

## **Forage Proximate Composition, Haematology and Serum Biochemistry of Red Sokoto Bucks Fed *Digitaria horizontalis* Supplemented with Graded *Leucaena leucocephala* Leaf Meal**

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**Target Audience:** Researchers, Students, Farmers and Policy makers

### **Abstract**

The study was carried out to evaluate the nutritional potentials of sun-dried *Leucaena leucocephala* leaves in the diet of growing Red Sokoto Bucks (RSB). Sixteen (16) growing RSB, averagely 8 - 9 months of age, weighing 10 - 11 kg  $\pm$  0.5, were used for the study. Four treatment diets 0%, 5%, 10% and 15% inclusion levels were formulated, designated as T<sub>0</sub>, T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> using a completely randomised design (CRD), respectively. Proximate composition of the supplemental diet (*Leucaena leucocephala* Leaves) and the basal diet (*Digitaria horizontalis*) was determined. Haematological and serum biochemical indices were recorded. The data collected were subjected to Analysis of Variance (ANOVA). The result revealed a significant ( $p < 0.05$ ) difference in the Proximate composition of the forage (*Digitaria horizontalis*) and *Leucaena leucocephala* leaves were iso nitrogenous (11.35% to 12.55 %). While crude protein percentage of *Leucaena leucocephala* leaves was 21.85 %. The crude Fibre of the concentrate diet, forage and *Leucaena leucocephala* leaves ranges from 13.49 to 15.49 % and 14.85 and 12.50%, respectively. Haematological and serum biochemical indices of the bucks almost fell within the normal range of haematology and serum values for a healthy RSB. Inclusion of *Leucaena leucocephala* at 15% gave the highest weight gain. Therefore, it was recommended that *Leucaena leucocephala* leaf meal can be included in the diets of growing RSB for improved feed utilisation and growth performance. Further research should be conducted to ascertain the effects of including *Leucaena leucocephala* leaves on other production parameters, such as meat or milk yield and composition of Red Sokoto Goats.

**Keywords:** Haematology, Serum biochemistry, Red Sokoto Bucks *Leucaena leucocephala*

### Description of Problem

Ruminant animals constitute a very important part of the livestock sub-sector of the Nigerian agricultural economy. The potential of small ruminant production in alleviating the low animal protein intake by man in developing nations such as Nigeria has been reported (1) and (2). They are prolific of all domesticated ruminants under tropical and subtropical conditions (3 and 4). Small ruminants suffer scarcity of feed supply and pasture quality in the Arid region of West Africa, especially during the dry season when the natural vegetation is of poor nutritive value (5). Ruminants consuming forage-based diets are fed supplements to conserve forage, improve animal performance, and increase economic returns (6). *Leucaena leucocephala* is a relatively fast-growing tree for the production of forage. (7) reported that the browse plant has the ability of being available all year round because of its drought resistance, persistence, vigorous growth, re-growth and palatability. The leaves have been found to play a valuable role in providing supplemental nitrogen to goats fed maize residues under the village system of management (8 and 9). Therefore, the study was designed to evaluate the nutritional potentials, haematology, and serum biochemistry of Red Sokoto bucks supplemented with sun-dried *Leucaena leucocephala* leaf meal. According to (9), Animal production in Nigeria is faced with nutritional challenges due to a lack of feed in terms of quantity and quality. The population of the world is expected to increase by about 29% from the current seven billion to nine billion in 2050, thereby resulting in competition for the

available feed resources and high cost (10) of animal protein sources. Therefore, it is necessary to evaluate the use of alternative sources. (11) reported that some multipurpose trees have nutritional properties that can be beneficial if incorporated in livestock feed. Utilising some of these forages to their full potential can result to sustainable livestock production (12). Examples of these trees include *Leucaena leucocephala*, *Moringa oleifera*, *Parkia biglobosa*, *Aspalia africana*, *Ficus exasperate* and others.

### Materials and Methods:

The experiment was conducted at the Livestock Unit of Teaching and Research Farm, Federal College of Horticulture, Dadin-Kowa, Gombe State, Nigeria. A total of 16 Red Sokoto bucks aged between 8–9 months old with an average weight of  $10\text{--}11\text{ kg} \pm 1$  were purchased from the livestock market within Kuri Town. All the animals were treated against internal and external parasites and housed individually in separate pens. The experimental animals were allotted to four dietary treatments ( $T_1$ ,  $T_2$ ,  $T_3$  and  $T_4$ ); each treatment was replicated 4 times in a Complete Randomise Design (CRD). The diets were supplied at 3% of the animal's body weight, and water was given *ad libitum*. Feeding was done every morning at about 08:00 am. Each animal was offered its respective basal diet of 600 g of *Digitaria horizontalis* (Crab grass) at 08:00 am, followed by the concentrate at 300 g per head per day at 04:00 pm as described by (11). The experiment lasted for a period of sixty-three days after two weeks adaptation period.

