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HAEMATOLOGICAL AND BIOCHEMICAL INDICES OF RED SOKOTO GOAT BREED (*CAPRA AEGAGRUS HIRCUS*) FED BROWSE'S PLANTS FEED FORMULATION

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ABSTRACT

The present study investigated the effect of different browse plant feed formulations on the haematology and serum biochemical indices of Red Sokoto Goat (*Capra aegagrus hircus*) breed. Fifteen (15) growing goats of average 8.60 ± 0.50 kg body weight were randomly allocated into five dietary groups in a completely randomized designed model with three (3) animals in each group. The control (T5) group was placed on a basal diet only while the remaining four groups were supplemented with *Afzelia africana* (TAa) *Detarium microcarpum* (TDm), *Daniellia oliveri* (TDo) and *Khaya senegalensis* (TKs). The studied lasted for fourteen (14) weeks.The chemical composition of crude protein CP (12.70 - 15.70 %) was similar (P>0.05) for all the treatments.The dry matter (DM) contents of the experimental diets varied between 92.70 and 94.40%.The haematology result showed that PCV (22.53 – 28.93 %), Hb (7.51 – 9.64g/dl), RBC (9.19 – 18.77 x 10^{12}), MCV (10.64 -17.53 fl), MCH (1.24 – 2.04 pg), and MCHC (33.32 – 33.33g/dl) were not significantly affected (P>0.05) in all the dietary treatments, except for WBC (8.38 – 13.51 x 10^{9}) which were significantly affected (P<0.05) in all the treatments. The lowest mean values (22.53%, 7.51 (g/dl), 9.19 x 10^{12}, and 1.24 pg) were recorded in the control (T5) diet for PCV, Hb, RBC, and MCH, respectively, as against the supplementary diet (T1-T4) treatments. The results of the glucose, total protein, and cholesterol recorded were significantly affected (P<0.05) in all the dietary treatments except for albumin, globulin, creatinine, and urea, which were not significantly different (P>0.05) in all the dietary treatments. The highest mean values (94.08, 121.82, and 31.69) were observed in glucose, cholesterol, and urea for the control (T5), while the lowest values (3.75, 2.16, 1.58, and 1.45) were recorded in all the treatments. Overall, the results show that there were significant differences (P<0.05) for some of the parameters evaluated. These findings suggest that the dietary treatments had a notable impact on specific biochemical markers, indicating potential variations in metabolic responses.

Keywords: Browse plants, Biochemical indices, Feed formulation, Haematology, Red Sokoto Goat

INTRODUCTION

One of the many variables influencing farm animals' physiology is their diet (Durak *et al.,* 2015). Dietary intake and the efficiency of metabolic processes determine an individual's nutritional status. These is ascertainable by either or combination of molecule, anthropometric or biochemical methods (Khattab *et al.,* 2017). Feed is an important aspect of livestock production.

In recent years, feed supplements have become more and more important in animal production (Mcgrath *et al.,* 2018). Proper nutrition and the addition of feed ingredients at normal or adequate levels can increase the production of meat. (Kiran *et al.,* 2012; Musa *et al.,* 2016; Rahman *et al.,* 2018).

Goats *(Capra aegagrus hircus*) meat impart on the nutrition and healthiness of several million people in underdeveloped nations. Goat rearing offers a significant source of high biological value animal proteins as well as vital minerals and vitamins that are important in human diets (Aruwayo *et al.,* 2011; Gbolabo *et al.,* 2015).

Dietery management is the paramount concern of animal agriculture since a well fed animal can resist environmental stresses and withstand disease causative organisms. Recently, there has been a growing interest in many tropical nations in discovering potentially principal feed sources amid trees and shrubs for incorporation in ruminant animal diets. Browse plants are leguminous trees and shrubs that are commonly used as animal feed. Management appropriation of feed and other environmental assets are crucial to the development of sustainable ruminant production (Stojković *et al.,* 2014; Mohammadi *et al.,* 2015; Ellison *et al.,* 2017). Ruminants' importance as a source of food (meat and milk) leads to the rapid growth of stock raising and higher production of greenhouse gases. Research have demonstrated the type and makeup of the feed that ruminants consume may have impact on the health and animal performance (Olafadehan . and Okunade, 2016; Zaher *et al.,* 2022).

