ISSN: 3448 - 4906
Volume 12, Number 3, 2025
International Journal of Innovations in Biological Sciences

EFFECTS OF *CYATHUS STERCOREUS* - TREATED *BALANITE AEGYTIACA* SEED MEAL ON HAEMATOLOGICAL INDICES AND SERUM BIOCHEMICAL PARAMETERS OF SAHELIAN BUCKS

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ABSTRACT

The study investigated the effect *Cyathus stercoreus* treated, biodegradable *Balanite aegytiaca* seed meal (TBSM) and groundnut cake (GNC) on haematology and serum biochemistry parameters of Sahelian bucks (SBs). Five dietary treatments were formulated as follows: control diet (T1) 0:100, 25:75 (T2), 50:50 (T3), and 75:25 (T4) and 100:0% TBMS:GNC. A 2.5 g of *Cyathus stercoreus* was added to 1 kg of ground *Balanite aegyptiaca* seed after been dissolved in 1 L of water. Thirty (30) healthy SBs weighing 10.93 ± 0.51 kg of body weight (BW) and aged 7 to 8 months were assigned to five treatments. This was replicated six times in a completely randomized design (CRD). The experiment lasted for 120 days, the animals were given the same amount of feed two times a day, at 7:00 and 12:00. Water was offered *Adlibithum*. The animals' initial weights were determined prior to the commencement of the experiment. At the end of the experimental period, blood samples were collected for haematology and serum biochemistry analysis. Parameters determined were proximate compositions of the experimental dies, haematology and serum biochemical indices. Haematological parameters determined were packed cell volume (PCV), Haemoglobin (Hgb), Red blood cell counts (RBC) and White blood cell counts (WBC). Serum biochemical parameters were Blood protein, Albumen, Globulin, Glucose Blood urea nitrogen, ALT and AST. Data obtained were subjected to Analysis of Variance. Results showed that PCV, HGB, RBC, WBC, MCHC, MCH and MCV ranged from 17.00 –24.90 %, 6.87 – 8.61 g/dl, 2.47 – 2.27, 10.35 $x10^6mm^{-1}$ – 19.07 $x10^6mm^{-1}$, 32.80 – 41.50 g/dl, 38.00- 48.20g and 101.45 – 118.85 fL, respectively. The blood indices (MCV, MCH and MCHC), were within the normal ranges indicating that the goats were not anaemic. Thus, the haematological and serum metabolites were within the established ranges for healthy goats suggesting that tannin concentration of *Cyathus stercoreus* treated, biodegradable *Balanite aegytiaca* seed meal were well tolerated by the goats. It was therefore, concluded that the feeding of the *Cyathus stercoreus* treated, biodegradable *Balanite aegytiaca* seed meal did not cause any major health disorders. The experimental diets are therefore recommended for fattening of goats.

Keywords: Haematology, Serum, Balanite aegyptiaca, Cyathus stercoreus Sahelian bucks, groundnut cake

Introduction

Feed is the main factor restricting livestock productivity, particularly in developing nations. This has forced researchers to look for readily available and affordable feed sources for goats such as agricultural wastes and agroindustrial by-products (FAOSTAT, 2023). Balanites aegyptiaca, a tree commonly found in arid and semi-arid regions, has been recognized for its potential as a feed ingredients due to its nutritional composition including protein and fiber content (Adamou and Kabir, 2018). *Cyathus stercoreus*, a fungus capable of biodegrading plant materials has been explored for its ability to enhanced the nutritional value of feed ingredients (Kabir and Bama, 2018) In Nigeria, ruminants depends largely on crop residues at least during the long dry period of the year for maintenance as well as production of meat, milk and skin. Blood is an important index of physiological and pathological changes in an organism (Mitruka and Rawnshey, 2007). The primary

