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Blood components and growth indices of West African dwarf goats fed various levels of boiled rubber (*Hevea brasiliensis*) seed meal

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Abstract

Growth, haematological and biochemical components of West African dwarf (WAD) bucks fed various inclusion levels of boiled rubber seed meal (Hevea brasiliensis) were investigated in this study. Sixteen WAD bucks aged 6-7 months were randomly assigned to the four dietary treatments (0-30%) of boiled rubber seed meal (BRSM). Each treatment has four bucks with a buck as replicate, in a completely randomised design. The experiment lasted for 56 days. Average daily feed intake (g) were 417.90; 428.93; 322.00 and 288.10 for diets A, B, C and D, respectively. Corresponding average daily weight gain (ADWG) were 31.69; 53.92; 46.62 and 34.64 with feed/gain ratio being least (6.90) for goats fed diet C (20% BRSM) which did not differ (P>0.05) significantly from animals fed diet B (7.95 BRSM). Apart from blood cholesterol, all haematological and biochemical parameters were not influenced by dietary treatments. Though all the inclusion levels (10-30%) of boiled rubber seed meal were safe as feed for WAD goat, diet B of 20% inclusion of boiled rubber seed meal enhanced best performance and is therefore recommended for use in formulating supplementary diet for WAD goat.

Keywords: Haematology; biochemical; rubber seed; alternative feedstuff; anti-nutrition.

Introduction

The population of developing countries including Nigeria increases rapidly with resultant increase in the demand for protein of animal origin (Agbakoba, 1995). The most critical aspect of human nutrition is the shortfall in animal protein intake, which is consequently blamed upon the high cost of animal feed which according to Agbakoba (1995) is well over 70% of the total cost. The high cost of feed could be traced to the existing competition between man and livestock for the conventional protein and energy sources. Animal protein consumption can be increased through improvement in the production of local breeds of animals like West African dwarf goats (Udo *et al*., 2016).

The quest for alternative source of feedstuff for feed formulation may pose health hazards to livestock due to anti-nutritional factors inherent in them. Screening of unconventional feedstuff to ascertain their health status is therefore a thing of concern in animal production and management. Blood is important for assessing the physiological and health status of animal and also for clinical evaluation of physiological/pathological conditions and diagnostic/prognostic evaluation of various types of diseases in animals (Obasoyo *et al*., 2005; Amel *et al*., 2006). Etim *et al*. (2013) noted that blood parameters change in relation to the physiological status of animal. The biochemical components (creatine, urea nitrogen, serum protein, blood count, haemoglobin, red blood cells, white blood cells, neutrophil, eosinophils, bilirubin etc) are means of determining the level of heart attack, liver and kidney condition, as well as evaluating protein quality and amino acid requirements in

animals (Harper *et al*., 1999; Swenson *et al.,*1990). Rubber seed has wide variety of anti-nutritional factors, and monogastrics generally have lower tolerance for such factors than ruminants Devendra (1988). Fresh rubber seeds contain toxic factors like cyanogenic glycoside, saponin, oxalate, tannin, phytate, trypsin inhibitor etc (Udo *et al*., 2016, Ononogbo, 1998). Anti-nutritional factors in rubber seed are heat labile and could be eliminated or reduced to an insignificant non-toxic level when toasted, boiled or stored for 4-6 months before processing (Udo *et al*., 2016; Offiong and Olomu, 1990). Many workers submitted that rubber seed meal is a good source of protein supplement in the diet of different breed of livestock like poultry (Yeong and Ali, 1999; Narahari Kothandaraman, 1984; Nouke and Endeley, 2001), rat (Yeong *et al*., 1981), pig (Babatunde *et al*., 1990) and sheep (Njwe *et al*., 1988). However, Babatunde and Pond (1988) reported that rubber seeds can be fed to livestock, yet little attention is devoted to exploiting it in Nigeria as feed for livestock. The trial was conducted to ascertain the growth, haematological and biochemical indices of WAD goats after being fed with graded level of boiled rubber seed meal. There is however, paucity of information on the blood indices of WAD goat fed boiled rubber seed meal.

Materials and methods

Experimental site

The study was carried out at the Teaching and Research Farm of Akwa Ibom State University, Obio Akpa Campus, Nigeria. Obio Akpa is located between longitudes 5^0 17^1N and $5^0 27^1$ and between longitudes $7^0 27^1$N and $7^0 58^1$E with annual rainfall between 3500mm-5000mm. It has an annual humility of 95% and an average temperature of 25^0C (Etim *et al*. 2013).

Processing of rubber seed

Rubber seeds (20 kilogrammes) were boiled in batches. They were introduced into the cooking pot whose water has attained boiling temperature of 100^0C. They were descanted after being allowed to boil for 30 minutes. The descanted seeds were sun-dried for seven (7) days, then dehulled and the nut milled, pressed (using garri pressing machine) to remove oil. The products were used to formulate boiled rubber seed meal (BRSM) based diets.