Numerous feed items, including browse plants, are given to animals without considering the potential health and physiological effects on them. Additionally, comparing blood samples and biochemical indicators with dietary intake may reveal that some nutrients in an animal's diet need adjustment or are not adequate (Mohammed and Saleh, 2018; Aksoy *et al.,* 2021).

Blood analysis plays a pivotal role in an animal physiological, nutritional, diseased state and offers the chance to perform a diagnostic evaluation of the existence of various amino acids derivative and other componenet in the body of animals. It also aids in differentiating between a state of stress, which can be physical, environmental, or nutritional. According to Onasanya *et al.,* (2015), nutritional research ought not solely concentrate on performance; it should also consider the impact on blood components, which are essential indicators of any abnormalities in the animal's body.

The components of blood are examined in order to track and assess an animal's nutritional and overall health. According to Kiran *et al.,* (2012), haematological characteristics are crucial indicators for assessing the physiological state and general health of animals and herds.The haematological components

are useful for tracking feed toxicity, particularly when it comes to feed ingredients that impact farm animals' blood profile and overall health. (Stevanović *et al.,* 2015).

A diagnosis is currently regarded as incomplete or not definitive in veterinary practices, if laboratory testing of blood constituents is not performed in concurrence with data derived from history and chemical examination. When evaluating an animal's health, Blood's biochemical and haematological is a crucial tool, as these parameters are a clear indicator of unobservable animal wellness. (Njidda *et al.,* 2014; Pradhan, 2016). Therefore, this research assessed the nutritional effects of browse plants formulated feed on haematological and biochemical parameters of Red sokoto goat breed.

MATERIALS AND METHODS

Study area

The research was conducted at the teaching and research farm of federal college of wildlife Management, New- Bussa Niger State. New-Bussa The experimental station (New Bussa) sits at 9º 53'N ,9.883º N and 4º 31'E, 4.517º E (NIPOST Archives, 2009).

Experimental animals and management

A total of fifteen growing Red Sokoto goats of average weight of 8.50±0.25 kg were used for the study. Each goat were housed in individual pen with concrete floor, furnished with drinking and feeding facilities. The goats were quarantined for fourteen (14) days and treated prior to the commencement of the experiment.against ecto parasites and endo parasites. They were allocated randomly to five dietary treatments in a totally unsystematic design. Each treatment was duplicated with three animals. The animals in last treatment (control) were served with basal diet only, while the remaining four treatments were supplemented with *Afzelia Aaricana. Detarium microcarpum, Khaya senegalensis and Daniellia oliveri,*Clean water was provided ad libitum daily.

Chemical Analyses

Crude protein (CP), Dried matter (DM), ash contents and ether extract and of diets were analyzed according to the official methods of analysis described by the (AOAC., 18th Edition, 2005) The acid detergent fibre (ADF), neutral detergent fibre (NDF), and lignin were according to Van Soest *et al.* (1991). Non-fibre carbohydrate (NFC) was estimated using the equations of Sniffen *et al.* (1992). Condensed tannins (CTs) were determined as reported by Makkar (2003)

Sample collection

After fourteen (14) weeks feeding trial,10 ml of blood were collected from jugular vein of each animal with the aid of needle and syringe. 5 ml of blood sample was dispensed into anticoagulant. bottles containing ethyl diethyl tetra acetic acid (EDTA). The bottles were slightly mixed to ensure proper mixing of the blood with EDTA without distorting the red cell and to prevent coagulation. An Automatic Fully Digital Hematology Analyzer(Auto Hematology Analyzer, 3 Parts, HEMA-

D6031, Bioevopeak Ltd, China) was used for determination of Haemoglobin, Hb (g/dl), Packed cell volume, PCV (%), red blood cell RBC ($X10^6$/µl) and white blood cell, WBC($X10^3$/µl), mean corpuscular volume (MCV) Mean corpuscular haemoglobin contents (MCHC), mean corpuscular haemoglobin (MCH)