function of the blood is to transport oxygen from respiratory organs to body cells (Duke, 2005) distributing nutrients and enzymes to cells and carrying away waste products (Jan *et al.*, 2015) thereby maintaining homeostasis of the internal environment (Bentrick, 2004). The various functions of the blood are carried out by the individual and collective actions of its constituents–the haematological and biochemical components (Akinmutimi, 2004). Haematological tests have been widely used for the diagnosis of various diseases and nutritional status of animal. The information gained from the blood parameters substantiate the physical examination and together with medical history provide excellent basis for medical judgment (Schalm *et al.*, 2005). In addition, it would help determine the extent of tissue and organ damage, the response of defense mechanism of the patient and aid in diagnosing the type of possible anemia (Schalm, 2005). Various physical, chemical and biological treatments have been used to improve utilization of low quality forages such as crop residues (Abebe, Merkel, Animut, Sahlu and Goestch, 2004). The fact that availability and benefits of this crop are numerous, it is still under-utilized. Thus, this study was aimed at determining the effects of feeding growing sahelian bucks on on haematological and serum biochemical indices with the diets containing treated *Balanites aegyptiaca* seed at graded levels.

MATERIALS AND METHODS

Study area

The study was conducted at Federal University, Gashua, Yobe State in Nigeria's Ruminant Unit of the Teaching and Research Farm of the Department of Animal Science. March and April are the hottest months, with average highs of 38 - 41.5°C, and June through September is considered the rainy season. With an average yearly rainfall ranging between 500 to 1000mm.

Treatment *Balanites aegyptiaca* seed with *Cyathus stercoreus*

Balanite aegyptiaca seeds (BS) were sourced from Garin Alkali Livestock Market of Yobe state, Nigeria. Subsequently, in accordance with the protocols of Musa, de Evan, Alao, Iglesias, Escribano, and Carro, (2020), a 1 L mixture of water with 2.5g *Cyathus stercoreus* was prepared and then added to 1 kg of *Balanite aegyptiaca* seed. Thereafter, the whole mixture was packaged to produce hemertic seal within thick polythene bags, it was sealed tightly, and was squeezed to remove and minimize air. To prevent the accumulation of volatile ammonia gas, the silage was opened and allowed to aerate overnight in the shade following 10 days of ensiling (Olafadehan *et al.*, 2016).

Measurement, source and formulation of experimental diets

Five test diets were compounded and labelled as T_1, T_2, T_3, $T_{4 \text{ and } T5}$. The five dietary treatments included the control diet containing 0% TBSM (T1) and the biodegradable TBSM at varying percentage ratios of 25:75 (T2), 50:50 (T3), 75:25 (T4) and 0:100 (T5) g/kg of dry matter (DM). T1 was a typical diet without TBSM. The meal was given to each animal at a proportion of 5% of their body weight. The *Cyathus stercoreus* and dried cassava peels were acquired from a private farm in Katagum town of Zaki L.G.A and other feed components were purchased from the Gashua Agro-commodity market in Yobe State. *Table 1* presents the experimental diets in g/1,000g.

Experimental procedure, design and management of experimental animals

The experiment was conducted between April and August with a temperature range of 33-41.5°C with a rainfall of 500 to 1000mm and a relative humidity of 25-35%, respectively (CLIMATEMP, 2020).

For the study, thirty (30) Sahelian Bucks in good health and weighing 10.93 ± 0.51 kg of body weight (BW) were bought at the Garin-alkali market in Gashua, Yobe State. Following a veterinarian examination, the animals were divided into five nutritional groups using a completely randomized design (CRD), with six replicates for each treatment. Two bucks served as an experimental unit. To protect them from harsh weather, each animal was kept individually in a 1.2 m × 0.9 m open-sided ruminant pen that had good ventilation. Two weeks prior to the experiment, the experimental bucks

received antibiotic treatments (ivermectin at 1 mL/50 kg of BW and oxytetracycline at 1 mL/10 kg of BW). The total mixed ration (TMR) provided to the animals was around 600 g per day per head (DM) at 5% of their BW. The animals were given the same amount of feed two times a day, at 7:00 and 12:00. Water was offered *Adlibithum*. The animals' initial weights were determined prior to the commencement of the experiment.
Weekly weight measurements were then recorded. Every day, the ort was removed and weighed before new feed was given. The feed conversion ratio, was calculated. After a two-week preliminary adaption period, the experiment was conducted for 120 days.

