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Haematological and Serum Biochemical Profiles of Red Sokoto Goats Fed Baobad (*Adansonia digitata*) Seed Meal Based Diets

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Abstract:

Objectives: The objective of the study was to investigate the haematological and serum biochemical indices of Red Sokoto goats fed diets containing graded levels of cooked Baobad (Adansonia digitata) seed meal.

Methods: Sixteen growing Red Sokoto goats aged between 7 to 9 months, with a weight range of 6.8 - 7.5Kg were randomly allotted into four (4) treatments of 4 goats each. Four concentrate diets were formulated containing 0, 5, 10, and 15 % baobad seed meal.The goats were fed 500g Digitaria horizontalis (Crab grass) at 8 AM , followed 1 hour later with the concentrate at 200g/goat/day. On the last day of the experiment blood samples were taken from the jugular vein of the goats for haematological and serum biochemical analysis Samples of the concentrate diets and crab grass were analysed for their proximate composition using the methods outlined by AOAC, (2000), Data were analysed using, SPSS, version 23, (2015), treatment means that were significant were separated using least significant difference (LSD) contained in the same statistical package. The experiment was conducted at the Small Ruminants Unit of the Livestock Teaching and Research farm, Federal College of Horticulture, Dadin Kowa, Gombe state, Nigeria for a period of 63 days after an adjustment period of 7 days.

Results: Heamatological and serum biochemical values fell within recommended values for growing goats. The haemoglobin concentration (Hb) values fell between 3.50 – 6.43g/dl and showed significant ($p<0.05$) difference. The PCV values ranged between 9.10 – 17.23% and there were significanct ($p<0.05$) differences across the treatments. The haematological values were generally better than that of the control. The total protein value in this study ranged from 38.33 – 40.57g/dl and were significantly ($p<0.05$) different, the urea levels of the experimental animals were significant ($p<0.05$), the values ranged from 3.50 – 4.17 mmol/dl.

Conclusions: It was concluded that inclusion of baobad seed meal in supplement diets for Red Sokoto goats up to 15% level of inclusion had no adverse effects on the haematological and serum biochemical profiles of the goats and infact improved some haematological values of the experimental goats, Further research using other breeds of goats as well as other species of ruminants such as sheep and cattle is recommended .Further research should also explore other processing methods for Baobad seeds.

Keywords: *Haematology; Serum Biochemistry; Red Sokoto Goats; Boabad Seed Meal; Crab Grass.*

1 Introduction

There has been an increased competition for feed ingredients that are used in manufacturing animal feed since some of these ingredients are also used as human food (Gadzirayi *et al.*, 2012). Hence, there is need to seek alternatives that are readily available, safe, nutritionally adequate and at the same time not in direct use by man (Ocheja *et al*., 2023; Oyibo *et al*., 2020; Oloche *et al.*, 2019) Some multipurpose trees have nutritional properties that can be beneficial if incorporated in livestock feed. Utilising some of these properties to their full potential can result in sustainable livestock production (Melesse *et al.*, 2011). One such example is the baobab tree it has been used for many traditional purposes. Ocheja *et al* (2023)reported that the production of meat and milk by ruminants require high levels of protein and energy , which are the two most expensive feed nutrients/components (Ocheja , 2020) . High levels of protein and energy are also needed for the production of by products such as skin, fats, fibre etc (Abalaka *et al*,.2021).

A readily available and fast means of assessing animals on a feeding trial may be the use of blood sample analysis (Olabanji, *et al*., 2007). It is therefore important to evaluate blood parameters particularly when unconventional feeds are feed to animals in order to determine the performance of such animals and the suitability and safety of such feeds on the species of livestock that is being fed (Babatunde., *et al* 1992).

The high cost of conventional protein sources has made their incorporation in ruminant diets uneconomical, hence the increased focus on their replacement with unconventional sources by researchers. (Ocheja *et al* 2021).

Use of less popular protein sources such as baobab seed has been reported to give lower cost/kg weight gain (Ikyume *et al* 2018).