The remaining 5 ml of blood collected were dispensed into plain bottle without anti-coagulant to harvest serum. Glucose, total protein, Albumin, Globulin,Cho;esterol. Creatinine and Urea were determined from the blood using the procedures of Stevanović *et al.,* (2015)

Statistical Analysis

Data were analyzed using one-way analysis of variance (ANOVA) of (SAS Institute, 2012) software. The data were displayed as pooled SEM and means. The differences between treatments were assessed using Duncan's multiple range test, and those differences were considered statistically significant when $P < 0.05$.

RESULTS AND DISCUSSION

The concentration of crude protein obtained in the browse plant used in this study was within the range that had been previously reported by Okunade et al. (2014) for tropical browse plants. Non-fiber carbohydrates and NDF were within the normal levels required for growing goats (Isah *et al.,* 2014; Jha *et al.,* 2019). Tannin and saponin contents in all the browse plants examined in this work are moderate for the level an animal can tolerate without any adverse effect (Okunade *et al.,* 2014). Baker *et al.,* (2021) also reported that constituent elements are subjected to wide fluctuations depending on soil and climate characteristics. These variations can significantly influence the nutritional profile of the browses, thereby affecting the overall health and growth performance of the goats.

Table 1: Chemical composition of concentrate supplemented with different browse plants

Feed formulations	Parameter							
	DM (%)	CP (%)	ASH (%)	FAT (%)	CF (%)	NDF (%)	CT (%)	Sap (%)
T1	93.10[a]	14.10[a]	8.30[b]	3.60[a]	12.60[a]	49.00[a]	3.40[a]	3.30[a]
T2	93.40[a]	16.10[a]	7.80[b]	4.30[a]	11.70[a]	44.30[b]	3.20[a]	4.20[a]
T3	92.90[a]	13.50[a]	11.50[a]	3.20[a]	14.20[a]	50.70[a]	3.30[a]	3.40[a]
T4	92.70[a]	12.70[a]	11.70[a]	3.60[a]	13.70[a]	47.80[a]	3.00[a]	4.50[a]
T5	93.20[a]	15.70[a]	6.40[b]	4.60[a]	9.10[b]	43.80[b]	0.00[b]	0.00[b]

T1 = Concentrate diet + Afzelia Africana, T2= Concentrate diet + Detarium macrocarpum, T3 = Concentrate diet + Danniellia oliveri, T4 = Concentrate diet + Khaya senegalensis, T5 = Concentrate (Control) diet

The constituent elements of the feed supplements are presented in Table 1. The crude protein (CP) (12.70 - 15.70%) was similar (P>0.05) for all the treatments. The dry matter (DM) constituents of the experimental diets varied between 92.70 and 94.40%. The mean NDF values of 50.70 and 43.80 g/100 g DM were low to moderate when compared with low-quality roughages, which ruminants can effectively degrade (Salah et al., 2014). The levels of condensed tannins recorded for all the treatments in this experiment are significantly lower than the range considered to depress feed intake, growth performance, and cidal effects (MaAllister et al., 2015).

Haematological and Biochemical indices of Red Sokoto Goat breed Fed Browse plants formualted feed diet

The hematological indices of goats fed diets supplemented with browse plants are presented in Table 2. All the

hematological parameters analyzed,such as PCV (22.53–28.93%), Hb (7.51–9.64 g/dl), RBC (9.19–18.77 x 1012), MCV (10.64–17.53 fl), MCH (1.24–2.04 pg), and MCHC (33.32–33.33 g/dl) were not significantly different (P>0.05) in all the dietary treatments, except for WBC (8.38–13.51 x 109), which were significantly affected (P<0.05) in all the treatments. The lowest values (22.53%, 7.51 (g/dl), 9.19 x 1012, and 1.24 pg) were recorded in the control (T5) diet for PCV, Hb, RBC, and MCH, respectively, as against the supplementary diet (T1-T4) treatments. Also, the highest values (17.53 fl and 13.51 x 109) were recorded in the control (T5) diet for MCV and WBC, as against the lowest values (13.67 - 15.41 and 8.38 - 10.56) recorded for the diet supplemented with browse plants (T1 - T4). All the hematology results analyzed are within the normal range value for growing goats. The results show that there were significant differences (P<0.05) for some of the parameters evaluated.