Samples of the *Leucaena leucocephala*

leaves and the concentrate diet were prepared for proximate analysis. Protein content of the samples was analysed using the Kieldahl procedure. ADF, NDF, crude fibre, and ash content were determined according to the method of (12).

At the end of the experiment, two sets of blood samples were collected in sample bottles from each Treatment buck via the jugular vein with the use of disposable syringe and sterile needles for laboratory test. The haematological parameters were analysed according to the method described by (13). This sample bottle contained Ethylene Diamine Tetra Acetic Acid (EDTA) as an anti-coagulant, to determine the Packed cell volume (PCV), Haemoglobin (HB), Red blood cell (RBC), White blood cell (WBC), Neutrophil (N), Lymphocyte (L), Eosinophil (E) and Monocyte (M)

The Serum Biochemical Indices were analysed according to the method described by (14). The sample bottles with no EDTA were used to determine the Aspartate Aminotransferase (AST), Creatinine, Glucose, Total protein (TP), Albumin (ALB), Sodium (Na), Urea (UR).

Total Cholesterol (TC). Data obtained from the study were subjected to analysis of variance (ANOVA) using (15), and treatment means that are significantly different were separated using least significant difference (LSD).

### Results and Discussion

The proximate composition of concentrate diet, the forage (*Digitaria horizontalis*) and *Leucaena leucocephala* leaves were summarised in Table 1. The crude protein values of the concentrate diets at different inclusion levels were iso nitrogenous (11.35% to 12.55 %). While crude protein percentages of *Leucaena leucocephala* leaves are 21.85 %. The crude Fibre of the concentrate diet, forage and *Leucaena leucocephala* leaves ranged from 13.49 to 15.49 % and 14.85 and 12.50% respectively. Acid detergent Fibre (ADF) and neutral detergent Fibre (NDF) range from 5.13 to 15.37% and 19.40 to 43.54% across the treatment. The high crude protein content of the concentrate diet shows it is high enough to meet the optimum microbial need in the rumen (16, 17 and 18).

**Table 1: Proximate Composition (%) of Experimental Diet, *Leucaena* leaves and the forage (*Digitaria horizontalis*)**

Parameters	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	<i>Leucaena</i> leaves	Forage ( <i>Digitaria horizontalis</i> )
Moisture	0.83	0.94	0.57	0.45	0.45	1.75
Ash content	3.94	3.55	3.15	2.84	2.30	1.26
Crude fat	0.63	0.24	0.35	0.13	5.05	0.036
Crude Protein	11.36	11.35	11.73	12.55	21.85	3.1
Crude fibre	15.49	15.00	13.65	13.49	12.50	14.85
CHO	67.75	68.89	70.55	70.45	63.51	79
Energy (Kcal/100g)	322.47	321.86	325.51	326.44	295.02	335.58
ADF %	5.13	8.56	12.64	15.37	19.40	32.38
NDF %	9.28	23.62	28.35	34.19	43.54	61.82

CHO = Carbohydrates, ADF, Acid Detergent Fibre and NDF, neutral detergent fibre.

The Results of the Haematological Parameters of Red Sokoto Bucks fed varying Levels of the Experimental Diet was represented in Table 2. Significant ( $p<0.05$ ) differences were observed in Packed Cell Volume (PCV). The values range from 21.50 – 28.50% observed in this study fell within the normal PCV Range of Goats (21 – 35%) as reported by (18), showing that the Protein Contained in the Experimental Diets were adequate for the Experimental Bucks in this study. The range of Haemoglobin (Hb) values (7.05 – 9.65 g/dl) obtained in this study was within the Normal Range of 7 – 15 g/dL and 8.08 - 9.50 g/dL reported by (18) for Red Sokoto Goats and (19) for West African Dwarf Goats, respectively. This might also be a pointer to the Crude Protein in the Diets. Haemoglobin functions as an oxygen carrier from the Lungs to all other parts of the body (20). Red Blood Cell Count

(RBC) was significantly ( $P<0.05$ ) Higher in diets one, three and four respectively ( $3.80, 3.90$  and  $3.60 \times 10^{12}/L$ ). All the parameters didn't met the Normal Range ( $5.0$  to  $8.0 \times 10^{12}/L$ ) for goats, this may be associated with anaemia or deficiency due to diarrhoea (as observed during the Trial), which depressed performance. This has been documented by some (21). White Blood Cell count (WBC) was significantly ( $P<0.05$ ) Higher in Treatment three ( $15.85 \times 10^9/L$ ) compared to Treatment two ( $6.35 \times 10^9/L$ ). The WBC count recorded was within the Normal Range of haematology parameters for Goats ( $6.8-20.1 \times 10^9/L$ ) (22 and 23). However, the high values observed may be due to the addition of *Leucaena leucocephala* leaves in the diet, which contributes to the nutritional status of the diet as suggested by (24).