Chemical analysis
Samples from the five experimental diets consisting of TBSM and GNC were brought to the lab and were dried individually in an air-draft oven at 60°C for 96 hours. The samples were then ground separately in a Wiley mill, were passed through a 1 mm sieve, and were sampled for chemical analysis using the Association of Official Analytical Chemists' standard procedures (AOAC, 2006). Three copies of each analysis were completed. The samples were oven-dried for 24 hours at 100°C for assessment of the dry matter content. The Ankom fibre analyser was used to perform fibre fraction analysis, including neutral detergent fibre (NDF), acid detergent fibre (ADF), and acid detergent lignin (ADL), as reported by Van Soest *et al.* (1991).

Parameters determined
Parameters determined were proximate compositions of the experimental diets, haematology and serum biochemical indices. Haematological parameters determined were packed cell volume (PCV), Haemoglobin (Hb), Red blood cell counts (RBC) and White blood cell counts (WBC) among others. Serum biochemical parameters were Blood protein, Albumin, Globulin, Glucose Blood urea nitrogen, ALT and AST. Ten (10) mls of blood samples were collected from two bucks in each treatment using sterile syringe and needle and then sent to haematology laboratory for haematological studies and chemical pathology laboratory for biochemical analysis in ATBUTH Bauchi. The blood samples were drawn from the jugular veins after restraining the animals. Three (3) mls of the blood was placed in a sterile sample bottle containing Ethylene Diamine Tetracetic acid (EDTA) for haematological studies and the remaining 7mls (without anticoagulant) was used for blood chemistry (serum metabolites) determination.

Haematological indices determination
The haematological parameters determined were packed cell volume (PCV), Red blood cell counts (RBC) and White blood cell counts (WBC) which were determined as described by Coles, (1986). Haemaglobin content was determined by cyanmthaemoglobin method (Coles, 1986).

Serum chemistry analysis
Blood urea concentration was determined by Nessler reaction (Tanis and Naylor, 1986). Serum total protein was estimated by the Biurret method as described by Nicole and Allen, (1985). Albumin was estimated by Bromo cresol green (BCG) method (Peter *et al*., 1982) whereas globulin concentration was determined by difference between total protein and albumin. Blood glucose was determined by glucose oxidase method (Stone, 1954). Serum enzymes; Alanine transaminase (ALT) and Aspartate transaminase (AST) were determined according to the methods of Reitman and Olafadehan, 2011) and the metabolites (urea and Creatinine) were determined as described by Eun *et al*., (2009). Mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentrations (MCHC) were calculated from packed cell volume, haemoglobin concentration and red blood cells values as described by Reitman and Olafadehan, 2011.

Table 1: Gross Composition of Experimental Diets

Ingredients (%)	T1 (0%)	T2 (25%	T3 (50%)	T4 (75%)	T5 (100%)
Cassava peel	200	200	200	200	200
Groundnut haulm	150	150	150	150	150
Wheat offal	180	180	180	180	180
Groundnut cake	200	150	100	50	00
Balanites aegyptiaca meal	00	50	100	150	200
Rice husk	240	240	240	240	240
Sulphur	10	10	10	10	10
Bone meal	10	10	10	10	10
Salt	5	5	5	5	5
Ruminant Premix	5	5	5	5	5
Total	**1000**	**1000**	**1000**	**1000**	**1000**

Data Analysis

Data obtained were subjected to Analysis of Variance (ANOVA) using JMP version 14 (2007). The significant differences occurred among means, Duncan Multiple Range Test (Duncan, 1955) was used to separate them.

RESULTS AND DISCUSSION

The blood biochemical profile and levels of serum enzymes of the experimental bucks are presented in (Table 2 and 3) respectively. Haematology of the goats indicated that the PCV, HGB, RBC, WBC, MCHC, MCH and MCV ranged from17.00 –24.90 %, 6.87 – 8.61 g/dl, 2.47 – 2.27, 10.35 $x10^6mm^{-1}$ – 19.07 $x10^6mm^{-1}$, 32.80 – 41.50 g/dl, 38.00- 48.20g and 101.45 – 118.85 um^{-3}, respectively. The fact that the blood indices (MCV, MCH and MCHC), which are important for diagnosis of anaemia inamost animals (Coles, 1986), were within the normal ranges indicating that the goats were not anaemic.

