

Haematological and serum biochemical indices of West African Dwarf goats fed selected forages

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Abstract

Rapid decline in the quantity and quality of forages during the dry season leads to poor animal performance. The nutritive qualities of five selected forages (*Spondias mombin*, *Ageratum conyzoides*, *Calopogonium mucunoides*, *Terminalia catappa* and *Dialium guineense*) were investigated. Twenty four West African Dwarf (WAD) goats were subjected to six dietary treatments with four animals per treatment in a completely randomized design. The experiment lasted for 84 days. All the forages were used to supplement *Pennisetum purpureum*. Blood parameters were determined. Highest values of 30.56 %, 11.76 g/dL and $12.91 \times 10^{12}/L$ were obtained in packed cell volume, haemoglobin and red blood cell respectively in goats fed *P. purpureum* + *C. mucunoides*. Highest value of glucose (70.33 g/dL) was recorded in goats fed *P. purpureum* + *S. mombin*. The study concluded that the selected plants can be used to feed ruminants with no deleterious effects on goats.

Keywords: Forages, WAD Goats, Supplements, Blood parameter

Description of Problem

The world's livestock producers are having difficulties in meeting the demand for animal production due to high cost of production and this disparity has led to serious malnutrition (1). Goats play a significant role in livelihoods of the rural populace in most developing countries. Apart from serving as a vital protein source, it also provides income for meeting urgent household needs (2). The West African Dwarf (WAD) goat is the dominant breed of small ruminants and makes up to 38% of the 38million goats found in the West African humid zone (3). It is well adapted to this environment and trypanotolerant. The main feed resources of this animal are native grasses, legumes that occur naturally in grasslands, tree leaves and crop residues. Generally, the feeding pattern of this animal is characterized by the native husbandry practice whereby it scavenges for food to

meet its daily nutrient requirements (4)

In Nigeria the rearing of goats is mainly traditional and as a result, it is characterized by inadequate feeding. This has necessitated the search for non-conventional feedstuffs which are cheap and not in high demand by humans (5). One of the fastest means of ascertaining toxicity of ingested feed in animals is by assessment of the blood. The blood serves as the indicator of the health status of animals and it is the normal channel to assess the cause of an abnormality or a malfunctioning of an animal as reported by (4). The study therefore examines the blood profile of West African Dwarf goats fed some selected forages.

Materials and Methods

Location of the experiment

The experiment was carried out in the premises of Yaba College of Technology, Epe Campus, Lagos State. It is situated at

latitude 6.58°N and longitude 3.98°E. It is 42m above the sea level along Epe Ijebu-ode road on km 16. Epe lies in lowland rain forest vegetation zone within the savanna agro-ecological zone of Southwest Nigeria (6).

Experimental feed materials and sources

The selected five forage plants were harvested around the premises of the campus (Yaba College of Technology, School of Agriculture Odoragunshin Epe campus, Lagos State) and fed fresh to the animals as supplement to grass. The feed was supplied at 5% body weight and the composition of the feed is:

Diet I (Control) – Pennisetum purpureum only (100%)

Diet II – Spondias mombin (40%) and Pennisetum purpureum (60%)

Diet III – Ageratum conyzoides (40%) and Pennisetum purpureum (60%)

Diet IV – Calopogonium mucunoides (40%) and Pennisetum purpureum (60%)

Diet V - Terminalia catappa (40%) and Pennisetum purpureum (60%)

Diet VI- Dialium guineense (40%) and Pennisetum purpureum (60%)

According to (7)

Feeding and management of animals

Twenty four male growing West African dwarf bucks weighing between 11.10 – 14.20kg were randomly assigned to six dietary treatments having four replicates per diet in a completely randomized design. The pens were thoroughly washed and disinfected. Animals were de-wormed with Albendazole® 2.5% oral suspension (Anthelmintic) at 1ml/10kg body weight and treated against ectoparasites with Cypermethrin® Pour-on at 1ml/10 kg body weight before allotting them to individual pens. Weights of the animals were taken

before the commencement of the experiment and thereafter weekly to monitor weight changes during the trial. A known quantity (40%) of selected forage plants with (60%) *Pennisetum purpureum* were offered to the animals on daily basis in the morning while (100%) *Pennisetum purpureum* only was served to the control animals. Clean water was offered daily ad libitum. After two weeks adaptation period had been observed, leftover feeds were weighed every morning and discarded. Voluntary feed intake was determined as the difference between feed offered and feed refused. The period of the experiment was 84 days (12 weeks).