**TABLE 2: Haematological Parameters of the Experimental Bucks Supplemented with Graded Levels of *Leucaena leucocephala* leaf meal.**

Parameters	Normal Range	(T <sub>1</sub> ) 0% LL	(T <sub>2</sub> ) 5% LL	(T <sub>3</sub> ) 10% LL	(T <sub>4</sub> ) 15% LL	SEM	LOS
Pack Cell Volume (%)	21-35	25.00 <sup>b</sup>	21.50 <sup>a</sup>	28.50 <sup>b</sup>	25.50 <sup>b</sup>	1.08	*
Haemoglobin Conc. (g/dl)	7-15	8.40 <sup>ab</sup>	7.05 <sup>c</sup>	9.65 <sup>a</sup>	8.95 <sup>a</sup>	0.40	*
Red Blood Cell ( $\times 10^{12}/L$ )	3.5-13.5	3.80 <sup>b</sup>	2.40 <sup>b</sup>	3.90 <sup>b</sup>	3.60 <sup>a</sup>	0.26	*
White Blood Cell ( $\times 10^9/L$ )	6.8-20.1	14.00 <sup>a</sup>	6.35 <sup>d</sup>	15.85 <sup>a</sup>	12.80 <sup>c</sup>	1.43	*
Neutrophils (%)	17-52	36.00 <sup>a</sup>	39.00 <sup>b</sup>	28.50 <sup>d</sup>	35.50 <sup>bc</sup>	5.03	*
Lymphocyte (%)	47-82	56.50 <sup>d</sup>	57.50 <sup>e</sup>	66.50 <sup>a</sup>	58.50 <sup>b</sup>	4.98	*
Eosinophils (%)	1-7	2.00 <sup>a</sup>	1.00 <sup>b</sup>	2.00 <sup>a</sup>	1.50 <sup>b</sup>	0.18	*
Monocytes (%)	0-10	5.50 <sup>a</sup>	2.50 <sup>d</sup>	3.00 <sup>bc</sup>	4.50 <sup>b</sup>	0.69	*

<sup>abc</sup> Means in the Same Row with Different Super Scripts Differs Significantly ( $p<0.05$ ). \* Means at 95% ( $p<0.05$ ). Source (Normal Range): (Tambuwal *et al.* 2002), LL = *Leucaena leucocephala*, SEM = Standard Error of Mean, LOS = Levels of Significant.

The Neutrophils (N) was significantly ( $P<0.05$ ) Higher in diet two (39.00%) for the experimental bucks. The Range of Neutrophils observed were between 28.50 – 39.00% which is similar to 28.67 – 40.00% reported by (25) for Red Sokoto bucks fed *Xylopia aethiopica* seed meal

diets, and these range fell within the Normal Range of 17–52% and 23.90–49.80% reported by (18) and (26). The values for Lymphocytes (56.50 – 66.50%) observed also falls within the Normal Range of 47 – 82% as reported by (18). There were more Lymphocytes than

Neutrophils recorded which agrees with (27) who reported that goats have more Lymphocytes than Neutrophils. Eosinophils values obtained (1.00 – 2.00%) were averagely within the normal range of (1 – 7%) for goats as reported by (25). Percentage Monocytes values observed (2.50 – 5.50%) were at the lower side of the Normal Range values of (0-10%) reported by (18).

Serum biochemical parameters of the Experimental Bucks Supplemented with graded level of *Leucaena leucocephala* Leaf meal are shown in Table 3 below. There were significant ( $p < 0.05$ ) differences across the treatment groups. The Normal Blood Urea Nitrogen values reported for Goats were  $5.48 \pm 0.41$  mmol/L (28) and 3.57 to 7.14 mmol/L (29). The Values observed in this Study (4.40 to 6.20 mmol/L) were all within the Normal Range Expected for Healthy Red Sokoto Goats (30). This indicates that *Leucaena* can be included up to 15% in the Diets of Red Sokoto Bucks to supplement other low-quality Feed Resources without affecting Liver Function.

The values obtained for Blood Glucose Level varied ( $P < 0.05$ ) across the Treatments, with the highest Value observed in  $T_2$  (4.35 mmol/L) containing 5% LL inclusion level. The Normal Physiological Range of Blood Glucose in Goats has been reported to be within a Range of 2.78-3.89 mmol/L (30). Therefore, the Concentration of Blood Glucose observed in this Study fell within the Normal Range except for  $T_2$  which is slightly higher than the Normal.

