NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 49 Number 1, April 2018. Pp.1-10
Available online at: http://www.ajol.info/index.php/naj

THE EFFECT OF SUBSTITUTING COWPEA HUSK WITH *Daniellia oliveri* FOLIAGE ON THE PERFORMANCE OF RED SOKOTO GOAT

***[1]Njidda, A.A., [2]Olafadehan, O.A., [2]Japhet, N., [2]Omole, O.A. and [2]Ofem, B.B.**
[1]Department of Animal Science, Federal University, Kashere, P.M.B. 0182, Gombe State, Nigeria
[2]Department of Animal Science, University of Abuja, P.M.B. 117, Abuja, Nigeria
*Corresponding Author's e-mail:ahmednj idda7@gmail.com

ABSTRACT
An experiment was conducted to determine the effect of replacing cowpea husk with Daniellia oliveri foliage on the performance of Red Sokoto Goats. Twenty five (25) Red Sokoto goats weighing on the average 13.00 ±1.2kg were divided into five groups with five animals per group. Each group was randomly assigned to the five dietary treatments in a completely randomized design (CRD). The diets compared were 100%, 75%, 50%, 25% and 0% cowpea husk and 0%, 25%, 50%, 75% and 100% D. oliveri foliage designated as T1, T2, T3, T4 and T5 respectively. Result indicates significant ($P<0.05$) differences in all the parameters studied for chemical composition of the experimental diets. T5 (100% D. oliveri inclusion) had the highest values for all the parameters for chemical composition except for ether extract acid detergent lignin. All the parameters for the chemical composition was observed to increase with increase in the level D. oliveri foliage. The nutrients digestibility investigated were significantly affected ($P<0.05$). Dry matter (DM) crude fibre (CFD) and neutral detergent fibre digestibilities (NDFD) was observed to decrease with increase in the level of D. oliveri foliage while crude protein (CPD) and ether extract digestibility increase with increase in the level of D. oliveri. Nitrogen intake and faecal nitrogen output (g/day) of goats in T5 and T3 (15.72 and 4.81 g/day) were significantly higher than the other treatment groups. Urinary nitrogen was significantly ($P<0.05$) influenced by all the dietary treatment groups, with goats on T4 (4.88 g day-1) being the highest output and T5 (3.32 g/day) the lowest. There was no significant effect ($p>0.05$) of feeding D. oliveri foliage on carcass components and organ weights except for carcass length, carcass weight, weight of skin, dressing percentage and weight of heart. From the results, it can be concluded that D. oliveri foliage can be fed as sole diet or in combination with cowpea husk in the semi-arid environment.
Keywords: Browse, Daniellia oliveri, goats, Digestibility and Carcass

Introduction

Goats have been estimated as 53.8 million in Nigeria (FAO, 2008). Goats contribute about 24% of Nigerian meat supply (Oni, 2002) and are one of the cheapest sources of animal protein because of its high fertility rate and quick maturity traits (Jansen and Burg, 2004). Goat meat is characterized by low subcutaneous fat content with greater muscle component at comparable age and slaughter live body weight (Babiker *et al.*, 1990). The meat quality is a combination of chemical and sensory attributes and a carcass with better fat/muscle proportions (Silva and Silva Sobrinho, 2002). According to Madruga (2004), goat meat has some advantages in comparison to other meats available in the market such as low fat, high digestibility, high protein, iron and unsaturated fatty acid levels. In spite of these attributes of goat meat and its acceptance by the populace, the production of the animal is bedevilled by inadequate nutrition. Goats in Nigeria suffer several nutritional stresses especially in the dry season as a result of seasonal variability and low nutritive quality of available pastures. This period is characterized by poor quality feeds that lead to low feed intake, utilization and performance. Studies have shown that multipurpose trees can be used as cheap protein supplement which can improve voluntary intake and general performance of animals fed low quality feeds (Shelton 2004). A number of browse plants worldwide serve as alternative feedstuffs for livestock (Ammar *et al.*, 2004). The leaves of the evergreen trees and shrubs are used as emergency feed by ruminants in the Guinea savannah region of northern Nigeria (Olafadehan 2011). In Nigeria, there are numerous tree leaves used as fodder and one of such of tree is *Daniellia* *oliveri* which is widely distributed and available. *Daniellia oliveri* foliage is a promising fodder with a good nutrient profile (g/kg DM): 178 crude protein (CP), 939 organic matter (OM), 549 neutral detergent fibre (NDF) and 324 acid detergent fibre (ADF) (Olafadehan and Okunade, 2016) However, *Daniellia oliveri* contains anti-nutritive factors such as tannins, saponins, oxalate and phytate (Otori and Mann**,** 2014, Okunade et al., 2015). Cowpea husk is among the most important crop residues obtained from cowpea plant and is used as fodder in Nigeria particularly in the northern part of the country where it is extensively planted. Some farmers grow the crops mainly for this purpose. Large quantity of cowpea husks is produced in the country and is widely used by smallholder ruminant farmers. The objective of this study is to investigate the effect of replacing cowpea husk with *Daniellia oliveri* foliage growth, digestibility, nitrogen utilization and carcass characteristics of Red Sokoto goats.