Baobad tree *(Adansonia digitata*) is a drought and fire-resistant tree that is found in most parts of Africa, including the deserts, FAO (2019). It is an indigenous leguminous plant that is cheap, readily available in the northern parts of Nigeria and its products are utilized for nutritional and medicinal purposes (Nkafamiya, *et al* 2007). Therefore, its utilization could probably help solve the problem of feed shortages especially in the critical period of the year (long dry season)

The study was designed to evaluate the heamatological and serum biochemical indices of Red Sokoto Goats fed diets containing graded levels of cooked baobad (*Adonsonia digitata)* seed meal as a feed resource for Red Sokoto goats.

2 Materials and Methods

2.1 Experimental site

The study was conducted at the Livestock Unit, Teaching and Research farm of Federal College of Horticulture, Dadin-kowa, Gombe State, Nigeria.

Dadin-kowa, Yamaltu-Deba Local Government Area is located in the Savannah zone of North- Eastern Nigeria, on latitude 11^0.30N and longitude 100^0 20E and on altitude of 240m above sea level (GPS, 2015), The area is characterized by short rainy season (4-5 months) with annual rainfall of 760mm to 1100mm, and long dry season (6-7 months). The ambient temperature could be as low as 24^0C during the dry cold season (October-January) and as high as 44^0C during the dry hot season (February-May) (UBRBDA, 2022).

2.2 Experimental Animals

A total of sixteen (16) red Sokoto goats aged between 7-9 months with an average weight range of 6.8 to 7.5kg, was used. The animals were purchased within Dadin kowa, kwadon and kuri town markets, and randomly allocated into four (4) treatments and each treatment was replicated 4 times. The animals were treated with Ivermectin for endo and ecto parasites control at 0.3ml each and oxytetracycline, hydrochloride and procaine penicillin at 2.0ml each to take care of scouring and nasal discharge and to provide a common health status.

2.3 Procurement, Processing of Baobab Seed and Experimental Feed

The Baobab seed was purchased from Dadinkowa and kuri town markets of Yamaltu-Deba LGA of Gombe state. The seeds were washed with clean water and cooked in hot water at 100 degree Celsius for 1 hour and sun dried, ground into meals using a milling machine, and used to replace groundnut cake at varying inclusion levels. Concentrate diet contained Maize offal (MO), Rice offal (RO), Groundnut cake (GNC), Egg shell meal (ESM), wood ash (Ash), Common salt and Cooked baobab seed meal, at different inclusion levels respectively.

2.4 Experimental Procedure

The goats were weighed on arrival and randomly distributed into four (4) treatment groups, each

treatment had four (4) goats, and each goat was served 500g of forage at 8:00am followed by the concentrate at 200g/day at 02:00pm. Forages was tied in small bundles and suspended from the top of each compartment within the reach of the animals. This reduced feed wastage and encouraged intake by the animals. The concentrate and the forages offered to the goats were weighed daily and the left over was also weighed and subtracted from the quantity of feed that was served to determine the feed intake of the animals. The experiment lased for sixty-three (63) days (9 weeks) after two weeks of adjustment period.

Table 1: Composition of Experimental Diets

INGREDIENT	Treatment			
	1(0%)	2(5%)	3(10%)	4(15%)
Maize offal	50.00	50.00	50.00	50.00
Rice bran	17.00	17.00	17.00	17.00
Groundnut cake	30.00	25.00	20.00	15.00
Cooked baobab seed	0.00	5.00	10.00	15.00
Egg shell Meal	2.00	2.00	2.00	2.00
Wood ash	0.50	0.50	0.50	0.50
Table salt	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Calculated	Nutrient	Content		
Crude protein	17.57	17.64	17.60	17.58
Fiber	13.5	14.0	14.50	15.00
Metabolisable energy (ME kcal/kg Diet)	2,840.71	2,829.04	2,817.37	2,805.70

2.5 Data Collection

2.5.1 Feed Intake

Feed intake of the experimental animals was obtained by weighing the quantities of supplemental concentrate and *digitaria horizantalis* (crab grass) offered daily at 08:00am and at 02:00pm respectively, the leftover was weighed to obtain the voluntary feed intake by subtracting the left over from the initial feed given.