Experimental diets

Four experimental diets (A-D) containing graded level (0-30%) of boiled rubber seed meal together with other conventional feedstuffs (Palm kernel cake, brewer dried grain, Cassava peels, Bone meal and common salt) as shown in Table 1 were used to formulate the experimental diets and used for the trial.

Table 1. Composition of boiled rubber seed meal based experimental diets

	DIETS			
Ingredients	A	B	C	D
Cassava peel	30.5	30.5	30.5	30.5
BRSM	0.00	10	20	30
Brewer Dried Grain	50	40	30	20
Palm kernel cake	17	17	17	17
Bone meal	2	2	2	2
Common salt	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**
Calculated constituents				
CP	14.58	15.79	15.85	15.91
GE (MJ/kg)	1.68	1.72	1.66	1.64

BRSM = Boiled rubber seed meal
*GE was calculated using regression equation by McDonald *et al*. (2011).

Animal management

A total of sixteen West African Dwarf bucks (weaners) with an average age of 6-7 months were bought from goat farmers within the University environment and used for the experiment. The animals were dewormed on the fifth day of their arrival and subsequently quarantined for 21 days. They were fed with forages and assigned supplemental diet for 21 days for acceptance /adaptation. Vaccination against *Pestes des petite ruminant* (PPR) was also given during the quarantine period using Rinder Pest Tissue Culture vaccine. The sixteen bucks were randomly separated into four treatment groups with four goats per treatment. Each goat was assigned to an individual pen of a well ventilated cement floor equipped with feeding and drinking troughs. Each animal received 1kg of designated diet in addition to 2kg of guinea grass (*Panicum maximum*). The feeding trial lasted for 56 days. Daily feed intake was determined by subtracting daily feed left over from the 1kg given the previous day. Weekly body weights were recorded for each animal. These were used to determine the average total weight gain, daily weight gain and feed conversion ratio for each goat.

Experimental procedure/design

The four diets containing 0-30% inclusion level of boiled rubber seed meal designated as A, B, C and D were formulated were randomly assigned to the four treatment groups of four goats per treatment group. An individual goat received one (1) kilogramme of the assigned diet in addition to two (2) kilogramme of guinea grass (*Panicum maximum*). The daily feed intake and weekly weight were recorded for each animal. These were used to evaluate their average daily feed intake, average total weight gain, average daily weight gain and feed conversion ratio for each treatment group.

Haematological and biochemical procedure

Samples of blood were drawn from the experimental animals through the jugular vein on the first day and on the fifty sixth day of the trial. 5ml of blood per animal was collected and 2.5ml placed into sterile vacutainer tubes containing Ethylene diamine tetracetic acid (EDTA) for haematological study, while the remaining 2.5ml was discharged into sterile vacutainer tubes without EDTA to allow blood clotting and serum decant for analysis. Packed cell volume (PVC) and erythrocyte counts were determined as described in Ewuola and Egbunike (2008). Total leukocyte counts were determined using Neubauer haemocytometer appropriate dilution.Blood constants (mean cell volume, MCV, mean cell haemoglobin, MCH and mean haemoblobin concentration, MCHC) were determined using appropriate formulae as described by Jain (1986). Serum total protein was determined using Biuret method as described by Reinhold (1953). Albumin was determined using bromoscresol green (BCG) method as described by Peter *et al*. (1982). Serum creatine was determined as described by Scott (1965).

Statistical analysis

The data obtained from the study were subjected to analysis of variance (ANOVA) procedure (Steel and Torrie, 1980). Treatment means were separated using Duncan Multiple Range Test (Duncan, 1955).

Results and discussion

Table 2 showed feed intake and weight changes of West African Dwarf goats fed various inclusion level of boiled rubber seed meal (BRSM).

Table 2: Performance of WAD goats fed experimental diets containing various levels of boiled rubber (*Hevea brasiliensis*) seed meal

Parameter	A	B	C	D	SEM
Initial mean wt (Kg)	6.83	6.63	6.58	6.50	0.367
Final mean wt (Kg)	8.94	9.65	9.19	8.44	0.555
Total feed intake (Kg)	23.40[a]	24.02[a]	18.03[b]	16.13[b]	1.294
Daily feed intake (g|d)	417.90[a]	428.93[a]	322.00[b]	288.10[b]	19.096
Total weight gain (Kg)	2.11[b]	3.02[a]	2.61[b]	1.94[c]	0.103
Ave.Daily weight gain (g)	37.69[c]	53.92[a]	46.62[b]	34.64[c]	1.679
Feed/gain ratio	11.09[a]	7.95[c]	6.90	8.31[b]	1.451

[a,b,c,] Means on the same row with superscripts differ significantly (P<0.05)

Goats fed 10% BRSM consumed significantly more feed (P<0.05) (428.93g/d) than goats fed 20 and 30% BRSM (322.00g/d and 288.10g/d respectively. The rate of consumption decreases from B-D (10%-30%), showing that consumption decreases as boiled rubber seed meal inclusion increases in the diet. Gohl (1982) reported that rubber seed is not quite palatable and appetizing to ruminant. Rajan *et al*. (1990) reported a linear decrease in feed intake and daily weight gain as the incorporation of boiled rubber seed meal went beyond 20%. This trend was replicated in this study.

