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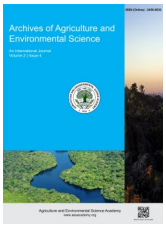

ORIGINAL RESEARCH ARTICLE

Effect of cassava peels and palm kernel cake (PKC) on the heamatological and serum biochemical of grower pigs in Nigeria

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ABSTRACT

The research was carried out for a period of ten weeks at the piggery unit of the teaching and research farm of the Faculty of Agriculture, Ambrose Alli University, Ekpoma, Edo State, Nigeria. The objective of this study was to assess the effect of cassava peels and palm kernel cake (PKC) at 50:50 ratio on the heamatological and serum biochemical of grower pigs. Forty (40) grower pigs of large white were used; pigs were divided into 5 groups based on average initial weights (20-25kg) and each group of grower pigs were respectively allocated to each of the five treatment diets in a completely randomized design (CRD). At the end of the ten (10) weeks feeding trial, the animals were starved of feed for 12 hours before blood samples were collected from two pigs each per treatment from the ear vein using a sterilized disposable syringe and needle. The parameters determine were red blood cells (RBC), hemoglobin (Hb), packed cell volume (PCV), white blood cell (WBC), total protein, albumin, and globulin and serum cholesterol. The result indicated that heamatological and serum biochemical parameters assessed fall within the normal range and is an indication of good nutrition and adequate nutrient intake. Therefore, the animals did not suffered muscular wastage but efficient utilization of cassava peels and palm kernel cake, ultimately resulted in high tissue deposition across treatment groups.

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INTRODUCTION

Cassava (*Manihot esculenta*) is widely grown in the tropical regions. It is estimated that most (60%) of the cassava crop is used for human consumption while the remainder (40%) is used for animal feed, starch and industrial applications (Oboh *et al.*, 2004). Since the early 1930s, cassava has been known and used as a livestock substitute instead of grains for monogastric animals. The popularity of cassava as a substitute resource in livestock feeds became fashionable first because of its relative cheapness compared to grains (especially corn) and later because of the increase demand for corn for human and industrial uses such as in textiles, breweries and bakeries (Moseri, 2010). Cassava roots can be fed to animals in different forms. It is advisable to have them processed before being included in the pigs rations (Igene, 2006). Fresh roots of cassava are high in hydrogen cyanide which has been known to be poisonous to animals. Although the commercial production of dried cassava chip and pellets in most tropical countries (except Nigeria) is still insignificant, there is a considerable potential to expand the use of cassava in local animal feed markets and assessment of the effects on blood parameters of livestock. The blood volume in animals is important in order to understand and interpret packed cell volume, hemoglobin concentration, red blood cell counts, plasma protein concentrations, and other heamatological values. According to Isaac *et al.* (2013), heamatological components are valuable in measuring toxicity, especially with feed constituents that affect the blood as well as the physiological and health status of farm animals. Afolabi *et al.* (2010) posited that changes in heamatological parameters are often used to

determine stresses due to nutrition and other factors. Heamatological parameters are those parameters that are related to the blood and blood forming organs Waugh and Grant (2018); Bamishaiye *et al*. (2009) and are good indicators of the physiological status of animals Khan and Zarfar (2005). Heamatological analysis involves the determination of different blood parameters which can be done using either electronic quantification or the manual quantification Etim *et al*. (2013). Heamatological studies have been found useful for disease prognosis and for therapeutic as well as feed stress monitoring Togun *et al.* (2007) and Unigwe *et al.* (2016). Thus, the objective of this study is to evaluate the effect of cassava peels and palm kernel cake on heamatological and serum biochemical of grower pigs.

MATERIALS AND METHODS

Experimental site

The research was carried out at the piggery unit of the teaching and research farm of the Faculty of Agriculture, Ambrose Alli University, Ekpoma. The farm is located in Esan West Local Government Area Council of Edo State, Nigeria; with an annual rainfall of 1500-2000mm per annual. Relative humidity is 75% and average temperature is 32^0C.

Experimental animal and design

The research was carried out for a period of ten weeks. A total of 40 grower pigs of large white were used for the study. The pigs were divided into 5 groups based on average initial weight (20-25kg) and each group of grower pigs were respectively allocated to each of the five treatment diets in a completely randomized design (CRD). Each treatment group contained 2 replicates of 4 pigs (2male and 2female).