2.6 Blood Sample Collection

At the end of experiment, two sets of 5ml blood samples were collected in a sample bottle from each buck via the jugular vein. One set of the sample bottle contained ethylene diamine tetra acetic acid (EDTA) for haemotological analysis while a plain sample bottle was used for determination of serum biochemical indices.

Haemotological parameters determined were: Packed Cell Volume (PCV),Haemoglobin Concentration (Hb), Red Blood Cell (RBC), White blood cell (WBC), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Neutrophils and Lymphocyte. While Serum biochemical indices determined were: Total protein, Glucose, Akaline Phosphate, Urea, and Cretanine. (Ewuola, *et al*., 2020).

2.7 Chemical Analysis

Samples of the Baobab seed meal, concentrate diets, forages and feaces were analyzed for their proximate composition according to the method of AOAC (2000).

The fibre was further analysed into its components (Hemicellulose, cellulose, lignin, Acid detergent fibre, Acid detergent lignin, Neutral detergent fibre) using the methods of Van (Soest *et al*., 1991).

2.8 Experimental design and Statistical Analysis

The experimental design was complete randomized design (CRD). Data obtained from the study were subjected to a one-way analysis of variance (ANOVA) using SPSS version 23(2015), and treatment means that were significantly different were separated using least significant difference (LSD) using the same statistical package.

3 Results and Discussion

3.1 Proximate composition and fiber fractions of the concentrate diets, Baobad seed Meal and Crab Grass

The proximate composition and fiber fractions of the concentrate diets, Baobad seed Meal and Crab Grass are summarized in Table 2. The concentrate diet had similar crude protein and energy values across the treatments (Iso-nitrogenous and Iso-Caloric). Crude Protein content of about 17% was adequate for growing goats in the tropics and also above the critical crude protein requirement of 8% reported by Lakpini *et al.,* 2002. Crude fibre content of the concentrate and test ingredient was

within the range of 12.68 % to 14.90 % across the treatments which is similar to 12% crude fibre recommended for different physiological stages, maintenance, pregnancy, lactation and growth.

Ether extract values were 3.07, 3.48 and 3.53% for T2, T3 and T4 respectively and were within the recommended values reported by Maithison *et al.*, 1997. Hemicellulose values ranged between 12.20 - 13.57 % across the treatments, including the test ingredient. Acid detergent fibre (ADF) and nutrient detergent fibre (NDF) ranged between 17.25 - 18.05% and 29.10 - 30.41 across the treatments. All the above values did not follow any particular pattern.

Table 2: Proximate Composition, Fiber Fractions of Experimental Diest and Boabad Seed Meal

NUTRIENT (%)	Treatment				
	1(0%)	2(5%)	3(10%)	4(15%)	CBS
Crude protein	17.58	17.02	17.51	17.57	18.28
Crude fiber	12.68	13.50	14.00	14.90	13.92
Nitrogen free extracts	74.90	73.61	79.66	70.74	77.50
Ether extracts	1.74	3.07	3.48	3.53	0.77
Ash	11.05	11.40	11.91	11.70	6.88
Dry matter	90.48	91.47	92.56	89.95	90.43
Moisture	9.57	8.53	7.44	10.05	9.57
Carbohydrate	62.22	62.12	68.88	62.82	63.58
Acid detergent fiber	17.25	18.05	17.58	17.50	17.45
Neutral detergent fiber	30.41	30.20	29.10	29.37	30.06
Cellulose	10.31	10.52	10.41	10.43	11.04
Hemicellulose	13.57	12.45	12.20	12.35	13.17
Lignin	6.20	6.22	.6.35	6.40	6.54

CBS = Cooked Baobab Seed Meals.

