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Heamatological and Serum Biochemical indices of weaned rabbits fed diets containing varying levels of Sundried Cassava Peel (SCP) as replacement for Maize

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Abstract
This study was conducted to determine the haematological and serum biochemical parameters of weaned rabbits fed diets with graded levels of sundried cassava peels as replacement for maize. A total of twenty male cross breed (Chinchilla x New Zealand) weaned rabbits were randomly assigned to five treatment groups in a completely randomized design. Each group was replicated four times with one rabbit per replicate. The animals were kept in individual cages. Five experimental diets were formulated such that T_1, T_2, T_3, T_4 and T_5 contain 0.0%, 12.5%, 25.0%, 37.5% and 50.0% inclusion levels of sundried cassava peels replacing maize respectively. Feed and water were provided ad libitum while experiment lasted for seven weeks. Results on heamatological and serum biochemical indices revealed no significant ($P>0.05$) in values of all the parameters evaluated. It was concluded that there was no adverse effects of the varying inclusion levels of sundried cassava peels (SCP) on the experimental animals across all dietary treatments even up to 100% replacement of maize. It was however recommended that more studies should be carried out on the optimum inclusion levels and its suitability in other classes of rabbit.

Keywords: *Heamatology, serum indices, sundried cassava peel, weaned rabbit*

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I. Introduction

In order to maximize food production and meet protein requirements in Nigeria, viable options need to be explored and evaluated (Owen *et al*., 2008). Among such options, is the use of livestock species that are yet to play a major role in animal production within the country. Fast-growing livestock such as rabbits possess a number of features that might be of advantage in the regards and in small holder subsistence-type integrated farming in developing countries.

Rabbit meat production has been on the increase from years back, not only because of its low cholesterol level, but also because it has a feeding habit with no appreciable competition with men. 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 weaned rabbits. Unfortunately, an increasing cost of livestock feed with concomitant increase in the cost of feed ingredients for livestock feeding has worsened the case. Therefore, there is need to consider alternative feeding ingredients. Cassava peel, a by-product of cassava processing unit belong to this category of feed ingredients.

Cassava peels meal offer a tremendous potential as a cheap and alternative feed stuff to maize. It is one of such by-products emanating from industrial processing of cassava into garri, chips and industrial starch. It offers a tremendous potential as a cheap and alternative feedstuff to maize. Several researchers have confirmed the suitability of cassava root flour and peels in the diet of rabbits (Omole and Sonaiya, 1981). Cassava peels (5– 15% of tuber weight), when processed, could be used to replace high input-dependent conventional energy feed ingredients in animal production (Oloruntola *et al*., 2016). However, the high level of structurally indigestible carbohydrates (cellulose, hemicellulose, pectin, and lignin) and high antinutrients (hydrogen cyanide, tannin, and phytate) coupled with low protein content (Oloruntola *et al*., 2018) have been identified as the major factors limiting its optimal use in monogastric feeding.

Meanwhile, one of the critical indicators of the physiological stages of farm animal is the blood indices, which reflect the relationship between the nutrition of an animal, health and its well being. They are useful for clinical evaluation of different conditions of an animal such as animal diseases, health and feed

quality. For instance, serum creatinine according to Belewu and Ogunsola (2010) helps in evaluation of liver function and diseases while serum urea evaluates renal function. Furthermore, packed cell volume as well as the red blood cells indices help to determine the feed toxicity and anemic conditions in farm animals.

Blood parameters change in relation to the physiological status of an animal. These changes could be as a result of several factors such as feeding level, feed quality, age, sex, breed, temperature and physiological status of animals. These differences have further underlined the need to establish appropriate physiological and nutritional baseline values for rabbits, which could help in realistic evaluation of the management practices, nutrition and diagnosis of health of the host animal. This study was however designed to determine the haematological and serum indices of weaned rabbit fed varying inclusion levels of sundried cassava peel (SCP), to ascertain its haematological safety margin and to improve on the scanty scientific literature available on the plant.

II. Materials And Methods

Location of Experiment

The research was carried out at the Rabbit Unit, Teaching and Research Farms of the Agricultural Education Department, Oyo State College of Education, Lanlate, Ibarapa East Local Government Area of Oyo State, Nigeria.

Sources and Processing of Experimental Material

Fresh cassava peels were collected from cassava processing plant around the College and sundried for some days to a constant moisture content of about 10%. The sundried cassava peels were processed, milled and stored until needed. Other feeding materials were purchased from feed mill around the study area.

Experimental Animals and Management

Twenty weaned crossbreed rabbits (Chinchilla x New Zealand white) were used for the experiment. They were randomly divided into five (5) experimental groups with four (4) rabbits constituting a replicate. The animals were assigned to the experimental diets in a Completely Randomized Design. Each rabbit received an assigned diet for 49 days. The animals were provided with feeders and drinkers. Prior to the commencement of the experiment, the cages were repaired, cleaned and disinfected. The animals were kept separately in hutch made of wood and net. The hutches were properly cleaned and disinfected while the feeders and the drinkers were washed and cleaned properly. Each animal was vaccinated against prevalence under current diseases and were quarantined for 14 days before the commencement of the experiment. They were also dewormed and given accaricides bath prior to the experiment.

