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Growth Performance, Nutrient Digestibility and Haematological Parameters of Red Sokoto Goats Fed Sabara (*Guiera senegalensis*) Leaf Meal

Research Article

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ABSTRACT

The objectives of the study were to evaluate the effects of Sabara leaf meal on growth performance, nutrient digestibility and haematological parameters of red Sokoto goats. Bucks were managed in a complete randomized design with 4 treatments and 3 replicates. The Sabara leaf meal (SLM) was fed at concentration of 0, 10, 20 and 30% in treatment 1, 2, 3 and 4 respectively. The experimental diets and clean drinking water were offered to the animals *ad libitum*. Initial body weights were all similar. Bucks fed diets with 10 and 20% Sabara leaf meal (SLM) gained weight ($P<0.05$) faster than those fed the control diets. Feed intake differ significantly ($P<0.001$) among the groups. T_4 recorded superior feed intake compared to T_1, T_2 and T_3. Body weight and feed conversion ratio (FCR) increased with levels of Sabara leaf meal (SLM) in the diets up to a point (T_3) with bucks on 20% Sabara leaf meal (SLM) being heavier. The metabolizable energy (CP), crude fibre (CF), ether extracts (EE) and nitrogen free extract (NFE) digestibilities also differed significantly ($P<0.05$) among the treatments. Similarly, the DM, CF, CP and EE digestibilities of T_3 were superior to the control (T_1). Hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and platelets differed ($P<0.05$, $P<0.01$) among treatments. However, packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC) and mean corpuscular hemoglobin concentration (MCHC) were not significantly ($P>0.05$) affected. The white blood cells differentials were slightly different between treatment groups but all remains within the reference range. The results of this study indicated that Sabara leaf meal could be used as feed resources to raise goats. The levels of least Sabara leaf meal (SLM) from 20 to 30% gave high growth performance and better benefits without adverse effect on biological performance. More research is needed to evaluate Sabara leaf meal on growth performance and nutrient utilization by goats.

KEY WORDS digestibility, non conventional feeds, Sabara, red Sokoto goats.

INTRODUCTION

Over the years, there has been a great increase in the production of goats in Nigeria which has resulted in poverty alleviation and the supply of high quality animal protein in order to meet the demand of the teeming population. Within the indigenous breeds of goats kept for meat production in Nigeria, red Sokoto goat is the most numerous and most widely distributed throughout the various ecological zones, particularly Guinea and Sudan savannah vegetation belt. In Nigeria, 96% of traditionally managed goats are under the free roaming and tethering system and chronic feed deficit represent major constraints to animal production in many developing countries of the world.

Inadequate animal protein in the diets of people in developing countries has called for the integration of some non-conventional protein sources into livestock production. Productivity of these livestock will depend to a large extend on their ability to utilize feeds that have no value in human feeding (Odeyinka *et al*. 2007). The inclusion of alternative feed stuffs in animal diet might be interesting in some circumstances (relative price, feed quality), but it is limited because of the lack of information on their nutritive value (Fanimo *et al*. 2003). However, the need to source for alternative feed stuffs so as to reduce high cost of livestock production cannot be overemphasized.

A wide range of multipurpose trees and shrubs are available in Africa, however, these trees and shrubs are still not fully and appropriately integrated into livestock feeding. Sabara (*Guiera senegalensis*) is a multipurpose tree which was thought to be used in traditional medicines. Its leaves are used to treat illness by human and are recognised in many parts of the world in the treatment of stomach pain and dysenteric diarrhoea (Aniagu *et al*. 2005), syphilis, beriberi, leprosy and impotence (Kerharo *et al*. 1948). It is being recognised as being effective against cough, respiratory congestion and fever (Kerharo and Adam, 1974). More so, it was also used against malaria (Azas *et al*. 2002), gastrointestinal pains, and rheumatism (Abbiw, 1990). In livestock production, it is used as feed ingredients to increase body weight, enhance milk secretion and also improve reproductive capacity (Kerharo and Adam, 1974).

