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Dietary Effect of Sundried Cassava Starch Extract Pulp on the Haematology and Serum Biochemistry of Weaned Pigs in Oyo State, Nigeria

Ogunbode, A. A.
Akinosun, A. A.
Azeez, J. O.
Dauda, R. A.
Ogunniyi, F. B
John, F.

ABSTRACT

This study investigates Dietary Effect of Sundried Cassava Starch Extract Pulp on the Haematology and Serum Biochemistry of Weaned Pigs in Oyo State, Nigeria. It focuses on the graded levels of sundried cassava starch extract pulp and blood indices (haematology and serum biochemistry) of crossbred (Largewhite x Landrace) weaned pigs. Sixteen (16) eight weeks old weaned pigs were randomly allotted into four dietary treatments containing 0%, 25%, 50% and 75% levels of sundried cassava starch extract pulp inclusion represented as T1, T2, T3 and T4 respectively. Each treatment had four pigs with two replicates each individually penned. The experimental design used was Completely Randomized Design. At the end of the feeding trial, blood sample (3ml) were collected from one pig in each replicate per treatment via the ear vein puncture using sterilized needle and syringe and taken to the laboratory for haematological and serum biochemistry analysis. Data obtained in each measured parameter was subjected to analysis of variance. Equal half of each sample was emptied into two different sets of bottles. One containing Ethylene Diamine Tetraacetic Acid anticoagulant to determine packed cell volume, haemoglobin, white blood cell, red blood cell, platelet and white blood cell differential counts. Pigs fed diet 4 had higher packed cell volume, haemoglobin and red blood cell of 40.67%, 13.40g% and $6.42x10^6$. However, pigs maintained on diet 3 recorded the highest values of $66.00x10^3$u/l and $112.00x10^3$ for white blood cell and platelet respectively. It can be concluded that sundried cassava starch extract pulp can be included in the diet of crossbred weaned pigs at 75% level without any adverse effects on the blood indices of the pigs.

***Keywords**: Cassava starch extract pulp, crossbred, haematology, serum, sundried, weaned pigs.*

Ogunbode, A. A.*; Azeez, J. O. *and* ***John, F.*** *are Lecturers in the Department of Animal Production Technology, while* ***Akinosun, A.A.; Dauda, R. A.*** *and* ***Ogunniyi, F. B.*** *are Lecturers in the Department of Animal Health and Production, Faculty of Animal and Fisheries Technology, Oyo State College of Agriculture and Technology, P.M.B.10, Igboora, Nigeria. *Corresponding Author's E-mail: aaogunbode@gmail.com.*

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INTRODUCTION

The early-life fast growing rate of modern strains of domestic animals comes with a number of problems which may include incidence of metabolic disorders, blood related diseases, skeletal diseases, mortality and morbidity. Blood parameters have been reported to be the major indices of physiological, pathological and nutritional status of an organism and changes in the constituent compounds of blood when compared to normal values, could be used to interprete the metabolic state of an animal as well as quality of feed (Babatunde, Fajimi and Oyejide, 1992). Assessment of haematological parameters can be used to evaluate the extent of deleterious effect of foreign compound on the blood and such laboratory analysis have been found to be accurate, reliable and it remains the bedrock of ethical and rational research, disease diagnosis, prevention and treatment (Okonkwo, Iyadi and Effiong, 2004 and Yakubu, Akanji and Oladeji, 2007). The best indicator of animal's wellbeing and its potential for production is its health status.

