31 x 10^3/mm^3 for healthy birds (Reltman and Frankel, 1957). The result showed that RBC counts range was 2.11-2.23 (x10^{12}/L). The RBC range was in line with range 1.8-2.4 obtained by Zanu *et al.* (2012). The WBC counts (x10^9/L) range was 101.50 - 109.98 while RBC counts (x 10^{12}/L) range was 2.11- 2.33. RBC values were lower than range of 3.08-3.20 reported by Owosibo *et al.* (2013).

Animals fed 12% DDCS had the highest PCV value. The PCV range (29.75-31.33) was in line with PCV range of 25.67-31.00 reported by Ari and Ayanwale (2014). The MCV (fl) obtained was lower than the range (128-135.3) reported by Adeyemo and Sani (2013) but in line with 92.44-122.09 reported by Akinola and Ethuk (2015). The non significant differences (P>0.05) in the values of the haematological parameters compare to the values observed for the control shows that there is no deleterious effect of the inclusion of DDCS at different levels on the serum parameters. The results of the serum metabolites of broilers fed graded levels of DDCS are shown in Table 4. There were no significant (P>0.05) differences in the serum metabolites of broilers fed different levels of DDCS (P>0.05).

AST values were between 84.33 and 92.75 IU/L. The values of AST were greater than the range of 13.72-15.65 reported by Akinola and Etuk, 2015. The non significant differences (P>0.05) in the values of the serum parameters compare to the values observed for the control shows that there is no deleterious effect of the different inclusion of DDCS at different levels on the serum parameters.

CONCLUSION

From the results it can be concluded that DDCS can be included in the diet of broilers up to 12% without any deleterious effect on the haematological and serum biochemical characteristics.

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Table 1: Composition of experimental diets

Ingredients	0% DDCS	4% DDCS	8% DDCS	12% DDCS
Maize	54.75	54.75	54.75	54.75
Soybean meal	25.00	25.00	25.00	25.00
Wheat offal	12.00	8.00	4.00	-
DDCS	-	4.00	8.00	12.00
Bone Meal	3.00	3.00	3.00	3.00
Oyster shell	1.50	1.50	1.50	1.50
Salt	0.20	0.20	0.20	0.20
Vitamin Premix	0.25	0.25	0.25	0.25
Lysine	0.15	0.15	0.15	0.15
Methionine	0.15	0.15	0.15	0.15
Total	100.00	100.00	100.00	100.00
Calculated % CP	19.65	19.71	19.41	19.10
Metabolizable energy (Kcal/Kg)	2,874.22	2,789.42	2,714.62	2,639.82
Crude fibre (%)	3.73	4.97	6.17	7.38

Table 2: Chemical composition of diets fed to experimental broilers

Parameter	0% DDCS	4% DDCS	8% DDCS	12% DDCS
Dry matter (DM)	93.18	92.94	93.49	93.33
Analysis % of DM				
Organic matter	88.85	92.61	91.04	89.56
Crude protein	25.81	26.25	26.25	26.25
Crude fibre	2.49	3.29	3.93	4.70
Ether extract	3.72	4.29	4.27	3.43
Ash	13.15	7.39	8.96	10.44
Nitrogen free extract	48.01	51.72	50.08	48.51

Table 3: Hematological parameters of broilers fed graded levels of dry distilled cassava with soluble

Parameter	0% DDCS	4% DDCS	8% DDCS	12% DDCS	SEM	PROB
WBC (x 10^9/L)	109.98	106.23	105.98	101.50	2.44	0.74
RBC (x 10^{12}/L)	2.33	2.14	2.11	2.23	0.04	0.14
PCV (%)	30.25	30.33	29.75	31.33	0.71	0.92
MCV (fl)	119.38	121.03	121.93	122.93	0.65	0.26
MCHC (g/dL)	7.28	7.40	7.98	7.03	0.28	0.71
MCH (pg)	8.95	8.00	10.64	8.80	0.43	0.14

[a, b, c, d]: Means within each row with different superscript are significantly different (p□ 0.05)
SEM = Standard error of mean, PROB = Probability

Table 4: Serum metabolites of broilers fed graded levels of dry distilled cassava with soluble

Parameter	0% DDCS	4% DDCS	8% DDCS	12% DDCS	SEM	PROB
Total protein (g/l)	34.50	38.33	33.25	30.00	1.31	0.28
Albumin (g/l)	9.28	10.70	10.93	13.13	0.65	0.24
Globulin (g/l)	25.23	27.63	22.33	16.90	1.43	0.10
Creatinine (umol/l)	46.25	71.33	61.00	51.00	5.39	0.42
AST (IU/L)	87.25	87.00	92.75	84.33	2.25	0.65
ALT (IU/L)	1.83	2.57	1.88	2.73	0.37	0.80
Cholesterol (mmol/L)	2.40	2.63	2.30	2.83	0.09	0.15
Tryglyceride (mmol/L)	0.43	0.27	0.43	0.23	0.04	0.26
HDL (mmol/L)	1.80	1.87	1.75	2.10	0.06	0.23
LDL (mmol/L)	0.41	0.67	0.35	0.63	0.07	0.24
Uric acid (mmol/L)	0.48	0.38	0.46	0.35	0.03	0.47

[a, b, c, d]: Means within each row with different superscript are significantly different (p□ 0.05)
SEM = Standard error of mean, PROB = Probability