The significance of determining haematological indices of domestic animals has been well documented. The haematological test serves as information base for important diagnostic tools in veterinary sciences. A variety of factors can affect the haematological and biochemical parameters in animals, including the breed, sex, age, nutrition, reproductive status and seasonal variation (Ozegbe, 2001; Wells *et al*. 1999). Similarly, Gramb *et al*. (2011) further reported that haematological components are influenced by the quantity and quality of feed. Low nutritional status of grass pasture and climatic factors can alter the blood values of goats (Radostits and Blood, 1994). Thus, as a start basic, red and white blood cell parameters are used to obtain the first steps in the nutritional research. Severe deficiency or toxic principles may be manifest as anaemia, haemolysis or leukaemia. For a more accurate and reliable diagnosis classical blood biochemistry and the analysis of trace elements are necessary (Singh *et al*. 2002).

Due to scarcity of sufficient green fodder for these natural browsers particularly during the dry season, attempts should be focussed on the utilization of abundant non-conventional foliage by goats. These resources tend to be available all year round. However, there is paucity of information on the digestibility of sabara leaf meal for goats and subsequent performance. The effects of on haematology are also not investigated to the best knowledge of the author. This study was therefore designed to investigate the digestibility of sabara leaf meal for red Sokoto goats and the growth performance of animals fed diets containing the leaves. Furthermore the effect of feeding on the haematological indices was studied.

MATERIALS AND METHODS

Location and climate

This study was carried out at the Small Ruminant Unit of the Teaching and Research Farm, Department of Animal Science, Kano University of Science and Technology, Wudil, located in the Sudan Savannah Region of Nigeria. The site is situated on latitude 12˚ 58 N and between longitudes 8˚ 25 E. The range of annual temperature and relative humidity is about 38-43 ˚C and 40-51% respectively. It has a mean annual rainfall ranges of 850-870 mm from May-October with a peak in August. Three distinct seasons are however, recognized viz: dry cold (October-January), dry hot (February-May) and wet (June-September).

Processing of leaf meals

Fresh matured Sabara (*Gueira senegalensis*) leaves were harvested in and around the Wudil town. The leaves were air dried for 7-9 hours every day for about 7 days until they became crispy while retaining the greenish coloration. The air dried leaves were then milled, using a hammer mill to produce Sabara leaf meal.

Experimental diets

Four experimental diets were formulated to contain 0% (control), 10, 20 and 30% Sabara leaf meal (SLM) for treatment 1 (T1), 2 (T2), 3 (T3) and 4 (T4) respectively (Table 1).

Experimental goats

Twenty four post-pubertal goats red Sokoto bucks aged between 8-12 months with body weights ranging between 11 and 12 kg were used for the experiment. The animals were purchased from the market and local households. They were quarantined for 2 weeks before they were allowed into the goat pens of the research unit. Bucks were examined for any physical defects especially the testicles before they were purchased to ensure normal descent of the two testicles.

Goat management

The bucks were managed under intensive system in a cross ventilated pens within the animal house. They were supplemented with mineral salt lick. Routine health care prac-

tices such as vaccination/medication, ecto-parasite control and de-worming were carried out. Fresh drinking water was provided *ad libitum*. The experiment lasted for twelve weeks.

Chemical analysis of the ingredients and diets

Proximate analysis procedure was used in determining the percent crude protein (CP), dry matter (DM), crude fibre (CF), ether extract (EE) and ash contents of both the Sabara leaf meal and the diets (Table 1). The chemical analysis was carried out according to the AOAC (2000) procedure.

Table 1 Ingredients composition of experimental diets fed to red Sokoto bucks

	Diets			
Ingredients	**T_1**	**T_2**	**T_3**	**T_4**
Maize	10	10	10	10
Cotton seed cake	16	13	10	0
Sabara leaf meal	0	10	20	30
Rice bran	10	10	10	10
Wheat offal	27	26	27	22
Cowpea husk	30	20	10	10
Chaff	6	10	12	17.5
Salt	0.5	0.5	0.5	0.5

Data collection

The goats were weighted individually at the start of the experiment and for the weight two weeks after. Weekly body weight gain was determined throughout the experimental period. Daily feed intake was measured by subtracting the leftover from the total feed given to the bucks per head per day. Then, a calculated daily intake in each treatment replicate were used to calculate live weight change and was determined by the difference in weight from the previous week, while feed conversion ratio was calculated as the ratio of the feed intake to weight gain. Digestibility trial was conducted by the collection of faeces from each of the bucks during the last seven days of the experiments after feeding known quantities of feed. Faecal samples were allowed to air-dry and weight. The air-dried samples were latter oven-dried and used for the determination of digestible nutrients. Faecal apparent digestibility of DM, CP, CF, EE, Ash and NFE were determined for each diet using the techniques outlined by AOAC (2000).