The intensification of animal agriculture however has created complex animal health and production problem for which there are no simple and reliable therapeutic and preventive procedures (Radostits, Blood and Gay, 1994). These conditions adversely affect the health or welfare of the animals and impair their homeostatic mechanisms resulting in the body dysfunction which may be fatal (Adenkola, Ayo, Sackey and Adelaiye, 2009). The blood consisting of blood cells and plasma fulfills the transport, regulatory, protective and homeostatic functions (Nasyrova, Sapronova, Nigmatullina and Ugrumov, 2006). Haematological profiles are important indicators of health and disease in animals and have become indispensable in the diagnosis, treatment or prognosis of many diseases (Mbanasor, Anene, Chime, Nnaji, Eze and Ezekwe, 2003). Determination of the haematological profile reflects the physiological responsiveness of the animals to its internal and external environment (Esonu, Enenalom, Udedibie, Herbert, Ekpor, Okoli and Iheukwumere, 2001). Cassava, a root crop was mainly grown in tropical and sub-tropical regions of the world. Cassava yields between 25 to 60 tons/ha and performed very well even in poor soils, tolerate diseases and drought (Chauynarong, Iji and Kanto, 2009). FAO, (2013) reported that Nigeria, Brazil, Thailand, Vietnam, Indonesia and Democratic Republic of Congo are the largest producers of cassava with the world production estimated at more than 230million metric tonnes annually. Therefore, the objective of the study is to assess the blood constituents of crossbred weaned pig fed varying levels of sundried cassava starch extract pulp.

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MATERIALS AND METHODS

The experiment was carried out at the piggery unit of the Teaching and Research Farm of the Oyo State College of Agriculture and Technology Igboora, Nigeria. The experimental areas lie in the savannah forest zone on latitude 7^0.43N and longitude 3^0.28E in an elevation of 140m above sea level. The average minimum temperature is above 21.5^{0}C and maximum average temperature above 32.5^{0}C. The cassava starch extract pulp was collected from Psaltry Farm International along Ado – Awaye Maya road. The fresh cassava starch extract pulp collected was sundried for three weeks based on intensity of the sun and environmental temperature after which it was milled using hammer mill and stored for proximate analysis. Sixteen crossbred Largewhite x Landrace weaned pigs in their 8th week of age were purchased from the piggery unit of the Teaching and Research Farm of Oyo State College of Agriculture and Technology, Igboora. The pigs were dewormed using ivomec and fed 4% of their body weight as feed per day and increased as the animal age increased while water was supplied *ad libitum.* The pigs were allowed three days acclimatization and the animals were fed twice daily morning by 7.30am and evening by 4.00pm. The experiment lasted for eight weeks.

Blood samples collection was done on last day of the feeding trial. It was done in the morning after the pigs were starved overnight in order to attain a stable blood evaluation and also for easy handling. Two pigs were randomly selected from each experimental diet, and blood samples were collected with the aid of 10-guage syringe and needle inserted into vein. Two sets of blood samples were taken from each pig to determine the haematological indices and serum metabolites. Blood samples meant for haematological parameters were emptied into vacutainer tubes containing ethylene diamine tetra-acetic acid (EDTA) as anti-coagulant. The tubes were immediately capped and the contents mixed gently for about 1 minute by repeated inversion. The samples were then taken immediately to the laboratory to determine packed cell volume (PCV), white blood cells (WBC), neutrophil, lymphocyte, monocyte and eosinophil. PCV was determined by the micro-haematocrit method (Dacie and Lewis, 1991). WBC was estimated using the improved Neubaver haemocytometer method as described by (Jain, 1986). Neutrophil, eosinophil, lymphocyte and monocyte were determined (Mitruka and Rawnsley, 1977).

Blood samples meant for serum metabolites were collected in vacutainer tubes without anticoagulants and sent to the laboratory. The tubes were kept in a slanting wooden rack and the blood samples were allowed to clot overnight. The