Table 2: Haematological parameters of Red Sokoto Goat breed Fed Browse plants formualted feed diet

Parameters	Normal Range	T1	T2	T3	T4	T5	SEM	P-Values
PCV (%)	22 - 38	25.03^{a}	28.93^{a}	28.93^{a}	28.37^{a}	22.53^{a}	1.06301	0.210
Hb (g/dl)	8 - 12	8.34^{a}	9.64^{a}	9.64^{a}	9.45^{a}	7.51^{a}	.35426	0.209
WBCx 10^{9}	4 -12	8.38^{a}	10.56^{a}	9.59^{a}	9.09^{a}	13.51^{b}	.56604	0.009
RBC x 10^{12}	8 - 18	16.73^{b}	18.77^{b}	17.90^{b}	17.77^{b}	9.19^{a}	1.35750	0.133
MCH (pg)	5.2 - 8.0	2.04^{a}	1.91^{a}	1.92^{a}	1.88^{a}	1.24^{a}	.134328	0.375
MCV (fl)	16 - 25	15.41^{a}	13.67^{a}	13.67^{a}	10.64^{a}	17.53^{a}	1.20825	0.527
MCHC (g/dl)	30 - 36	33.33^{a}	33.33^{a}	33.32^{a}	33.32^{a}	33.32^{a}	.00296	0.737

abc means within a row that is not having the same superscript alphabet are significantly differ, (P < 0.05)
PCV: Packed cell volume, haemoglobin: (Hb), WBC: White blood cell (WBC) counts, RBC: Red blood cell, MCH: Mean corpuscular haemoglobin, MCV: Mean corpuscular volume,MCHC: Mean corpuscular haemoglobin concentration.

The results of the effect of serum biochemical parameters of red Sokoto goats breed fed diets supplemented with browse plants is presented in Table 3. The results of the glucose, total protein and cholesterol recorded were significantly affected (P<0.05) in all the dietary treatments except for albumin, globulin, creatinine, and urea, which were not significantly different (P>0.05) in all the dietary treatments. The highest mean values (94.08, 121.82, and 31.69) were observed in glucose, cholesterol, and urea for the control (T5) diets as against the lowest values (3.75, 2.16, 1.58,and 1.45) recorded for total protein, albumin, globulin, and urea in dietary treatments (T1-T4), respectively. The total cholesterol recorded varied in value (82.75 - 92.59 mg/dl) with no significant difference in treatments T1 - T4 except T5, which showed highly significant (P < 0.05). Urea recorded parity among the dietary treatments with a range of 18.94 to 25.54 mg/dl. Glucose values with no significant reduction range from 49.56 to 59.84 mg/dl) among the dietary treatment but significantly increased (P<0.05) in the controlled diet.

Table 3; Biochnemical indices of Red Sokoto Goat breed Fed Browse plants formualted feed diet.

Parameters	Normal Range	T1	T2	T3	T4	T5	SEM	P-Values
Glucose (mg/dl)	48 – 76	49.56^{a}	57.61^{ab}	59.61^{b}	59.84^{b}	94.08^{c}	4.27581	0.001
Total Protein (g/dl)	6.0 - 7.0	5.57^{b}	5.22^{b}	5.62^{b}	4.58^{ab}	3.75^{a}	.22975	0.016
Albumin (mg/dl)	2.7 -3.9	3.66^{b}	2.97^{ab}	3.56^{b}	3.05^{ab}	2.16^{a}	.20213	0.111
Globulin (mg/dl)	2- 8.0	1.90^{a}	2.25^{a}	2.06^{a}	1.53^{a}	1.58^{a}	.11040	0.168
Cholesterol (mg/dl)	80 – 130	82.75^{a}	88.78^{a}	86.34^{a}	95.59^{a}	121.82^{b}	4.48813	0.011
Creatinine (mg/dl)	1.2- 1.9	0.90^{a}	0.89^{a}	1.13^{b}	1.17^{b}	1.45^{b}	.07297	0.066
Urea (mg/dl)	15 – 33	18.97^{a}	24.64^{ab}	25.52^{ab}	23.29^{ab}	31.69^{b}	1.53547	0.100