At the end of the experiment, three (3) bucks from each treatment group were randomly selected and bled between 08:00 and 09:30 hour through the jugular vein. Three (3) millimetres (3 mL) of blood collected from each of these bucks was stored in a plastic sample bottles containing anti-coagulated ethylene diamine tetraacetate (EDTA), to prevent the blood from clotting. The collection was done in the morning to avoid excess bleeding and stress. The haematology was performed according to Feldman *et al.* (2002); to get total red blood cells (RBC), total white blood cell count (WBC), packed cell volume (PCV), haemoglobin concentration (Hb), mean corpuscular haemoglobin (MCH), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), platelets counts and total and differential leucocytes count (TLC and DLC).

Experimental design

The animals were allocated to four treatment groups of three replicates each containing 2 bucks. There were thus 6 bucks per group in the Completely Randomized Design experiment.

Statistical analysis

Data collected were subjected to Analysis of variance (ANOVA) using the general linear model (GLM) procedure of Statistical Analysis System SAS, (1998). Contrast were further analysed by Duncan multiple range test. The level of significance was $P<0.01$.

RESULTS AND DISCUSSION

The chemical composition of the experimental diet is shown in (Table 2). The crude protein (CP) content of the diet was approximately 16%. The CP value of SLM in the present study (17.17) was higher compared to the treatment diets. The dry matter (DM) contents which varied from 96.70-98.10 was quite high. The highest crude fibre (CF) level was recorded in diet T_1 followed closely by diet T_4, T_3 and T_2 in that order. The ether extract (EE) or ash level observed ranged from 3.00-4.00. The highest moisture content was recorded for diet T_4.

Results of growth performance of red Sokoto bucks fed SLM are presented in (Table 3). The mean initial live weights were similar among the treatment groups. There was an increase in final body weight of bucks as the level of replacement with SLM increased in the diets. Final body weight was significantly ($P<0.05$) affected by the dietary treatments, with T_3 (16.67) being the highest, although similar with T_4 (15.87), followed closely by T_2 (15.60) and T_1 (14. 00) in that order. Bucks fed diets with 20% and 10% SLM gained weight faster ($P<0.05$) than bucks fed 30% and diets without SLM (control). The daily weight gain (DWG) was significantly higher ($P<0.05$) for bucks fed 20% and 10% Sabara leaf meal in the diets (50.19 and 47.62 g/d respectively) as compared those fed 30% (42.86 g/d) and 0% SLM (32.68 g/d). Average daily feed intake (ADFI) values of 595.02 g, 662.28 g, 644.46 g and 669.0 g were obtained for T_1, T_2, T_3 and T_4 respectively. Feed intake increases ($P<0.001$) as the level SLM increases. Feed conversion ratio in T_3 was inferior to the other treatments.

Apparent digestibility of the various nutrients is presented in (Table 4). Dry matter (DM) digestibility shows no significant ($P>0.05$) difference among the treatment groups.

Table 2 Chemical composition of the experimental diets and Sabara leaf meal (SLM)

	Treatment (diets)				
Constituents (%)	**T_1**	**T_2**	**T_3**	**T_4**	**Whole SLM**
Dry matter (DM)	96.90	97.10	96.70	97.70	98.10
Crude protein (CP)	15.40	15.80	15.90	16.20	17.17
Crude fibre (CF)	33.00	25.00	29.00	32.00	28.00
Ether extract (EE)	3.00	4.00	3.00	3.00	3.00
Ash	3.00	3.00	4.00	3.00	3.00
Moisture	3.10	2.90	3.30	2.30	1.90

SLM: Sabara leaf meal.

Table 3 Performance of Sokoto red bucks fed diets containing various levels of Sabara leaf meal (SLM)

	Treatments (diets)				
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**
Mean initial body weight (kg)	11.50	11.63	11.43	12.07	0.42^{ns}
Mean final body weight (kg)	14.00^{b}	15.60^{a}	16.67^{a}	15.87^{a}	0.71^{*}
Average weight gain (kg)	2.50^{c}	4.25^{ab}	5.13^{a}	3.80^{b}	0.43^{*}
Average daily weight gain (g)	32.68^{c}	47.62^{ab}	50.19^{a}	42.86^{b}	6.42^{*}
Average daily feed intake (g)	595.02^{c}	662.28^{ab}	644.46^{b}	669.00^{a}	6.45^{***}
Feed conversion ratio	13.13^{c}	15.44^{b}	18.17^{a}	15.84^{b}	2.598^{*}

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
NS: not significant and SEM: standard error of means.
* (P<0.05) and *** (P<0.001).