Haematological and serum indices

Blood sample was collected from the individual goat at the end of the experiment. 5ml of blood samples was collected from each animal before morning feeding via the jugular vein by using hypodermic syringe. Half of the blood was collected from each animal and drop in a well labelled bottle containing EDTA (Ethylene Diamine Tetra acetate) for the determination of packed cell volume (PCV), haemoglobin concentration (HB), red blood cell (RBC), and white blood cell (WBC) etc. The remaining half was emptied into a bottle containing no anti-coagulant for determination of total protein, glucose etc.

Statistical analysis

All data collected was subjected to one-way Analysis of Variance (ANOVA) while significant differences among means were compared using Duncan's Multiple Range Test (8).

Statistical model

$$Y_{ij} = \mu + T_i + \epsilon_{ij}$$

Where,

Y_{ij} = observation from animal j receiving diet i

μ = population mean

T_i= mean effect of selected browse plants
 ε_{ij}=Random residual error

Results

Haematological parameters of WAD goat fed selected forages

Effect of different selected forages on the haematological parameters of WAD goat are presented in Table 1. Significant variations (P < 0.05) were observed in PCV, Hb, RBC, WBC, neutrophil and lymphocyte whereas diets had no significant (P > 0.05) variation on monocyte. Animals fed *P. purpureum* + *C. mucunoides* recorded significant P(< 0.05) highest value of PCV (30.56%) followed by animals fed *P. purpureum* (28.17%) while the least PCV value (23.00%) was observed in animal fed

control diet (*P. purpureum*). Haemoglobin concentration value was least (9.27g/dl) in animals fed *P. purpureum* + *D. guineense* while the highest (P < 0.05) value was recorded in animals fed *P. purpureum* + *C. mucunoides*. Diet had significant (P < 0.05) influence on the RBC; animals fed *P. purpureum*+ *C. mucunoides* recorded highest (P < 0.05) RBC value of 12.91x10¹² /l. The WBC was drastically reduced in *P. purpureum* + *S. mombin* (P < 0.05) while animals fed *P. purpureum* + *D. guineense* recorded significant (P < 0.05) highest value of 11.49x10³/mL with lowest value of 31.00% for Neutrophil as well as significant (P < 0.05) highest value of 60.67% for lymphocyte.

Table 1: Effects of selected forage plants on the haematological indices of WAD goats

Parameters	<i>P.purpureum</i> only	<i>P.purpureum</i> + <i>D. guineense</i>	<i>P.purpureum</i> + <i>C. mucunoides</i>	<i>P.purpureum</i> + <i>S. mombin</i>	<i>P.purpureum</i> + <i>A. conyzoides</i>	<i>P.purpureum</i> + <i>T. catappa</i>	±SEM
PCV	23.00 ^d	25.33 ^{cd}	30.56 ^a	28.07 ^{abc}	27.55 ^{bc}	28.17 ^{ab}	0.65
Hb	9.83 ^{bc}	9.27 ^c	11.76 ^a	10.67 ^b	10.33 ^{bc}	10.08 ^{bc}	0.22
RBC	9.07 ^c	10.37 ^{bc}	12.91 ^a	9.17 ^c	9.69 ^{bc}	10.83 ^b	0.35
WBC	10.21 ^b	11.49 ^a	9.68 ^b	8.50 ^c	8.22 ^c	9.78 ^b	0.29
Eosinophil	1.10 ^a	0.50 ^b	0.50 ^b	0.11 ^b	0.50 ^b	0.56 ^b	0.09
Lymphocyte	61.00 ^a	60.00 ^a	60.67 ^a	56.67 ^{ab}	52.33 ^b	54.00 ^b	0.96
Neutrophil	34.17 ^{ab}	36.00	31.00 ^b	33.53 ^{ab}	35.67	35.39	0.54
Monocyte	0.23	0.50	0.13	0.20	0.17	0.50	0.05

^{abcd} Means along the same row with different superscripts are significantly different (P<0.05)

PCV: Packed cell volume, Hb: Haemoglobin, RBC:Red blood cell, WBC: White blood cell