Haematological and biochemical indices

The normal and baseline values of haematological and biochemical values of West African Dwarf goats is presented in Table 3. Data of haematological and biochemical of WAD goats on fifty sixth day of this study is also presented in Table 3.There were no significant differences (P>0.05) observed among the parameters under investigation except for cholesterol values. Except for White blood cells values (ml), other parameters in the four treatments groups fell within the reported for WAD goat (Radostits *et al*. (2005), Daramola *et al*. (2005), and Oni *et al*. (2007). White blood cells are the body's natural defence against external influences that may be occasioned by antigens. Antigens may include disease parasites as well as anti-nutrients found in feedstuffs; thus WBC levels in the body may rise depending on the extent of aggression. Animals fed diet A (0% BRSM) surprisingly had abnormal WBC values which goes to suggest that the abnormality observed in this study may not be connected with traces of anti-nutrient/s in the diets.

Table3. Haematology and biochemical values of WAD goats fed diets containing various levels of boiled rubber seed meal with baseline and normal blood rang

	A	B	C	D	Baseline	Normal range
PCV (%)	26.75	26.75	25.50	26.50	26.75	22-38
HB g/l	82.25	80.75	83.50	88.00	83.50	80-120
RBC (µl)	9.70	10.32	10.55	10.60	8.13	8.0-18.00
WBC (ml)	15.20	14.95	12.20	14.22	10.05	4.0-13
Neutrophil (%)	37.75	47.25	46.60	46.75	36.5	35-40
Lymphocytes (%)	52.75	53.25	57.50	58.25	-	-
Eosinophils (%)	1.25	1.50	1.00	1.50	4.87	1-70
Basophils (%)	0.00	0.00	0.00	0.00	1.25	1-2.50
Biochemical						
Creatinine (%)	30.00	32.27	33.25	35.67	30.68	28.25-36.65
Urea (mol/l)	5.22	5.17	6.30	6.42	6.80	0.8-9.70
Total Protein (g/l)	71.00	69.75	72.50	67.00	73.50	64-74.50
Cholesterol (mg/dl)	1.84[ab]	1.44[b]	1.71[ab]	2.14[a]	2.02	2.07-3.36
Sugar (mg/l)	1.60	1.68	1.72	1.65	1.52	2.7-10
T. B. (µmol/l)	0.57	0.42	0.60	0.65	0.36	0.3-0.40
C. B (µmol/l)	0.30	0.01	0.85	0.59	0.32	0.2-0.40
SGPT (units/l)	11.75	12.50	11.75	12.25	32.00	15.3-52.3
SGOT (units/l)	22.75	23.25	24.25	25.25	35.00	12-38

[a,b] Means on the same row with different superscripts differ significantly (P<0.05).

SGPT = Serum glutamate pyruvate transaminase. **SGOT** = Serum glutamate oxaloacetate transaminase, **PCV**= Pack cell volume, **HB**= Haemoglobin, **RBC**= Red blood cell, **WBC**= White blood cell, **TB** and **CB**= Total and Conjugated bilirubin.**Source of normal range**: Radostits *et al.* (2005).

The abnormal values may arise from other source/s of infection and not anti-nutritional factor from boiled rubber seed meal. Cholesterol serum concentrations in goat fed diet A (1-84), B (1.44) and D (2.14) were similar (P<0.05), but D has superior value (P>0.05) to B (1.44). Diets containing BRSM (B-D) had lower values (1.71-2.14) of cholesterol than the normal range (2.07-3.36). The result shows that BRSM could be used to produce low cholesterol meat (chevon) which could be eaten by all classes of man.

Conclusion

The study showed that the rate of feed consumption decreases as BRSM inclusion level increases (10%-30). There were no significant (P>0.05) differences in the blood parameters investigated except for cholesterol and white blood cells values among the treatment groups. However, other parameters values fell within the values reported for WAD goats (Radostits *et al*., 2005). Thus, boiled rubber seed meal generally enhanced performance in West African dwarf goat, and 20% inclusion level showed superior values in all the parameters among the treatment groups. With low cholesterol, least feed conversion ratio, comparable daily weight gain; and haematological and biochemical values falling within the normal rage; 20% boiled rubber seed meal is therefore recommended for use to formulate supplementary diet for WAD goat in the humid tropics.

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