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serum (supernatant) was separated clearly by decanting after the blood samples were spun in a centrifuge at 3000 rpm for 10 minutes. The serum samples were kept in sterile vacutainer tubes and kept deep frozen at -100^{0}c prior to analysis to determine urea (Kaplan and Szabo, 1983), total cholesterol (Roschlan, Bernet and Guber, 1974), aspartate aminotransferase (Reg and Holder, 1983) and alanine aminotransferase (ALT) (Holder and Reg, 1983) activities using spectrophotometric method. Total protein (TP) was determined (Peters, Biamonte and Doumas, 1982) while albumin was determined using the BCG (bromocresol green) method (Peters, Biamonte and Doumas, 1982).Data obtained in the study were subjected to one way analysis of variance (Nousis, 1999), mean values of variables showing significant (p<0.05) difference were separated using Duncan Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The haematological values of crossbred weaned pigs fed with varying dietary inclusion level of sundried cassava starch extract pulp are presented in Table 2.0. Erythrocyte indices such as PCV, haemoglobin, RBC, WBC, and platelets values obtained increased significantly (p<0.05) among the treatment groups. The PCV ranging from 20.00% in T2 to 40.67% in T4were observed. Haemoglobin ranged from 6.80g/dl in T2 to 13.40g/dl in T4. Pigs fed diet T4 had the highest value 6.42 of RBC while the least value 3.19 was obtained in diet T2. WBC was highest 66.00 in pig fed diet T3 while the lowest value 53.03 was obtained in pig fed diet T1. The higher values of packed cell volume and haemoglobin observed in the study was an indication that the animals did not show any anemic condition and this also tends to indicate a better utilization of sundried cassava starch extract pulp by the pigs. The increase packed cell volume observed is an indication that the oxygen carrying capacity of the pigs is high which suggested absence of nutritional anaemia. PCV and haemoglobin values obtained in the study were within the reference range of 32 -50% and 10 -16g/dL reported by (RAR, 2009). Increased packed cell volume shows a better transportation and thus result in an increased primary and secondary polycythemia (Isaac, Abah, Akpan and Ekaette, 2013). Doyle, (2006) reported that there was a strong influence of diets on packed cell volume and haemoglobin which are strong indicators of the nutritional status of animals. Haemoglobin has the physiological function of transporting oxygen to tissue of the animal for oxidation of ingested feed so as to release energy for the other body functions as well as transport carbon dioxide out of the body of animal (Soetan, Akinrinde and Ajibade, 2013).

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RBC is involve in the transport of oxygen and carbondioxide in the body and a reduced red blood cell count implies a reduction in the level of oxygen that would be carried to the tissues as well as the level of carbon dioxide returned to the lungs. Higher values of red blood cells showed that the animals are free of anemic condition (Muhammed and Oloyede, 2009). The implication is that the test feed ingredient had no deleterious effect on the blood profile of the pigs. Pigs fed 50% inclusion level of sundried cassava starch extract pulp recorded the highest value (66.00) for WBC while the least value (53.03) were obtained in pigs on control diet. The major functions of the white blood cells are to fight infections, defend the body by phagocyte against infection by foreign organism.

Animals with high white blood cell are capable of generating antibodies in the process of phagocytosis and have high degree of resistance to diseases (Soetan, Akinrinde and Ajibade, 2013). Platelets had significant effect ($p<0.05$) on the animals fed the sundried cassava starch extract pulp. The observed differences in the mean values of platelets might have been the cause of the varied degree of blood clotting of the pigs fed the experimental diets. The values obtained for platelet increased as the levels of inclusion of test ingredient increased, this may hinder prolonged and excessive loss of blood in the case of injury of the animals. The result of the serum indices of crossbred weaned pig fed graded level of sundried cassava starch extract pulp are showed in Table 2. Serum total protein and globulin were not significantly ($p>0.05$) difference across the dietary treatment. Total protein is an indirect index for measuring the nutritional protein adequacy (Eggum, 1970).

Similarity between the control and the other diets with sundried cassava starch extract pulp inclusions observed in the experiment suggests that the nutritional quality of sundried cassava starch extract pulp. There were significant difference ($p<0.05$) in the values of albumin contents in the blood samples of pigs on experimental diets. The values of those on diet 4 were significantly higher ($p<0.05$) to other diets at 3.70g/dl. The variation in albumin level observed for all diets in this study contradicted the report when *Telfaira occidentalis* leaf meal was served as protein supplement to broilers (Fasuyi and Nonyerem, 2007). The most sensitive biochemical indices of mild or impending protein deficiency is a drop in serum albumin into the marginal range (Ross, Christie, Halliday and Jones, 1978). Yakubu, Akanji and Oladeji, (2007) reported that a decrease in total albumin value indicates hypo-albuminemia. This may result from deficient intake of proteinous food, deficient biosynthesis of albumin, excessive protein breakdown, chronic liver diseases, starvation and chronic gastro-intestinal disease which may inhibit protein digestion, absorption and metabolism.