The haematological parameters of Red Sokoto goat fed cooked baobab seed meals are presented in Table 3: The haemoglobin concentration (Hb) values ranged between 3.50 – 6.43g/dl and showed significant ($p<0.05$) difference. The haemoglobin concentration (Hb) at 5, 10, and 15% levels of inclusion were 6.43, 5.45, and 5.33 g/dl respectively, were higher than the control at 0% (3.50g/dl). The baobab seed have been reported to be rich in iron (Chisoro *et al.*, 2017) this may have positively influenced the haemoglobin concentration (Hb) values of the bucks fed cooked baobab seed meals. The Hb values fell within the reference range of (5.0 – 15g/dl) reported by (Daramola *et al*., 2005) Reported values were lower than 8.55 – 12.58g/dl reported by (Okunlola *et al.*, 2012) for Red Sokoto goats fed baobab (*Adansonia digitata*) fruit meal supplement and also lower than 8.38 – 9.42g/dl reported by (Oloche *et al* ., 2019) for kano brown goat fed *Gmelina arborea* leaves and supplemented with diets containing water soaked sweet orange peels. Moderately higher Hb values of 11.28 – 12.78g/dl observed for red sokoto goat fed diet containing varying levels of yam peel meals with *Ficus polita* leaves as basal diet was reported by (Oloche *et al* 2018).

The PCV values range between 9.10 – 17.23% and there were significanct ($p<0.05$) differences across the treatments. The PCV values at 5, 10, and 15 % inclusion levels were slightly higher than the control (0 % inclusion levels). Baobab seed meals was observed to improve the PCV of the animals on the treatment with CBSM. PCV of the experimental animals were slightly within normal reference values of 10 – 18%, reported by (Daramola *et al*., 2005) for West African dwarf goat fed baobab seed meals supplement and also within 10- 22% reported by (Thomas *et a*l 2008). However (Oloche *et al*., 2019) reported higher value of 33.75 – 37.50% for red sokoto goat fed diet containing varying levels of yam peel meal with *ficus polita* leaves as a basal diets.

Defense of the body against invasion by pathogens and foreign bodies are the major function of WBC, therefore animals with very low WBC are usually exposed to higher risk of disease infection but those with normal WBC count are capable of generating antibodies in the processs of phagocytosis and more capable of fighting diseases (Soetan *et al*., 2013). WBC values for this study ranged from 12.90 – 22.83 ($X10^3U/L$) and significantly ($p<0.05$) different across the treatments, not withstanding observed value were similar with 12.50 – 22.83($X10^3U/L$) reported by Daramola *et al* (2005) for West African dwarf goat. This suggested that cooked baobab seed meals did not have any adverse effect on the blood of the experimental animals. Lower WBC Values of 5.30 – 7.40 ($X10^3U/L$) for West African dwarf goat fed complete diets containing graded levels of sweet orange peel meals was reported by Plumb *et al.*, 1999). The MCHC were between 42.73 - 51.87 g/dl and within the normal range of 30.00-56.00 g/dl reported by (Plumb *et al*., 1999) for healthy goats

(Okunlola., 2012) and comparable to 33.33-33.55 g/dl for Red Sokoto goats fed baobab fruit meal. Observed PCV, Hb and MCHC values of bucks' feed CBSM meal were within normal reference values implying that the presence of the test ingredient in the diets did not induce anaemia in the experimental animals. Neutrophils counts range from 0.00 - 5.20% and within the normal reference range reported by (Daramola *et al*., 2005) for healthy goats. High neutrophils (neutrophilia) indicate the presence of microbial infection. The normal neutrophils values observed in this study show that the CBSM did not compromise any immunity of the animals.

Table 3: Effect of Feeding Graded Levels of Cooked Baobab *(Adonsonia digitata)* Seed Meals on Haematological Parameters of Red Sokoto Goat

PARAMETERS	Treatment				
	1	2	3	4	SEM
HaemoglobinConc (g/dl)	3.50^{c}	6.43^{a}	5.47^{b}	5.33^{b}	0.19
Packed Cell Volume (%)	9.10^{b}	17.23^{a}	16.23^{a}	16.07^{a}	0.12
Red Blood Cell (X10^{12}/L)	1.49^{a}	1.30^{b}	1.33^{b}	0.77^{c}	0.04
White Blood Cell (X10^{3}/L)	14.27^{b}	14.81^{b}	22.83^{a}	12.90^{c}	0.06
Mean Corpuscular Haemoglobin (pg)	46.30^{b}	43.57^{c}	51.87^{a}	42.73^{c}	0.09
Mean Corpuscular Volume (Fi)	41.54	41.53	41.10	40.07	0.29
Neutrophils (%)	0.00^{c}	0.00^{c}	2.80^{b}	5.20^{a}	0.08
Lymphocyte (%)	100.0^{a}	100.0^{a}	97.77^{b}	94.97^{c}	0.21

a,b,c= Means on the same row with different superscripts differ significantly (P<0.05).
SEM = Standard error of the Means.