Management of animals

These pigs were fed twice daily and water supplied *adlibitium*. The treatment diets consisted of the following of cassava peels/Pkc at 0, 25, 50, 75 and 100% replacement of maize in the diet. The 50:50 ratio of cassava peels and palm kernel cake was derived by equal weighing (kg) of the two test ingredients percentage in the diet using a manual scale, all diets were formulated to be iso-nitrogenous and iso-caloric.

Heamatological studies

At the end of the ten (10) weeks feeding phase, the animals were starved of feed for 12 hours before blood samples were collected from each pig from the ear vein using a sterilized disposable syringe and needle. Prior to bleeding, a cotton swab soaked in 70% ethanol was used to dilate the ear vein and to prevent infection or contamination of the blood sample. A 5.0ml blood was collected from each pig into labeled sterile universal bottles containing Ethylene-Diamine-Tetra-Acetic acid (EDTA) as anticoagulant. This was used to determine the total red blood cells (RBC), hemoglobin (Hb), and packed cell volume (PCV), white blood cell (WBC). Another 5.0ml of blood was collected into labeled sterile sample bottles without anticoagulant and used to determine the biochemical components *viz*., total protein, albumin, globulin and serum cholesterol according to AOAC (2000).

Statistical analysis

The data collected on various parameters were analyzed using FAO (2002) package. The difference in treatment means were separated using Duncan's New multiple range test as outlined by Obi (2002).

RESULTS AND DISCUSSION

With the exception of the neutrophils and MCHC, significant ($P<0.05$) differences were showed in blood parameters of grower pigs fed levels of cassava peels/Pkc experimental diets as presented in Table 1. Values for packed cell volume (PCV) showed significant ($P<0.05$) difference on the dietary treatments. Numerically, values were 44.50, 48.23, 48.45, 49.08, and 51.95(%) for treatments 0, 100, 50, 25 and 75(%), respectively. It was however indicated that treatment 0% was significantly ($P<0.05$) influenced compare to other treatments. Red blood cell (RBC) and hemoglobin (%) values were significantly ($P<0.05$) higher in treatment 4 (75%), with corresponding values of 8.13×10^{-6}/ml and 12.98g/dl, while the lowest was in control (0%) diet in both RBC and Hb with values of 7.17×10^{-6}/ml and 11.48g/dl, respectively. White blood cell (WBC) was lowest (26.45×10^{-3}/ml) among grower pigs fed 25% treatment diets and highest in treatment 1(39.50×10^{-3}/ml). MCV value ranged from 59.90fl in diet 1 to 64.00 in diet 4. MCH was least in control (0%) with the value 15.55(pg) and higher value was obtained in 75% (17.25pg), respectively. Mean corpuscular hemoglobin concentration (MCHC) recorded values of 25.95, 26.30, 26.50, 26.90 and 26.52% for treatment 1, 2, 3, 4 and 5 respectively. Values recorded for neutrophils were 60.80, 59.73, 57.35, 55.45, and 51.60% for 1, 2, 3, 4 and 5.

Serum biochemical parameters of grower pigs fed experimental diets are shown in Table 2. Serum biochemical parameters for grower pigs fed dietary treatments were significantly ($P<0.05$) affected on the total protein, albumin, creatinine, urea and globumin for all treatment groups. Total protein values recorded ranged from 8.05(g/dl) for treatment 5 to 8.39(g/dl) in treatment 1. Albumin values of 3.50, 3.60, 3.40, 4.10 and 3.75g/dl for treatments 1, 2, 3, 4 and 5 respectively. Globumin recorded values of 4.89, 4.50, 4.80, 4.60 and 4.30g/dl for treatments 1, 2, 3, 4 and 5 respectively. Creatinine values were 1.00, 0.80, 1.10, 0.93 and 0.87g/dl while urea values of 40.50, 39.50, 28.50, 45.50 and 35.50g/dl for treatment 1, 2, 3, 4 and 5. Cholesterol values ranged from 109.00 to 118.25mg/dl from experimental diet 5 to 1, significant ($P<0.05$) differences were recorded for treatment 1, 2 and 3. However, no significant ($P>0.05$) differences observed between 4 and 5 with corresponding values of 118.25, 116.30, 114.00, 110.00 and 109.00mg/dl for treatment 1, 2, 3, 4 and 5, respectively.