Experimental Diets

Five diets, 1, 2, 3, 4 and 5 were formulated from maize, dried cassava peels, wheat offal, fish meal, groundnut cake, soybean, bone meal, oyster shell, vitamin premix, methionine, lysine and common salt. Treatment one (T1) did not contain the test ingredients, thereby serving as the positive control. The experimental diets were formulated such that sundried cassava peel was included as replacement for maize at the levels of 0.00% (0.00% SCP+50% maize), 12.50% (12.50% SCP+37.5%maize), 25.00% (25.00% SCP+25.00% maize), 37.5% (37.50% SCP+12.50% maize) and 50.0% (50.00% SCP+0.00% maize) for T1, T2, T3, T4 and T5 respectively as presented in Table 1.

Collection of blood samples

Blood samples (5 ml) were drawn from each animal on the last day of the study. The rabbits were bled through the ear marginal vein. The samples were separated into two lots and used for biochemical and haematological studies. An initial 2.5 ml was collected from each sample in labeled sterile universal bottle containing 1.0 mg/ml ethyldiamine tetracetic acid and used for haematological analysis. Another 2.5 ml was collected over anti-coagulant free bottle. The blood was allowed to clot at room temperature and serum separated by centrifuging within three hours of collection. Serum biochemistry and haematological parameters were measured using Beckman Coulter Ac-T10 Laboratory Haematology Blood Analyzer and Bayer DCA 2000+ HbA1c analyzer, respectively. Mean cells haemoglobin (MCH), MCV and mean cell haemoglobin concentrations (MCHC) were calculated.

Data Analysis

The results were analyzed using the Special Package for Social Sciences Window 17.0. One-way analysis of variance (ANOVA) was employed to determine the means and standard error. Treatment means were compared using Duncan' s new multiple range test.

III. Results And Discussion

Table 1: Gross composition of experimental diet

Ingredient	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Maize	50	37.5	25	12.5	-
DCP	-	12.5	25	37.5	50
W/O	22	22	22	22	22
Fish Meal	3	3	3	3	3
GNC	4	4	4	4	4
Soybean	15	15	15	15	15
Bone meal	3	3	3	3	3
Oyster shell	1	1	1	1	1
Premix	1	1	1	1	1
Salt	0.5	0.5	0.5	0.5	0.5
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Analysis					
Crude protein (%)	16.8	16.75	16.75	16.73	16.7
Crude fibre (%)	4.6	4.55	5.96	6.6	6.68
Metabolisable Energy (Kcal/kg)	2580	2585	2590	2599	2600

† Contained per kg premix: Vitamin A 4,000,000 IU; Vitamin D3 2,000,000 IU; Vitamin E 7,000 IU; Vitamin B2 4,000 mg; Nicotinic acid 15,000 mg; Calcium D-pentothenate 8,000 mg; Biotin 40 mg; Vitamin B12 10 mg; Mn 20,000 mg; Fe 50,000 mg; Zn 100,000 mg; Cu 10,000 mg; Iodine 750 mg; Co 3,000 mg.

Serum biochemical indices of weaned rabbits fed varying inclusion levels of cassava peel as replacement for maize:

Results of serum biochemical indices of rabbits fed different levels of sundried cassava peel were not statistically ($P > 0.05$) affected by dietary treatments (Table 3). The serum total protein content was 5.00 and 6.40g/dl for diets 3 and 5 respectively. The total protein contents were within the normal reference range (5.4 – 7.5 g/dl) reported by Medirabbit (2011). This suggests that normal protein metabolism occurred in rabbits, since protein synthesis is related to the amount of protein available in the diet (Iyayi and Tewe, 1998).

The albumin values (3.20 and 5.20 g/dl for diets 3 and 5 respectively) were comparable with the normal clinical range (2.70 - 5.00 g/dl) for apparently healthy rabbits reported by Medirabbit (2011). This suggests a proper functioning of the liver of rabbits fed varying inclusion levels of sundried cassava peel. Furthermore, the globulin concentration ranges of 0.80 and 1.80 g/dl for diet 1 and 3 respectively for different levels of sundried cassava. These values were below the range 2.50 – 4.50 g/dl given by Burke (1994) for rabbits. All the serum biochemical indices in this study recorded no significant differences between dietary treatments, implying that replacing maize with sundried cassava peel up to 50% will not impact negatively on the serum biochemistry of rabbits. Furthermore, the mean corpuscular volume ranges between 55.70 in diet 3 and 62.20 fl in diet 1. The values were within the MCV content (60.00 – 69.00 fl) reported for apparently healthy rabbits (Medirabbit, 2011); but higher than 32.75 – 34.00 fl reported by Bitto *et al*. (2006). Likewise the mean corpuscular haemoglobin obtained in this study range between 27.85 and 38.95 pg/cell for rabbits fed diet 1 and diet 4 respectively.