SEM: Standard error of mean

Serum biochemical parameters of WAD goat fed selected forages

Serum biochemical parameters of WAD goat fed selected forages are shown in Table 2. Significant variations (P < 0.05) were observed in total protein, glucose, globulin, albumin and blood urea whereas diets had no significant (P < 0.05) influence on Creatinine and Alanine Aminotransferase (ALT). Animals fed *P. purpureum* + *A. conyzoides*

had the lowest value of total protein (59.00 mg/dL) while the highest value was observed in animals fed *P. purpureum* + *S. mombin* (67.33 mg/dL). Animals fed *P. purpureum* + *S. mombin* had significant highest value of glucose (70.33 g/dL) while glucose was drastically reduced in animals fed *P. purpureum* + *A. conyzoides*. Albumin value recorded was significantly (P < 0.05) highest in animals fed *P. purpureum* + *D. guineense*

(37.93 mg/dL) while the lowest value (31.67 mg/dl) was observed in animals fed the control diet. Globulin values ranged from 23.43 – 31.93 mg/dL in animals fed *P. purpureum* +*A. conyzoides* and *P. purpureum* + *S. mombin* respectively. Animals fed *P. purpureum* + *S. mombin* recorded significantly ($p < 0.05$) highest value of blood urea (17.37 mg/dL) while the least value was observed in animals fed *P. purpureum* + *C. mucunoides* (11.90 mg/dL). The highest value of creatinine was observed in *P. purpureum* + *A. conyzoides* (0.97

mg/dL) while the least value was observed in animals fed *P. purpureum* + *D. guineense* (0.54 mg/dL). Animals fed *P. purpureum* + *A. conyzoides* recorded the lowest value of ALT (8.67U/l) while the highest value was recorded in animals fed the control diet. Animals fed *P. purpureum* + *A. conyzoides* and *P. purpureum* + *T. catappa* both recorded significantly ($P < 0.05$) highest value of Aspartate transaminase (AST) (17.67U/l) whereas the least value was observed in animals fed *P. purpureum* + *C. mucunoides*.

Table 2: Effects of selected forage plants on the Serum chemistry of WAD goats

Parameters	<i>P.purpureum</i> <i>m</i> only	<i>P.purpureum</i> <i>m</i> + <i>D. guineense</i>	<i>P.purpureum</i> + <i>C. mucunoides</i>	<i>P.purpureum</i> + <i>S. mombin</i>	<i>P.purpureum</i> + <i>A. conyzoides</i>	<i>P.purpureum</i> + <i>T. catappa</i>	±SEM
T.Protein	61.67 ^b	61.93 ^b	66.00 ^a	67.33 ^a	59.00 ^c	61.33 ^{bc}	0.75
Glucose	55.00 ^b	49.27 ^c	66.83 ^a	70.33 ^a	44.67 ^d	51.00 ^{bc}	2.31
Globulin	30.00 ^{ab}	24.00 ^c	30.00 ^{ab}	31.93 ^a	23.43 ^c	28.00 ^b	0.81
Albumin	31.67 ^c	37.93 ^a	36.00 ^{ab}	35.40 ^{ab}	35.57 ^{ab}	33.33 ^{bc}	0.57
Blood urea	15.00 ^b	14.40 ^b	11.90 ^c	17.37 ^a	11.33 ^c	12.93 ^{bc}	0.56
Creatinine	0.82	0.54	0.70	0.93	0.97	0.81	0.07
ALT	14.21	12.67	14.00	12.33	8.67	13.23	0.76
AST	13.00 ^{ab}	13.00 ^{ab}	11.00 ^b	14.33 ^{ab}	17.67 ^a	17.67 ^a	0.78

^{abc} Means along the same row with different superscripts are significantly different ($P < 0.05$)
ALT: Alanine Aminotransferase; AST: Aspartate transaminase; SEM: Standard error of mean

Discussion

The comparison of an animal hematologic and biochemical values with a reference interval provides evidence for numerous conditions such as infection, malnutrition and stress (9). Hence, laboratory tests on blood are very vital tools to detect any deviation from the normal in the animal body (10).