The Creatinine content of the Bucks increased with increasing *Leucaena leucocephala* supplementation, with the

highest value of 84.50 mmol/L except for Treatment three (75.00 mmol/L), which falls within the Normal Range (60-140 mmol/l) reported by (30). Creatinine is known to have a Link with kidney function, and at high levels it can result in kidney disease (31). The values obtained for blood sodium (N) Level varied ( $P < 0.05$ ) across the treatments, with the highest value observed in  $T_2$  (5% LL). The values observed ranged from 140.00 – 147.00 (mmol/L), and these were above the Normal Range (1.30- 6.0 mm/L) for Red Sokoto Bucks as reported by (32).

The cholesterol values are generally higher than the Range of 61.50 – 92.00 mg/dL as reported by (33) for West African Dwarf Goats fed composite graded levels of Sweet Orange Peel Meal. The observed values (91.00 – 105.50 mg/dL) are, however, Comparable to the Range of 109.92–111.45 mg/dL ( $2.9 \pm 0.02$  mmol/L) reported by (34) for Red Sokoto Goats fed on Natural Grazing Rangeland in Northern Nigeria and fall within the 65–136 mg/dL Normal Range for Goats (35). Although differences exist in the cholesterol values among the treatments, the values obtained for Total Protein Level also varied ( $P < 0.05$ ) across treatments, with the highest value observed in  $T_2$  containing 5% inclusion Level. The Normal Physiological Range of Blood Protein in Goats has been reported to be within a Range of 30 – 65 g/L (30). Therefore, the Concentration of Blood Protein observed in this study fell within the Normal Range. There were significant ( $p < 0.05$ ) differences in the ALB values in this Study. The ALB values ranged from 28.50 – 35.00 g/L, and this Range compares favourably with the normal

range value for Red Sokoto Goats as described by (30). ALP values of 11.90 – 17.50 IU/L reported in this Study fell within the Normal Range of (12 – 34 IU/L) for Red Sokoto Goats as described by (30).

**Table 3: Serum Biochemical Indices of Red Sokoto Bucks fed diets containing Graded Levels of *Leucaena leucocephala* Leaf meal as supplement to Crab Grass.**

Parameters	Normal range	(T1) 0%LL	(T2) 5%LL	(T3) 10%LL	(T4) 15%LL	SEM	LOS
- - -	1-10.5	5.40 <sup>ab</sup>	5.10 <sup>b</sup>	4.40 <sup>c</sup>	6.20 <sup>a</sup>	0.48	*
Glucose(mmol/L)	2.78-3.89	3.35 <sup>d</sup>	4.35 <sup>a</sup>	3.50 <sup>bc</sup>	3.70 <sup>ab</sup>	0.16	*
Creatinine (mmol/L)	60-140	78.50 <sup>b</sup>	84.50 <sup>a</sup>	75.00 <sup>c</sup>	84.50 <sup>a</sup>	2.24	*
Sodium (mmol/L)	1.30-6.0	144.50 <sup>c</sup>	147.00 <sup>a</sup>	145.00 <sup>b</sup>	140.00 <sup>d</sup>	1.72	*
Total cholesterol (mg/dl)	- - -	105.50 <sup>a</sup>	98.50 <sup>b</sup>	92.50 <sup>c</sup>	91.00 <sup>d</sup>	3.34	*
Total Protein (g/L)	30-65	56.50 <sup>b</sup>	58.00 <sup>a</sup>	53.00 <sup>c</sup>	50.50 <sup>d</sup>	1.57	*
Albumin (g/L)	20-42	35.00 <sup>a</sup>	31.50 <sup>b</sup>	30.00 <sup>c</sup>	28.50 <sup>d</sup>	1.47	*
Alkaline phosphate (IU/L)	12-34	17.50 <sup>a</sup>	11.90 <sup>d</sup>	13.50 <sup>bc</sup>	14.40 <sup>b</sup>	1.47	*

<sup>abc</sup> Means in the Same Row with Different Super Scripts Differs Significantly (p<0.05), \* Means at 95% (p<0.05), Source (Normal Range): (RAR2009), LL = *Leucaena leucocephala*, SEM = Standard Error of Mean, LOS = Levels of Significance.

**Conclusion and Application:**

1. The Haematological and Serum Biochemical Indices of Red Sokoto Bucks fell within the Normal Range when fed *Leucaena leucocephala* leaf meal at 15% inclusion level without any detrimental effect on the Performance of the Animals.
2. *Leucaena leucocephala* leaves contain adequate nutrients required by growing Red Sokoto Goats.

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