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Haematology and Serum Biochemical Profile of Weaner Rabbits Fed Yam Peels at Graded levels as a Replacement for Maize

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ABSTRACT

Serum haematology and biochemical profile of weaner rabbits fed graded levels of yam peels replacing maize were evaluated. The experiment which lasted fifty-six days using 15 weaner rabbits was laid in a randomized complete block design using five dietary treatments with three replications each. The dietary treatments evaluated were 5%, 10%, 15%, 20% and 0% inclusion level of yam peels replacing maize. Results revealed significant ($P<0.05$) differences in all the parameters evaluated except for the white blood cells, lymphocytes and globulin. The results obtained did not follow any pattern except chloride levels which had significant ($P<0.05$) decrease across all the treatments (88.00 – 72.00 mmol/L). Higher values were obtained from the control-based diet in the haematological and serum electrolytes profile. While higher values were obtained in animals fed 20% inclusion of the test ingredient for globulin (32.00 g/L), total cholesterol (3.00 mmol/L), high density lipoproteins (1.00 mmol/L), alkaline phosphatase (3.50 U/L), alanine amino transferase (8.00 U/L) and aspartate amino transferase (10.00 U/L). It is concluded that there is no adverse effects of the yam peels diet on the experimental animals across all dietary treatments. It is however recommended that more studies should be carried out on the optimum inclusion levels and its suitability in other classes of rabbit.

Keywords: Serum, Haematology, Weaner Rabbits, Yam Peels, Serum Electrolytes

I. INTRODUCTION

The problem of animal protein insufficiency in Nigeria and other developing nations has attained a deplorable status which calls for urgent remedy to avert the imminent protein malnutrition. This problem has been attributed to high cost of conventional ingredients for feed making which has made monogastric animal feed a major cost of production (Agbakoba *et al*., 1995).

Iyeghe-Erakpotobor *et al.* (2002), reported that increased rabbit production is one sure way of meeting the animal protein requirements of the Nigerian populace and increased production of fryers and breeders. This can be ensured through proper nutrition and feeding of weaner rabbits.

Rabbit production is promising because as monogastric herbivores, they do not compete directly with Man for both cereal and legume grains. Rabbit is also favoured because of its high fecundity, low cost of investment, short generation interval, as well as ability to utilize diverse forages (Taiwo *et al.,* 2004). The animal protein shortage facing Nigeria cannot be solved by large animals with their slow production cycle.

Rabbit farming is growing in many countries today, hence feeding problems associated with poultry and pig farming are now being encountered by rabbit breeders who depend solely on pellets and concentrates for their animals (Omole, 1992; Esonu and Udedibe, 1993). The escalating prices of pellets and concentrates for feeding rabbits in Nigeria constitute considerable constraints on the expansion of commercial rabbit production. Thus, there has been increasing research effort focused on the utilization of alternative cheap feed sources for rabbits.

The scarcity and high cost of cereal grains, especially maize, has necessitated research into alternative energy

sources for livestock feeding. Yam (*Dioscorea rotundata*) is produced in large quantities in Nigeria and form important energy sources for human and livestock feeding. The peels from the processing of these roots are readily available at cheap costs in many parts of the country because they have limited or no human food value. Yam peel meal (YPM) is reported to be a good source of protein but poor in energy (Diarra *et al.*, 2012). A readily available and fast means of assessing clinical and nutritional status of an animal on feeding trial may be the use of blood analysis (Olabanji *et al.*, 2009). Haematological parameters are important and reliable medium used in monitoring and evaluating health and nutritional status of animals (Babatunde *et al.*, 1992; Onifade and Tewe, 1993; Gupta *et al.*, 2007).

This experiment was thus conducted in order to evaluate the effect of yam peels on the haematology and biochemical profile of weaner rabbits fed graded levels as a replacement for maize.

II. METHODS AND MATERIAL

The experiment was conducted at the Rabbit unit of the Livestock Teaching and Research Farm of Bayero University Kano which lies on latitude 11°58.675' North and longitude 8°25.746' East on an elevation of 468m above sea level. It has a mean daily temperature which ranges between 30°C to 33°C and annual rainfall ranging between 787 and 960 mm (KNARDA, 2001). The rabbit unit was disinfected two weeks before the arrival of the rabbits.