The PVC in this study fell within the reported PCV normal range of 24 – 48% reported for healthy animal (11) except in goats fed with control diet. (12) reported highest PCV value of 25.5 in goats fed with graded level of dried cassava leaves which was lower to the values recorded in goats fed

with *P. Purpureum* + *C. mucunoides*, *P. purpureum*+*S. mombin*, *P. purpureum*+*A. conyzoides* and *P. purpureum*+*T. catappa*. (13) opined that PCV values for ruminants vary from breed to breed. This finding suggested that these animals have tendency for compensatory accelerated production (CAP) of PCV in case of infection and stress. Compensatory accelerated production has been shown to return PCV to normal following an infection (14). The haemoglobin concentration in the blood of the studied animals (goat) showed a similar pattern of variation observed in PCV. The same trend observed in PCV was noticed in the haemoglobin (Hb) concentration value of

goats fed with *P.purpureum* + *C.mucunoides* as the best value was recorded. The observed least value in goats fed with *P. purpureum*+*D. guineense* was higher than the values reported by (15) for goats fed treated *Jatropha curcas* kernel cake rations but fell within the reported values of in Sudan desert lambs fed untreated or urea treated groundnut hull supplemented with different protein sources (15). The haemoglobin range was however fell within the reported values for sheep fed with selected forages (16). The values of RBC counts observed in the present finding fell within the range reported by (17), (18), (19) and (20) respectively. The highest RBC counts observed in goats fed with *P. Purpureum* + *C. mucunoides* could be linked to the high iron and zinc profile of the browse forage as well as the CP content of the forage. This observation is in conformity with the report of (21) who observed that red blood cells and haemoglobin are positively correlated with protein quality and protein level in the diet and that decreased in red blood cell counts are associated with low protein deficiency in the diet.

The higher WBCs count recorded in the goats fed with *P. purpureum*+*D. guineense* may be as a result of the response of the animals to protect themselves against invading pathogens which could be resulted from secondary metabolite in the plant. Hence it is probable that the higher WBCs observed were a response to possible threat of these pathogens to the animals' immune system. This finding was corroborated with the report of (18) and (19). The values of lymphocytes which is one of the WBC precursors ranged from 52.33 – 60.67% fell within the reported mean values of 58.00 to 69.25% observed in goats fed with some leaves (20). The lymphocytes values recorded by the WAD goats in this study fell within the normal range (50 – 70%) for goats

reported by (21), but contrary to those (49.8 – 53.7 %) reported for WAD goats by (22). The variations in the lymphocytes values recorded in this study compared to those reported by the cited authors may be due to differences in diets as affirmed by (17). Lymphocytes play an important role of impacting immunity (18). Serum glucose observed in this study fell within the reported value range of (18). These values also compared favourably with the glucose value reported for Naemi sheep by (19). The blood glucose values exhibited by the WAD goats in this study were indicative of their nutrient status. (23) observed that blood glucose has been used to monitor the nutrient status in goats. The high level of serum glucose recorded in goats fed with *P. purpureum*+ *S. mombin* could be attributed to the high level of blood sugar as a result of increased digestibility of nutrients resulted in the proportion of propionate which is a major precursor of glucose that supplies about 27 – 55% of the glycogenic material as reported by (24) by so doing enough glucose is present in the system of the goats. A continuous supply of glucose is necessary as a source of energy especially for the nervous system and erythrocytes (25) below critical blood glucose concentration there is brain dysfunction which can lead to a state of coma and death. The range of serum protein observed in this finding is within 59.00 – 67.33g/dl. (26) reported range values of 6.3 – 8.5 g/100ml in WAD goats. (28) reported mean value of 4.4 g/dL in Red Sokoto goats. (27) opined that serum protein concentration at any given time is a function of hormonal balance, nutritional status, water balance and other factors affecting health. Serum protein concentration indicates the balance between anabolism and catabolism of protein in the body.

The levels of blood urea recorded in this study fell within the reference values

reported by (27). The blood urea levels in the study were within the recommended limits which suggest that the kidneys and liver in the body of the animals were functioning well. Evaluation of the blood profile of animals may give some insight as to the potentials of a dietary treatment to meet the metabolic needs of the animals. ALT and AST values were influenced by the dietary treatments though no significant variation was seen in the ALT. The AST obtained fell within the reported values of 41.05 – 59.00 by (28).

Conclusion and Applications

1. The results of the hematology and serum biochemistry of the goats fed with *C. mucunoides*, *S. mombin* and *T. catappa* revealed that the three forage plants can be used to feed ruminants with no harmful effects on goats.
2. *C. mucunoides*, *S. mombin* and *T. catappa* could be fed to ruminants without any adverse effects on the blood content at combination ratio level of 2:3

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