The mean level of total serum protein ranged from 5.81 to 6.64g/dl across treatments. There was no significant ($P>0.05$) difference among treatment means. Albumin ranged from 2.27 to 3.46g/dl which differed ($P<0.05$) significantly across treatments. The mean globulin contents ranged from 2.43 to 3.18g/dl which also differed ($P<0.05$) significantly across treatments. The mean haemoglobin level of the experimental animals was within the normal range (8–12 g/dl) as reported by Kaneko et al. (1997) for goats. This suggested that the general health of all experimental goats in the present study remained optimum. Blood urea nitrogen (BUN) levels are an indicator of protein nutrition status of the animal (Baker *et al.*, 1995). The values of the BUN which ranged from 2.55 to .3.50mg/dl some were within the normal range (3.6- 7.1 mg/dl) for goats. Blood urea nitrogen levels are similar to that reported by Jan et al. (2015). Protein digestion in ruminants results in unused ruminal ammonia being transported to the liver via the portal blood where it is converted to urea. This together with urea from deamination of amino acids arising from post-ruminal digestion and systemic protein turnover then circulates in the blood (Hammond and Chase, 1996).

This also suggests that the energy and protein intakes of experimental animals were sufficient to maintain body weight and to prevent muscle breakdown. Reduction in the values of PCV and Hb may indicate a low protein intake, liver damage or anaemia. Haemaglobin falls gradually in animals on a low protein intake, parasitological infestation or liver damage (Linsday, 2007).

Table 2: Serum Biochemical Parameters

	TREATMENTS					
PARAMETERS	T1	T2	T3	T4	T5	SEM
Total Protein	5.81	5.46	6.04	6.01	6.64	0.48 NS
Albumin	2.74^{c}	3.03^{bc}	2.84^{c}	3.26^{a}	3.46^{a}	0.20**
Glucose	5.15	5.42	5.20	5.46	5.50	0.22 NS
Globulin	3.07	2.43	3.20	2.75	3.18	0.51**
Blood Urea	3.30^{b}	3.10^{bc}	2.55^{c}	2.79^{c}	3.50^{a}	0.18**
AST	5.92	5.82	5.66	5.38	6.10	0.60 NS
ALT	4.06^{d}	6.19^{b}	5.63^{c}	6.43^{a}	6.60^{a}	0.51**

^{abcd}Means with different superscript within row differs significantly (P<0.05), NS = Not significant, SEM = Standard Error of Mean

Table 3: Haematological Parameters

	TREATMENTS					
Parameters	T1	T2	T3	T4	T5	SEM
WBC(g/dl)	10.35^{d}	13.15^{c}	19.07^{a}	15.10^{b}	17.03	1.08*
RBC(X10^{6}mm^{-1})	1.83^{b}	2.33^{a}	2.27^{a}	2.47^{b}	2.44	0.14*
HGB(g/dl)	8.15^{a}	8.61^{a}	8.45^{a}	7.32^{b}	6.87^{c}	0.40*
PCV (%)	23.20^{b}	24.90^{a}	25.75^{a}	17.00^{d}	18.05^{c}	1.50*
MCV(um$^{-3)}$	118.85^{a}	113.60^{b}	115.85^{b}	101.45^{c}	103.53^{c}	1.44*
MCH(pg)	48.20^{a}	38.00^{c}	39.30^{c}	40.55^{b}	41.61^{b}	2.11*
MCHC(%)	41.50^{a}	36.05^{c}	32.80^{b}	39.65^{b}	40.13^{a}	1.68*
LYM(%)	66.25^{a}	56.65^{a}	51.40^{b}	49.87^{c}	48.50^{c}	2.52*

^{abcd}Means with different superscript within row differs significantly (P<0.05), NS = Not significant, SEM = Standard Error of Mean

CONCLUSION

From the research findings, the absence of clinical signs of ill health as a result of tannin toxicity symptoms and the findings of the haematological and serum metabolites within the established ranges for healthy goats suggest that tannin concentration of *Cyathus stercoreus* were well tolerated by the goats. Therefore, it is concluded that the feeding of the *Cyathus stercoreus* -treated *Balanite aegyptiaca* seed meal have no any major health problem to the Sahelian bucks. The experimental diets are therefore recommended for use as feed for small ruminants.

Acknowledgement

We Acknowledged the effort of TETFUND towards making this research a reality and a success which will bridge a serious gap in animal nuitrition for a sustainable agriculture.

Authors' declaration

We declared that this study is an original research by our research team and we agree to publish in the journal.

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