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The level of cholesterol in the animals decreased significantly as the inclusion level of sundried cassava starch extract pulp increased. The low level of cholesterol indicates the possibility of pig having anorexia, liver dysfunction and mal-absorption of fats which are some of the symptoms of abnormal cholesterol metabolism in the body as well as their level in the blood (Hanczknowski, Szymozak and Hanezknowski, 2009). Cholesterol is an essential structural component of cell membrane and lipoproteins and serve as the prosecutor for steroid hormones and bile acids biosynthesis. There is an association between blood levels of cholesterol and the risk of coronary heart disease in humans and premature development of atherosclerosis. There were significant differences ($p<0.05$) in the values of aspartate aminotransferase (AST) obtained for all experimental pigs on diets 1, 2, 3 and 4. Alanine aminotransferase (ALT) value obtained was significantly different ($p<0.05$) across the dietary treatments. Pigs on diet 1 had the highest alkaline phosphate (ALP) value of 206.00mmol/L and pigs on diet 4 had the lowest alkaline phosphate value (ALP) of 112.05mmol/L. Ganti, (1979) stated that ALP activity can be utilized to assess the health of the liver as it owes its origin to the osteoblasts and some of it are normally excreted in the bile (Alo, Oyebanji and Abatan, 2009).

The values of glucose and urea were higher on pigs served sundried cassava starch extract pulp compared to the control diets. The value of glucose and urea ranged from 71.00mmol/l to 87.00mmol/l and 10.20mmol/l to 10.80mmol/l respectively. Iyayi and Tewe, (1998) reported that urea depends on both the quality and quantity of the protein supplied in the diet of pigs. Higher levels of urea in blood could be attributed to the presence of some anti-nutritional factors which might have lowered the quality of the protein, indicating imbalance of amino acids in the diet, which caused elevated blood urea concentration.

CONCLUSION

This study investigates Dietary Effect of Sundried Cassava Starch Extract Pulp on the Haematology and Serum Biochemistry of Weaned Pigs in Oyo State, Nigeria. It indicates that for white blood cell differential counts T3 compared favourably with the control for percent lymphocyte, eosinophil and mean cell haemoglobin. Neutrophil, monocyte and mean cell volume were significantly affected. Diets 4, 2 and 3 had a higher than that of the control diets. Serum protein, albumin and cholesterol were significantly affected. Diet 4 had a higher serum protein and albumin than that of the control diet. Serum protein ranged from (6.50g/dl – 7.39g/dl) in diets 1 and 4 and albumin ranged from. For

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cholesterol, the value ranged from (117.33g/dl – 144.00g/dl).Globulin value compared favourably with the control. Sundried cassava starch extract pulp had significant ($p<0.05$) effect on aspartate aminotransferase (AST) and alanine aminotransferase (AST). Based on the aforementioned results, this study revealed that sundried cassava starch extract pulp is a good non-conventional feedstuff to be included in weaned pig diet up to 75% without adverse effect on blood indices.