Fifteen weaner rabbits of mixed sexes with an average initial weight of 0.70 kg of eight weeks age were sourced from the Rabbit Unit of the National Animal Production and Research Institute (NAPRI) Shika Zaria, Nigeria. The yam peels were shade dried for 5 days and were later crushed to a coarse consistency before been used in formulating the diets.

Five experimental diets were formulated and designated as treatments A,B,C,D and E. Treatment A was a maize based diet which served as the control without yam peels while treatments B, C, D and E were dietary treatments in which yam peels was used to replace maize at 5, 10, 15 and 20% respectively.

At the end of the feeding trial which lasted 12 weeks, two rabbits per treatment were randomly selected for blood evaluation. The rabbits were slaughtered by severing the jugular vein for blood collection. Five (5) ml of blood was collected separately from each animal into bottles containing EDTA (ethylenediamine tetraacetic acid) for haematological parameters and plain bottles without anticoagulant for biochemical indices.

Dry matter (DM), Crude Fiber (CF), Ether Extract (EE), Nitrogen Free Extract (NFE), Ash and Crude Protein (CP) were determined using the AOAC (2005) procedure while Acid-detergent fibre (ADF) and Neutral-detergent fibre of the dietary treatments were determined as described by Van Soest *et al*.,(1991).

The haematological parameters were determined using the Cell-DYN 3500 Hematology Analyzer (Abbott Diagnostic Division, Santa Clara CA). Recommended settings and calibration for rabbit hematology were applied according to the manufacturer's operation manual. Blood samples with EDTA anticoagulant were used for the determination of the selected haematological parameters (Archetti *et al.*, 2008).

The serum biochemical parameters were determined at 37 °C in a random-access clinical analyzer (SYNCRON CX5-DELTA, Beckman Coulter, and Fullerton, U.S.A.) using kits by the same firm. The parameters and the respective methods applied are: aspartate aminotransferase (AST) - Henry method; alanine aminotransferase (ALT) - Henry method; creatinine - colorimetric, Jaffè method; urea - enzymatic colorimetric, urease method; Inorganic phosphorus (Pi), - phoshomolybdate method. (Amadori *et al*., 1997). Alkaline phosphtase was determined with the enzyme kits (Techon Diagnostics, Tarry-town, NY) as outlined by Hewitt *et al.* (1989).

Other parameters obtained were analyzed colorimetrically for total protein (TP) by the Biurette method with kits (Plasmatec; Plasmatec Laboratory products Ltd., UK). Albumin (Ab) concentration was determined by the bromocresol green (BCG) method (Peters *et al*., 1982). Cholesterol concentration was determined using the Biurette method of Coles, (1986). Triglycerides were analyzed using the fluorometric

analysis methods, HDL and IDL were determined by ultracentrifugation, precipitation and electrophoresis (Cox and Garcia-Palmieri, 1990).

Bicarbonate was determined by the enzymatic method reported by Forrester *et al*. (1976) using phosphoenolpyruvate (PEP) as a reagent. Plasma electrolytes were determined electrochemically with Ektachem ion-selective electrode slides for chloride, sodium and potassium. Blood calcium was assayed with Calcium Ektachem slides. Appropriate calibrator (Eastman Kodak Co.) was used for the assay (Hewitt *et al.*, 1989).

Data collected were subjected to Analysis of variance (ANOVA) using the SAS (2001) statistical software. Least significant difference (LSD) were used to separate means at $P<0.05$.

III. RESULTS AND DISCUSSION

Results with respect to haematological profile of weaner rabbits fed graded levels of yam peels replacing maize are presented in Table 1. There were significant ($P<0.05$) differences in all the variables evaluated except for white blood cells and lymphocytes. Experimental animals placed on the control based diets had significantly ($P<0.05$) higher haemoglobin, red blood cells, packed cell volume, mean corpuscular haemoglobin, and mean corpuscular haemoglobin concentration. The mean values obtained though statistically significant ($P<0.05$) did not follow any particular trend.