Table 2: Serum parameter of grower rabbits fed varying inclusion levels of cassava peel

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	SEM	LOS
Total Prot (g/dl)	5.50	5.30	5.00	6.30	6.40	0.25	NS
Albumin (g/dl)	4.70	4.40	3.20	4.90	5.20	0.31	NS
Globulin (g/dl)	0.80	0.90	1.80	1.30	1.20	0.16	NS
Creatin (mg/dl)	0.50	0.30	0.10	0.50	0.50	0.07	NS
Cholesterol (mg/dl)	84.80	60.50	55.60	57.20	54.30	5.08	NS
Glucose (g/dl)	100.20	121.50	96.80	104.30	98.60	4.00	NS

a,b Means with different superscripts in the same row are significantly different (P<0.05), SEM- standard error of mean, LOS=level of significance, NS=no significance

Haematological profile of rabbits fed varying levels of cassava peel as replacement for maize:

Results of haematological parameters were not statistically (P > 0.05) affected by dietary treatments (Table 3). The results for haemoglobin concentration in this study ranged between 12.9 and 15.7 g/dl for diets 4 and 5 respectively. The haemoglobin value for all the treatments were within the normal ranges 10 – 15 g/dl and 10 – 17.5 g/dl reported by Aduku and Olukosi (1990); Flecknell (2000) and Medirabbit (2011) for rabbits. The RBC values in the present study were higher than the values of 4.31– 4.43 ($x10^{12}$/l) reported by Sogunle *et al*. (2007) for rabbits fed cassava peel meal (CPM) diets. The variation in the values could be attributed to the differences in the levels of inclusion. The haemoglobin concentrations are within the reported range of 9.9– 19.3 g/dl indicated by Tuffery (1995) for healthy rabbits. The adequate haemoglobin concentration for all the experimental rabbits is probably an indication that inclusion of processed CPM in the diets supported haemoglobin synthesis which according to Sirois (1995) is, among other factors, primarily affected by protein intake. The result suggests absence of microcytic hypochromic anaemia which is due to iron deficiency and improper utilization for the formation of haemoglobin. The similar trend obtained for haemoglobin and PCV could be ascribed to the direct relationship between haemoglobin concentration and the PCV (Jain, 1986).

The WBC values reported in this study were higher than the values of 6.05-9.30 x 10^{6L} reported by Sokunbi and Egbunike (2000) for rabbits fed neem (*Azadirachta indica*) leaf meal. Higher WBC count of rabbits on diets 4 and 5 compared to other diets could probably be due to the blend of anti-nutrients present in sundried cassava peel. However, obtained values are within the range 3.3-12.2 x $10^{9L}$for normal rabbit (Archetti, 2008). This observation implies that the diets supported haemopoietic tissues with resultant production of adequate WBC. It has been reported that toxic substance in feed tends to suppress haemopoietic tissues with consequent production of lower WBC. Since none of the rabbits suffered from leucopenia, it appears that replacing maize with sundried cassava did not affect the immune status of the rabbits because the WBC functions primarily as a defense system as it contain lymphocyte that have a central role in the immunological defense mechanism of the body (Eroschenko, 2000).

Table 3: Heamatological parameter of grower rabbits fed varying inclusion levels of cassava peel

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5	SEM	LOS
PCV(%)	51	43	44	38	55	2.704	NS
Hb (g/dl)	13.9	14.7	14.8	12.9	15.7	0.421	NS
RBC ($x10^{12/L}$)	8.2	7.5	7.9	6.5	9.8	0.481	NS
WBC ($x10^{9L}$)	19.5	16.3	16.7	14.2	21.1	1.094	NS
Neut. (%)	29	29	30	38	36	1.711	NS
Lym (%)	70	71	70	61	62	1.947	NS
Eos (%)	0	0	0	0	0	0	NS
Bas (%)	0	0	0	0	1	0.179	NS
Mon (%)	1	0	0	1	1	0.219	NS
MCV (fl)	62.2	57.33	55.7	58.46	56.12	1.0415	NS
MCH (pg)	16.95	19.6	18.73	19.85	16.02	0.672	NS
MCHC (g/dl)	27.25	34.19	33.64	33.95	28.55	1.335	NS

a,b,c Means in the same row with different superscripts are significantly different (p< 0.05), SEM = standard error of mean, PCV=packed cell volume, Hb=heamoglobin, WBC = White blood cell, MCH: mean corpuscular volume; MCHC: mean corpuscular haemoglobin concentration, LOS=level of significance, NS=not significance

IV. Conclusion

It is concluded that replacing maize with sundried cassava peels up to 100% 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 sundried cassava peels as a substitute for maize. It is however recommended that further studies on the optimum level of inclusion of sundried cassava peels to be established. Sundried cassava peels should be included in other categories of rabbits to ascertain its suitability. Hence, replacement of maize with cassava peel even up to 100% is tolerable especially with the processed fine cassava peel based diet due to its higher digestibility.

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