Table 4 Nutrient digestibility of Sokoto red bucks fed different levels of Sabara leaf meal (SLM)

	Treatment (diets)				
Nutrient Digestibility (%)	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**
Dry matter (DM)	89.80	90.90	92.00	92.40	1.19^{ns}
Crude fibre (CF)	64.49^{b}	72.73^{b}	89.90^{a}	71.05^{b}	1.45^{*}
Crude protein (CP)	64.02^{b}	65.69^{b}	69.92^{a}	68.63^{a}	1.61^{*}
Ether extract (EE)	61.21^{b}	78.33^{a}	79.83^{a}	78.14^{a}	0.65^{*}
Ash	66.40	64.90	63.20	58.10	4.43^{ns}
Nitrogen free extract (NFE)	71.83^{a}	70.52^{a}	73.45^{a}	67.59^{b}	1.65^{*}

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
NS: not significant and SEM: standard error of means.
* (P<0.05) and *** (P<0.001).

Crude fibre digestibility was significantly (P<0.05) higher in T_3 than other treatment groups while crude protein and ether extract digestibility was significantly higher in T_3 and T_4 compared to T_1. However, T_4 had the lowest nitrogen free extract digestibility value.

The haematological parameters of red Sokoto goats fed Sabara (*Guiera senegalensis*) leaf meal are presented in (Table 5). The haematological parameters estimated were PCV, Hb, RBC, WBC, MCH, MCV, MCHC and Platelets. Non significant differences were found between the treatment for PCV, RBC, WBC and MCHC (P>0.05). Some small changes in MCV and MCH associated with increased in SLM concentration in the diet were Blood platelets in the T3 (20% SLM) (367.00) was higher than those in T_1, T_2 and T_4.

There were no significant differences in (P>0.05) in monocytes, eosinophils and basophils between the experimental groups. The relative lymphocytes counts was higher (P<0.05) in T_1 and T_4 (68-70) than in other treatment groups which were 63 and 64 for T_2 and T_3 respectively, but all within the reference range. Differential neutrophil counts were lowest (P<0.05) in T_4 (28) and highest in T_2 (36).

Our diet had a higher crude protein content than recommended by ARC (1980) and NRC (1985) for optimum microbial gut activities. Gatenby (2002) however indicated that the ARC and NRC levels are too low and suggests that 10-12% CP in the diet is necessary for better production in ruminant. Therefore, the experimental diet of the current study likely provided adequate nitrogen for the rumen microbes to maximally digest the dietary fibres and thereby generating adequate levels of volatile fatty acids (Lamidi *et al*. 2010). The dry matter (DM) content which appreciates with increasing level of SLM in the diet was higher compared with the ranges of 92.8-93.6% (Turner *et al*. 2005) or 93.1-95.2% (Belewu and Yahaya, 2008). The crude fibre content in this experiment was higher than the result reported for goat diets (9-11.1%) (Okoruwa *et al*. 2012), probably due to differences in non con-conventional protein fractions. The ether extract (EE) was higher than that indicated by Abbator, (2013). However, the moisture content of the latter experimental diet was higher than that of the Sabara leave meal in our study (2.3-3.3%). The initial body weight (IBW) of the animals did not vary significantly which indicates that the weights of the animals were very much similar at the commencement of the experiment.

Table 5 Haematological indices of red Sokoto bucks fed diets containing various levels of Sabara leaf meal (SLM)