The values of WBC obtained were all within the reference values provided by Burnett *et al.* (2006) and Van Praag, (2004). The obtained MCV values were all within the values reported by Hewitt *et al.* (1989) except for the control based diet and 15% inclusion levels of yam peels which were higher. All the values obtained for MCH were all within the range reported by Hewitt *et al.* (1989). Both the values for MCHC and Lymphocytes obtained were all within the reference range as reported by Van Praag, (2004). The values for Monocytes obtained were all higher than the range provided by Van Praag, (2004) except that of the control based diet. All the values obtained for the Neutrophils were slightly lower than the reference range provided by Van Praag, (2004) except for that of 5% levels of inclusion. Values obtained for the platelets were all within the reference range reported by Hewitt *et al.* (1989).

The difference in the value for haemoglobin between the control based diet and the other treatments might be attributed to the anti-nutritional factors present in the test ingredient. The value for the haemoglobin resulted to the occurrences of higher values for PCV, MCV and MCHC in treatment A (the control based diet).

Table 2 presents results with respect to blood chemistry of weaner rabbits fed graded levels of yam peels replacing maize. There were significant ($P<0.05$) differences in all the variables evaluated except for globulin. Experimental animals placed on 20% inclusion of yam peels had significantly ($P<0.05$) higher values for total cholesterol, urea, high density lipoproteins, alkaline phosphatase, alanine amino transferase and aspartate amino transferase.

The mean values obtained did not follow any specific trend across the treatments. Values obtained for globulin and total protein fell within the normal reference range values reported by Van Praag, (2004). The values of albumin for animals fed 5% inclusion level of yam peels was within the normal rabbit reference value reported by Van Praag, (2004), while others were slightly lower. The values for total cholesterol obtained for 5%, 10%, and 15% inclusion levels of yam peels were within the reference range reported by Hewitt *et al.* (1989) while that of the control based diet and 20% inclusion levels of yam peels were higher. Values obtained for urea, ALP, ALT and AST were all below the reference values reported by Hewitt *et al.* (1989); Van Praag, (2004); Burnett *et al.* (2006).

Table 3 presents results with respect to serum electrolytes of weaner rabbits fed graded levels of yam peels replacing maize. There was significant ($P<0.05$) differences in all the variables evaluated. Experimental animals placed on the control based diet had significantly ($P<0.05$) higher Ca, Cl^-, K and Na values. The mean values obtained did not follow any specific pattern except that of chloride which had significant ($P<0.05$) decrease across the treatments. All the values obtained were all lower than the normal reference values reported by Burnett *et al.* (2006); Hewitt *et al.* (1989);

Van Praag, (2004) except for sodium which fell within the value range provided by Burnett *et al.* (2006). All these might be attributed to either the environment or the laboratory analysis techniques being used because the values obtained in the control based diet were as well low.

Table 1. Haematological profile of weaner rabbits fed graded levels of yam peels as a replacement for maize.

Haematological Indices	**Treatments**					**LSD**
	A (0%)	**B (5%)**	**C (10%)**	**D (15%)**	**E (20%)**	
Haemoglobin (g/dL)	18.05^{a}	12.35^{cd}	12.95^{bc}	11.55^{d}	13.35^{b}	0.909
Red blood cell (10^6/uL)	6.48^{a}	6.14^{a}	5.97^{a}	4.58^{b}	6.12^{a}	0.909
White blood cell (10^3/uL)	6.60	6.55	6.60	7.10	6.95	4.45
Packed cell volume (%)	55.50^{a}	43.95^{c}	49.35^{b}	36.90^{d}	49.00^{b}	4.24
Mean corpuscular volume (mm^3)	81.45^{b}	70.55^{e}	78.05^{c}	87.05^{a}	74.75^{d}	0.909
Mean corpuscular haemoglobin (pg/cell)	26.95^{a}	19.45^{c}	20.95^{b}	27.05^{a}	21.15^{b}	0.909
Mean corpuscular haemoglobin concentration (g/dL)	33.05^{a}	27.85^{c}	26.86^{d}	30.95^{b}	28.25^{c}	0.909
Lymphocytes (%)	69.60	56.20	77.10	73.75	60.45	24.30
Monocytes (%)	2.95^{d}	6.65^{c}	10.75^{a}	8.55^{b}	8.35^{b}	0.909
Neutrophils (%)	29.05^{ab}	40.60^{a}	17.40^{b}	21.85^{ab}	32.25^{ab}	19.39
Platelets (10^3/uL)	598.00^{b}	588.00^{b}	736.00^{a}	474.00^{c}	475.00^{c}	18.18

Means with different superscripts denotes significant ($p<0.05$) difference across rows.