Table 1: Effect of feeding sundried cassava starch extract pulp on haematology parameters of weaner pigs

Parameters	**T1 (0%)**	**T2 (25%)**	**T3 (50%)**	**T4 (75%)**	**SEM**
PCV (%)	25.50^{c}	20.00^{d}	34.00^{b}	40.67^{a}	2.39
HB (g%)	8.12^{c}	6.80^{d}	11.30^{b}	13.40^{a}	0.79
RBC (10^6)	4.18^{c}	3.19^{d}	5.31^{c}	6.42^{a}	0.36
WBC(10^3u/l)	53.03^{d}	62.00^{b}	66.00^{a}	54.50^{c}	1.62
Platelets x10^3	85.00^{c}	108.00^{b}	112.00^{a}	86.00^{c}	37.64
Lymphocyte (%)	50.00^{a}	48.00^{a}	50.00^{a}	43.00^{b}	1.13
Neutrophil (%)	42.00^{b}	44.00^{ab}	41.00^{b}	46.00^{a}	0.80
Monocytes (%)	3.00^{ab}	4.00^{a}	1.50^{b}	2.00^{ab}	0.41
Eosinophil (%)	6.00	4.00	6.00	6.00	0.42
MCV (μ^3)	61.0	62.69	64.03	63.86	0.45
MCH (µ/µg)	719.52	21.32	21.28	20.87	0.28

$^{a, b, c, d}$ –means on the same row with different superscript on the same row differ ($p<0.05$) significantly.
SEM = standard error of the mean
PCV = Packed cell volume
Hb = Heamoglobin
RBC = Red blood cell
WBC= White blood cell
MCV = Mean cell volume
MCH = Mean cell haemoglobin

Table 2: Effect of feeding sundried cassava starch extract pulp on serum indices of weaned pigs

Parameters	**T1 (0%)**	**T2 (25%)**	**T3 (50%)**	**T4 (75%)**	**SEM**
Total protein (g/dl)	6.50^{bc}	6.10^{bc}	7.00^{ab}	7.30^{a}	0.15
Albumin (g/dl)	2.80^{b}	2.60^{b}	3.50^{a}	3.70^{a}	0.09
Globulin (g/dl)	3.70	3.50	4.00	3.50	0.09
Cholesterol (g/dl)	123.00^{ab}	144.00^{a}	123.00^{ab}	117.33^{b}	4.16
AST	31.00^{b}	30.00^{b}	37.00^{a}	20.00^{c}	2.32
ALT	40.00^{a}	22.00^{bc}	20.00^{c}	25.00^{b}	3.00
Glucose (mg/dl)	77.00^{b}	87.00^{a}	84.00^{a}	71.00^{c}	2.37
Urea (mg/dl)	10.50^{ab}	10.80^{c}	10.70	10.20^{b}	0.10

$^{a, b, c, d}$ = means on the same row with different superscript are significantly difference($p<0.05$)
SEM= Standard Error of the mean AST= Serum aspartate aminotransferase
ALT= Serum alanine aminotransferase ALP= Serum alkaline phosphatase

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Table 3: Gross composition of experimental diet

Ingredients	**T1 (0%)**	**T2 (25%)**	**T3 (50%)**	**T4 (75%)**
Maize	53.00	39.73	26.50	13.25
Groundnut cake	15.00	15.00	15.00	15.00
Palm kernel cake	13.00	13.00	13.00	13.00
BDG	15.00	15.00	15.00	15.00
SCSEP	0.00	13.27	26.50	39.75
Fish meal	1.30	1.30	1.30	1.30
Bone meal	2.00	2.00	2.00	2.00
Salt	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20
Methionine	0.20	0.20	0.20	0.20
Total	100	100	100	100
CalculatedAnalysis				
Crudeprotein (%)	17.41	17.43	17.45	17.47
Crude fibre (%)	6.38	6.41	6.28	6.33
Ash(%)	3.08	3.28	3.23	3.35
EE(%)	4.36	4.32	4.41	4.35
M E(k/cal/kg)	2831.89	2950.79	3069.33	3188.05

M.E = Metabolizable Energy
E.E= Ether Extract
SCSEP=Sundried Cassava Starch Extract Pulp
BDG= Brewers Dried Grain

Table 4: Proximate composition of sundried cassava starch extract pulp

Parameters	**Values**
Crude protein %	1.30
Ash content %	4.40
Crude fibre %	3.15
Ether extract %	0.17
Dry matter %	94.90
Moisture %	5.1
Gross energy (kcal/kg)	4328.72

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