	Treatment (diets)				
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**
Packed cell volume (%)	36.67	35.00	31.75	33.33	2.04^{ns}
White blood cells ($X10^6/mm^3$)	20.30	20.07	18.17	19.18	0.71^{ns}
Haemoglobin (g/100 mL)	12.53^{a}	11.22^{ab}	10.16^{b}	10.87^{ab}	0.54^{*}
Red blood cells ($X10^6/mm^3$)	4.50	4.57	4.66	5.28	0.37^{ns}
Mean corpuscular volume (fl)	81.23^{a}	76.66^{ab}	68.12^{ab}	64.55^{b}	3.98^{*}
Mean corpuscular haemoglobin (pg)	27.81^{a}	24.60^{b}	21.86^{bc}	20.95^{c}	0.92^{**}
Mean corpuscular haemoglobin concentration (%)	34.44	32.09	32.10	32.57	0.74^{ns}
Platelets	340.00^{ab}	316.67^{b}	367.00^{a}	336.56^{ab}	20.30^{*}
Relative differential cell count					
Neutrophil (%)	65.23^{a}	60.17^{b}	61.37^{b}	65.59^{a}	1.44^{*}
Monocytes (%)	1.67	1.41	2.00	1.74	0.58^{ns}
Eosinophil (%)	3.67	3.33	3.78	4.56	1.09
Lymphocytes (%)	30.00^{ab}	36.00^{a}	33.00^{ab}	27.70^{b}	2.21^{*}

The means within the same row with at least one common letter, do not have significant difference (P>0.05).
NS: not significant and SEM: standard error of means.
* (P<0.05) and *** (P<0.001).

The final body weight (BW) tended to increase (P<0.05) with increasing level of SLM replacement, being highest in 20% SLM diet. Animals in T_3 had superior body weight. Efficient utilization of the feed is likely the cause of this, since growth rate was generally lower in the control groups (T_1) than in bucks fed SLM. Since all the diets adequately met the recommended nutrients for growing male goats, the above effect is very likely caused by SLM. The average weight gain (AWG) was statistically higher (P<0.05) for the bucks fed 20% SLM diets. This can be explained the fact that the animals of the T_3 group ingested more CP than all others. SLM may possess a growth stimulating effect, and the bucks seem to have more appetite for the test diets with (SLM) than for diets. However, weight gain by goats is highly dependent on protein and energy contents of forages (Ash and Norton, 1987). Thus, supplementing diets only with SLM may not be adequate measure to increase performance. CP content must therefore be optimized.

Daily weight gain (DWG) in the present study suggests that the inclusion of SLM up to 20% does not have any deleterious effect on growth of the animals and that the rumen microbes efficiently utilize the diets. The average daily weight gain of 50 g/d in T_3 in the present study compared favourably with 47 g/d that reported by Gelaye *et al.* (1990) for goats offered Alfalfa hay. Although there is breed difference, Warmington and Kirton (1990) suggested that comparison of the productive potentials of goats breeds is difficult because of the diversity of forages and supplements used in the wide range of production environments.

Although, the growth rate of buck fed diets containing 20% SLM were better, there were no improvement in the feed conversion ratio. It is rather the increased feed intake that accounts for the better performance of the bucks fed SLM. Daily feed intake (DFI) was significantly higher (P<0.001) in T_4 compared with the other treatment groups.

The high feed intake observed is an indication that the diet is nutritionally balanced since growth was better than in the control.

Sahlu *et al.* (2004) indicated that efficient utilization of nutrients that supply adequate energy protein is required for optimum growth performance in animals. Since growth reduction could be attributed to the presence of anti nutritional factors contained in leaf meals, (Dutta *et al.* 1986), it appears that Sabara leaf meal may not have anti nutritional properties as performance were better in animals fed SLM supplements.

Similarly, it has been reported that a number of factors; odour, taste, texture and colour of finished feed influences intake in animals (Arnold *et al.* 1980; Farinu *et al.* 2005). The apparent digestibility of CF, CP and EE increased with increasing levels of SLM in the diets. These results indicated that up to 30% of Sabara leaf meal could be included in the diet of bucks for metaproduction. However, the optimum results appeared at 20% SLM inclusion.

CONCLUSION

Sabara leaf meal in this study was a good nutrient for optimizing goat meat production. Feed uptake and utilization, nutrient digestibility and daily weight gain all were improved. Sabara leaf meal is abundantly available and is a cheap alternative source of protein. Up to 30% Sabara leaf meal can be included in the goat diets without any adverse effect on performance, nutrient digestibility and haematological parameters. To further optimize the rations supplemented with SLM more research is needed, especially characterizing potentially dose dependent anti-nutritive factors in the meal. We concluded that sabara leaf meal is a feed stuff with potential to solve the problem of feed scarcity and to reduce demand of expensive protein supplements in

the diets of ruminants. We could not show any clinical relevant negative results of supplementing SLM in the daily ration of bucks.

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