abc means within a row that is not having the same superscript alphabet are significantly differ, (P < 0.05)

Discussion

The amount of protein (12.70 - 16. 10%) recorded in this study was adequate and above 8.5 % required for growing goats (Olafadehan and Okunade, 2016).

The quantity of dried matter content in the diet recorded in all the treatments employed in this study was as a result of the quality of most tropical crop residues (Cui *et al.*, 2020; Millam *et al*., 2020). The analogy in some of the nutrients composition of the feeds could be due to fact that the compositions for all the treatments are the same.

The packed cell volume (PCV) measures the proportion of red blood cells in the blood, and the red blood cells (RBC) through hemoglobin (Hb) carry oxygen throughout the animal body. The values of packed cell volume (PCV) and hemoglobin concentration reported in this study were within the normal range (22-38% PCV and 8-12 g/dl) as reported by Aksoy et al. (2021), which also agreed with Rahman et al. (2018) but disagreed with values of 38-45% reported by Hendawy et al. (2020), when supplementing herbal plant to pregnant ewe. The continued increase in WBC observed in this study could be attributed to the ability of the body to fight infections, defend the body by phagocytosis against invasion by foreign substances (Olatunde et al., 2021). The RBC values recorded in this present study (9.19 -18.77 g/dl) were within the normal range which indicated that the goats remained evidently in sound health throughout the investigation regardless of nutritional supplement since normal red blood cells have been associated with absence of haemolytic anaemia, depression of erythropoiesis and is similar to the report of Gbolabo, et al. (2015) who reported a range of 10-18 ×1012 g/L in small ruminants. The MCH, MCV, MCHC values reported in this study were not significantly influence

among the dietry treaments which could be attributed to the improved intake and digestibility close to those of some other studies reported by (Mohammed and Saleh, 2018; Zaher et al., 2022). This discrepancy may be attributed to variations in the sample population or methodologies employed in the studies. The results of glucose, total protein, and cholesterol obtained in the present study were in line with those of Zaher *et al.*, (2022), who stated that feeding weaned baladi goat kids rations consisting of 60% concentrate feed mixture + 20% clover hay + 20% Spanish panicum mombasa improved ($P<0.05$) the serum protein, albumin, and A/G ratio. The highest mean value observed in glucose, cholesterol, and urea was in agreement with those reported by *Aruwayo et al.*, (2015). The albumin, globulin, creatinine, and urea recorded with no significant difference in the dietary treatments were within the normal range and in agreement with the report of Zaher *et al.*, (2022). Who reported no significant difference among different dietary supplements of goats fed with Mombasa and blue panic as salt-tolerant alternatives to alfalfa under arid conditions? The goats remained apparently in good health throughout the experiment irrespective of dietary treatments.

CONCLUSION

It was evident from this study that browse plant feed formulation fed to goats maintained them in good health throughout the experiment, as the values obtained were within the range of values reported for goats in northern Nigeria. Browse plant feed formulation diet achieved an overall better health performance in goats than feeding diet without supplementation. From the present study, it can be concluded that the hematological and biochemical parameters for goats studied in this experiment fall within the recommended limit. Consequently, tactical browse plant supplementation of diet feed in goats may be more economical as feed additional nutrients without reservation on the health of the ruminant animals. These findings suggest that while most dietary treatments did not lead to significant changes in cholesterol and glucose levels, the controlled diet demonstrated a marked improvement. Further investigation may be needed to understand the mechanisms behind these variations and their implications for overall health.

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