Table 2. Blood chemistry of weaner rabbits fed graded levels of yam peels as a replacement for maize.

Index	**Treatments**					**LSD**
	A (0%)	**B (5%)**	**C (10%)**	**D (15%)**	**E (20%)**	
Albumin (g/L)	22.00^{b}	26.00^{a}	24.00^{ab}	21.00^{b}	23.00^{ab}	3.64
Total protein (g/L)	50.50^{c}	58.50^{a}	55.50^{b}	56.00^{b}	55.00^{b}	1.82
Globulin (g/L)	28.00	32.00	26.00	29.00	32.00	10.28
Total cholesterol (mmol/L)	2.55^{b}	2.00^{c}	2.00^{c}	2.00^{c}	3.00^{a}	0.364
Urea (mmol/L)	2.20^{a}	1.50^{b}	2.20^{a}	2.00^{a}	2.00^{a}	0.364
Creatinine (mmol/L)	19.00^{c}	35.00^{a}	15.00^{d}	32.00^{ab}	30.00^{b}	3.64
Triglycerides (mmol/L)	1.11^{b}	1.11^{b}	1.00^{b}	1.50^{a}	1.21^{ab}	0.364
HDL (mmol/L)	0.83^{ab}	0.80^{ab}	0.50^{b}	0.80^{ab}	1.00^{a}	0.364
IDL (mmol/L)	1.56^{a}	1.00^{b}	1.40^{a}	0.90^{b}	0.86^{b}	0.364
ALP (U/L)	2.50^{ab}	2.50^{ab}	1.50^{b}	1.50^{b}	3.50^{a}	1.82
ALT (U/L)	6.00^{ab}	8.00^{a}	7.00^{ab}	4.00^{b}	8.00^{a}	3.64
AST (U/L)	8.00^{ab}	9.00^{a}	8.00^{ab}	5.00^{b}	10.00^{a}	3.64

Means with different superscripts denotes significant ($p<0.05$) difference across rows

Table 3. Serum electrolyte profile of weaner rabbits fed graded levels of yam peels as a replacement for maize.

Electrolytes	**Treatments**					**LSD**
	A (0%)	**B (5%)**	**C (10%)**	**D (15%)**	**E (20%)**	
Bicarbonate (mmol/L)	14.00^{cd}	17.00^{bc}	18.00^{ab}	21.000^{a}	13.00^{d}	3.64
Calcium (mmol/L)	1.61^{a}	0.91^{b}	1.13^{b}	1.15^{b}	1.11^{b}	0.364
Chloride (mmol/L)	88.00^{a}	85.00^{a}	81.00^{b}	75.00^{c}	72.00^{c}	3.64
Inorganic Phosphate (mmol/L)	0.72^{b}	0.22^{c}	0.91^{ab}	1.11^{a}	0.80^{ab}	0.364
Potassium (mmol/L)	2.00^{a}	1.70^{a}	1.20^{b}	2.00^{a}	2.00^{a}	0.364
Sodium (mmol/L)	129.00^{a}	125.00^{bc}	123.00^{c}	128.00^{ab}	117.00^{d}	3.64

Means with different superscripts denotes significant ($p<0.05$) difference across rows.

IV. CONCLUSION

It is concluded that replacing maize with yam peels up to 20% inclusion level did not have any adverse effect on the weaner rabbits in terms of the haematology and blood biochemical profiles. Thus, cost of production with respect to feeding can be reduced using yam peels as a substitute for maize. It is however recommended that further studies on the optimum level of inclusion of yam peels to be established. Yam peels should be included in other categories of rabbits to ascertain its suitability.

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