Materials and Methods

Experimental animals and diet

The experiment was conducted at the Teaching and Research of University of Abuja, Abuja, Nigeria. Twenty five (25) growing Red Sokoto male goats, aged between 7 and 8 months and with a mean initial body weight (BW) of 13 ± 0.5 kg, were used for this study. The animals were bought from an open livestock market in Madalla about 10 km from the study site. The pens and the surroundings were cleaned and disinfected with a strong antiseptic (Morigad) two weeks before the arrival of the animals. On arrival, the animals were given prophylactic treatments consisting of intramuscular administration of a long acting antibiotic (Oxytetracycline LA at the rate of 1 ml/10 kg) and subcutaneous injection of Ivomec at the dose of 1 ml/50 kg to control endo and ectoparasites. The animals, housed in individual cages, were allowed to adapt to the environment and the diets for 14 days before the commencement of the experiment. This was followed by an 8-week measurement period. The leaves of *Daniellia oliveri* used for the study were harvested from several stands in the University environment and were allowed to dry at room temperature. The leaves ere chopped to about 5 mm long to avoid selection by the goats. The animals were randomly allocated to five dietary treatments in a completely randomized design with four animals per treatment. Treatments compared include:

T_1 = 100% cowpea husk + 0% *Daniellia oliveri* foliage
T_2 = 75% cowpea husk + 25% *Daniellia oliveri* foliage
T_3 = 50% cowpea husk + 50% *Daniellia oliveri* foliage
T_4 = 25% cowpea husk + 75% *Daniellia oliveri* foliage
T_5 = 0% cowpea husk + 100% *Daniellia oliveri* foliage

Feed was fed daily *ad libitum* once daily at 08:00 h. Goats had free access to water and mineral licks. The quantity of feed provided and the residue of previous days were weighed to determine the feed intake of each animal. Goats were weighed at the beginning of the experiment and at weekly intervals in the morning before feeding.

Digestibility and nitrogen balance studies

One goat was taken from each treatment and placed in metabolism cages for a 7-day period. Faecal samples of the animals were collected daily in the morning before feeding for the seven days collection period. After collection of the total faecal output per animal per day, 20% of the faecal output was saved daily for the determination of the undigested portion of the nutrient excreted in the faeces on a dry matter basis. The faecal samples were dried in a forced air oven for 70°C for 48 hours. The dried faecal sample of each goat was then bulked over the 7-day collection period and sub sampled. The oven dried sub samples were milled with a simple laboratory mill and then stored in air tight bottle until required for analysis. Urinary sample were also collected and measured for each animal. About 20% of the total daily output was saved from each animal. The 7-day samples were bulked together for each animal and subsamples were taken per animal. The subsamples were stored in air tight bottles containing few drops of concentrated H_2SO_4 to prevent loss of nitrogen and kept in the freezer until when required for analysis.

Carcass evaluation

At the end of the 56 days Experimental period, three animals were selected randomly from each treatment for carcass evaluation. They animals were kept off feed for twelve hours overnight. Live weight was recorded immediately prior to and after slaughter. The animals were skinned and weight of skin recorded. Carcass length, and omental and mesenteric fat weight were recorded. Organs like the lungs, heart, spleen, liver and kidney were separated and weight recorded. Cut up parts, hind leg, fore leg and head, were also recorded. The dressing percentage was calculated.