The importance of blood cannot be over emphasized as we all know that blood plays a vital role in the life of all living

Table 1. Composition of experimental diet for growers pig.

Ingredients	0	25%	50%	75%	100%
Maize	45.00	33.75	22.50	11.25	---
Cassava peels/PKC	---	11.25	22.50	33.75	45.00
Ground Nut Cake	18.87	20.0	21.13	22.28	23.42
Wheat Offal	30.83	28.70	27.37	26.02	24.68
Bone Meal	1.50	1.50	1.50	1.50	1.50
Limestone	2.00	2.00	2.00	2.00	2.00
Palm Oil	1.00	2.00	2.20	2.40	2.60
Growers Premix*	0.25	0.25	0.25	0.25	0.25
Salt	0.35	0.35	0.35	0.35	0.35
Ronozyme**	0.20	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis:					
Crude Protein (%)	17.00	17.00	17.00	17.00	17.00
ME (Keal/Kg)	2824	2804	2783	2761	2739
Fibre (%)	5.07	6.72	8.37	10.01	11.64
Ash (%)	5.88	9.00	12.16	15.39	18.62
Calcium (%)	0.80	0.80	0.80	0.80	0.80
Starch (%)	40.15	37.04	33.91	30.77	27.62
Fat (%)	6.21	7.47	8.72	9.97	11.23

*Grower Premix supplied the following per kg diet: Vit A 10,000,000 IU; Vit D32,000,000IU; Vit E 8,000 IU; Vit K 2,000mg;Vit B12,000 mg; Vit B25,500mg; Vit B61,200 mg; Vit B12 12 mg; Biotin30mg; Folic Acid 600 mg; Niacin 10,000 mg; Pantothenic Acid 7,000mg; Choline chloride 500,000 mg; Vit C 10,000mg; Iron 60,000 mg; Mn 80,000 mg; Cu 8,00mg; Zn 50,000 mg; Iodine 2,000 mg; Cobal 450 mg; Selenium 100 mg; Mg 100,000 mg; Anti-Oxidant 6,000 mg; PKC – Palm Kernel Cake, GNC = Groundnut cake, C.P. = Crude protein, ME = Metabolizable energy. **Ronozyme Composition of the product, sodium sulfate (52.7%), calcium carbonate (15%), kaolin (9%), dextrin and sucrose (8%), cellulose (6%) and vegetable oil (7%). Bulk density of 1,100 kg/m^3. The particle size distribution of the product showed that 98% of the particles are between 150 and 1,200 µm in diameter and less than 1% of particles are below 150 µm.

Table 2. Heamatological parameters of grower pigs fed experimental diets.

Parameters	Levels of inclusion (%)					
	0	25	50	75	100	
	1	2	3	4	5	SEM (±)
PCV (%)	44.50^{c}	49.08^{ab}	48.45^{ab}	51.95^{a}	48.23^{ab}	2.50
RBC (×10^{-6}/ml)	7.17^{b}	7.76^{ab}	7.66^{ab}	8.13^{a}	7.41^{b}	0.33
WBC (×10^{-3}/ml)	39.50^{a}	26.45^{d}	32.75^{b}	28.20^{cd}	33.40^{d}	1.85
HB (g/dl)	11.48^{b}	12.90^{a}	12.85^{a}	12.98^{a}	12.60^{d}	0.54
MCV (g/dl)	59.90^{b}	63.35^{a}	63.25^{a}	64.00^{a}	63.03^{a}	1.07
MCH (pg)	15.55^{b}	16.65^{ab}	16.75^{a}	17.25^{a}	17.00^{a}	0.56
MCHC (%)	25.95	26.30	26.50	26.90	26.52	0.58
Neutrophils (%)	60.80	57.35	51.60	55.45	59.73	4.35

The letters a, b, c, d, e means along the same row with different superscripts are significantly (P<0.05) different from each other, SEM: Standard error of mean.

Table 3. Serum biochemical parameters of grower pigs fed experimental diets.