The serum biochemical profile of the goat fed experimental diet are presented in Table 4: significant (p<0.05) difference across the treatments was observed in urea, alkaline phosphate, total protein, random glucose and creatinine. However, the value for alkaline phosphate ranged from 68.13 – 367.33 and were significantly (p<0.05) different. All other biochemical parameters were within normal range reported by Blood *et al*.,(2007).

The urea levels of the experimental animals is significant (p<0.05) the values ranged from 3.50 – 4.17 mmol/dl, which was similar to the result reported for West African dwarf goat fed sun dried cashew pulp based diet by Okpanachi *et al*., (2018). Significant (P<0.05) difference for blood sugar, urea, alkaline phosphate and non-significant (P>0.05) difference in cholesterols levels were reported for west African dwarf goat fed diets containing graded levels of cashew nut shell by (Ocheja *et al*., 2016).

Alkaline phosphate values at 10 and 15% inclusion levels obtained in the study were within normal range and showed significance (p<0.05) compared to other treatments and similar to the report for West African dwarf goat fed cassava peel meal supplemented with African yam bean by Ozung *et al*., 2018. Normal values of alkaline phosphate range from 42 –97 ul^{-1}(Arigbede *et al*., 2012). Abnormally high alkaline phosphate is an indicator of bone diseases, liver diseases, bile obstruction, variation could also be due to feed, collection and handling of blood samples, genetic, environment, sex and age of the animals. Abnormally high urea value indicate poor protein quality as well as poor protein utilization in animals.

The serum glucose levels in this study was significant (p<0.05) at 10% inclusion levels and had the highest value, it was also observed there was no particular trend in the increase of glucose. However, several factors are indicators of this increase in glucose levels and these are. Age of the animals, with are correlated with the concentration of nutrition (Serrano *et al*., 2008). It could also be due to nutritional timing and method of blood sample collection for the study. Low levels of blood sugar in small ruminant can also be due to anorexia, starvation, and disturbance in the digestion (Mitruka *et al*., 2007). The total protein value in this study ranged from 38.33 – 40.57g/dl and were significantly (p<0.05).

Table 4: Effect of Feeding Graded Levels of Cooked Baobab *(Adonsonia digitata)* Seed Meals on Serum Biochemistry Parameters of Red Sokoto Goat

PARAMETERS	Treatment				
	1	2	3	4	SEM
Urea (hmol/l)	4.17^{a}	3.80^{b}	3.50^{c}	4.13^{a}	0.12
Alkaline Phosphate (iu/l)	111.70^{a}	367.33^{a}	68.13^{d}	97.33^{c}	0.83
Total Protein (g/dl)	40.10^{a}	40.57^{a}	38.33^{b}	40.07^{a}	0.13
Random Glucose (mmol/l)	4.07^{b}	4.90^{b}	3.53^{c}	5.60^{a}	0.09
Creatinine (mmol/l)	59.83^{b}	56.70^{c}	64.80^{a}	63.20^{a}	0.30

a,b,c = Means on the same row with different superscripts differ significantly (P<0.05).
SEM = Standard error of the Means.

4 Conclusion and Recommendations

4.1 Conclusion

The inclusion of baobad seed meal in supplement diets for Red sokoto goats up to 15% level of inclusion had no adverse effects on the haematological and serum biochemical profiles of the goats and appeared to have improved some heamatological values of the experimental goats.

4.2 Recommendations

Further research using other breeds of goats as well as other species of ruminants such as sheep and cattle is recommended.

Further research should also explore other processing methods for Baobad seeds.

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