	Levels of inclusion (%)					
	0	25	50	75	100	
Parameters	1	2	3	4	5	SEM (±)
Total protein (g/dl)	8.39^{b}	8.11^{d}	8.20^{c}	8.70^{a}	8.05^{e}	0.02
Albumin (g/dl)	3.50^{bc}	3.61^{bc}	3.40^{bc}	4.10^{a}	3.75^{b}	0.13
Globumin (g/dl)	4.89^{a}	4.50^{a}	4.80^{a}	4.60^{a}	4.30^{b}	0.26
Creatinine (g/dl)	1.00^{a}	0.80^{bc}	1.10^{a}	0.93^{bc}	0.87^{bc}	0.05
Urea (g/dl)	40.50^{ab}	39.50^{a}	28.50^{c}	45.50^{a}	35.50^{b}	2.90
Cholesterol (mg/dl)	118.25^{a}	116.30^{b}	114.00^{c}	110.00^{d}	109.00^{d}	0.73

The letters a, b, c, d, e means along the same row with different superscripts are significantly (P<0.05) different from each other, SEM: Standard error of mean.

organisms. Heamatological components are valuable in measuring the abnormality, especially with feed constituents that affect the blood as well as the physiological and health status of farm animals (Isaac *et al*., 2013). Results from PCV of the grower pigs were significant (*P<0.05*) differences among levels of inclusion in the experimental diets. The result was however within the normal range for healthy grower pigs as reported by Isaac *et al.* (2013) that animals with good blood composition are likely to show good performance. This shows that the use of cassava peels/pkc meal (0, 25, 50, 75 and 100%) as replacement for maize had no effect on the packed cell volume of the animal blood. Packed cell volume measures the percentage composition of the blood cells in relation to other contents such as the plasma, food nutrient and is therefore useful in accessing the normal blood level in the animal.

Results obtained for RBC, WBC, Hb, MCV, MCH, and MCHC shows significant (*P<0.05*) differences on the experimental diets. There were gradual increased from control (0) to (100%) in RBC, Hb, MCV and MCH across all levels of experimental diets. The control diet containing maize as the energy source was lower to other diets as the values were generally lower with particular references to RBC and Hb. The slight increase of hemoglobin level above that of the control from other treatments fall within the normal range and is an indication of good nutrition or adequate nutrient intake including iron, copper, vitamin or amino acid in accordance with Daramola *et al.* (2005), who posited that heamatological values could serve as base line information for comparison of nutrient deficiency, physiology and health status of farm animals.

The serum metabolites of total protein, albumin, Globumin, creatinine, Urea and cholesterol were significantly (*P<0.05*) affects by dietary treatments. These parameters are indicators of adequacy of protein in terms of quality and quantity in the diet. It show whether there are protein malnutrition, alterations in the dietary intake of protein and pattern of muscle utilization and possibly the extent of muscle wastage and subsequent degradation of muscle phosphorous creatinine to form creatinine according to Adesehinwa *et al.* (2011). The results showed that total protein, albumin and globulins in the diet supported normal protein reserves in pigs resulting efficient protein utilization (Togun *et al.* (2007; Unigwe *et al*., 2016). Serum creatinine and urea levels in animals are indicative of muscular wastage (Harper *et al*., 1979; Amaefule *et al*., 2012). Values obtained were fairly constant and comparable across the treatment groups; therefore, the animals did not suffered muscular wastage but efficient utilization of diets, ultimately resulting in high tissue deposition (Afolabi *et al*., 2010) across treatment groups. Cholesterol level was significantly highest (*P<0.05*) in maize based and 25% diet, and was attributed to levels of fat deposited (Table 3). This result is in agreement with Togun *et al.* (2007) Unigwe *et al.* (2016) and Anayo (2010) that posited higher fibre diets reduced blood glucose which indicated decreased in the level of cholesterol as the level of inclusion of African yam beans (AYB) in the diet increased.

Conclusion

The heamatological and serum biochemical parameters assessed fall within the normal range and is an indication of good nutrition or adequate nutrient intake. Therefore, the animals did not suffered muscular wastage but efficient utilization of diets, ultimately resulting in high tissue deposition across treatment groups. However, heamatological and serum biochemical studies of cassava peels/PKC diets of grower pigs has proved that, it can be in cooperated on other monogastric animals is then suggested.

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