Chemical analysis

The feed samples were analysed for proximate constituents according to AOAC (2002), while NDF, ADF and acid detergent lignin (ADL) were determined by the procedures of Van Soest *et al*. (1991). Hemicellulose was calculated as the difference between (NDF) and (ADF. Cellulose was calculated as the difference between (ADF) and (ADL).

Statistical analysis

Data were subjected to ANOVA in completely randomized design using the SAS (2009). Treatment means were separated using Duncan's multiple range test of the same software.

Results and Discussion

Chemical composition

The result of the chemical composition is presented in Table 1. Except for ether extract which decreased, most of the nutrients increased with increasing level of cowpea husk replacement with *Daniellia oliveri* foliage (P<0.05).

Growth performance of Red Sokoto goats fed mixture of cowpea husk and *Daniellia oliveri*

The growth performance of goats fed selected semi-arid browses is shown in Table 2. Final body weights significantly (P<0.05) differed with animals on diet T_4 (75% *Daniellia oliveri* inclusion) being the highest on the average with a weight value of 17.0 Kg. The lowest mean final body weight value (15.7 Kg) was recorded with animals on T_1 though there as significant difference (P>0.05) between T_1 and T_2 respectively. Metabolic weight of the animals differed significantly different (P<0.05) between the diets. It ranged from a low value of 7.76 to a high value of 8.60 (kg). This result follow similar pattern for average and daily body weight gain The dry matter intake per metabolic weight (DMI g kg^{-1} $W^{0.75}$) was not significantly (P>0.05) among treatment. The dry matter intake (g day^{-1}) was highest for T_1 (154.00) and lowest for T_2 (149.80 g day) Feed conversion rate was best in T_4 (75% *Daniella oliveri* inclusion) compared to other treatments.

Nutrient digestibility of Red Sokoto goats fed mixture of cowpea husk and *Daniellia oliveri*

The result of nutrient digestibility is shown in Table 3. The dry matter (DM), crude fibre (CF) and neutral detergent fibre (NDF) showed significant difference (p<0.05) among treatments and was observed to decrease with increase in the level of *Daniella oliveri*. Crude protein (CP), ether extract (EE) and acid detergent fibre (ADF) showed significant difference (p<0.05) among treatments and the values were observe to increase as the level of *Daniella oliveri* inclusion increase. The acid detergent lignin content show significant (p<0.05) influence among treatments.

Nitrogen intake and utilization of Red Sokoto goats fed mixture of cowpea husk and *Daniella oliveri*

The result of nitrogen utilization by goats fed selected semi-arid browses is shown in Table 4. Nitrogen intake differ significantly (P<0.05) and was the highest for diet T_5 (15.72 g day^{-1}) (100% *Daniella oliveri*). Faecal nitrogen output was also significantly different (P<0.05) with highest T_2 (25% *Daniella oliveri*) value (4.68 g day^{-1}). N digestion also differ significantly (p<0.05) among treatments with highest value in T_5. Urinary nitrogen (N) output values recorded for the different diets are 4.56, 3.63, 3.82, 4.88 and 3.32 g day^{-1} for T_1, T_2, T_3, T_4 and T_5 respectively and differ significantly (p<0.05). Total N output was observed to be lowest in T_5 and no significant different (p>0.05) between T_1, T_2, T_3 and T_4. Nitrogen retained and absorbed differ significantly (P<0.05) among treatments which ranged from 0.19% to 8.11% and 4.31% to 11.43% respectively. T_5 had the highest value for N retained and absorbed as percent of N intake.

Carcass characteristics of Red Sokoto goats fed mixture of cowpea husk and *Daniella oliveri*

Generally the results (Table 5) of the carcass characteristics did not show any significant difference (p>0.05) among treatments except for carcass length, carcass weight of skin dressing percentage and weight of heart (p<0.05). Carcass length, carcass weight, dressing percentage weight of lung was observed to be highest for T_3 compared to other treatment groups.

The results of the chemical composition of the experimental diets are presented in Table 1. The high crude protein content of *Daniellia oliveri* foliage makes it suitable supplements for goats. The CP content was observed to increase with increasing level of *Daniellia oliveri* foliage, this findings is in line with the reports of Okagbare *et al.* (2004) and Njidda (2011) that browse forage species have CP content which remains all year round. The crude protein level in this study also compares favourably with some foliage crops that have been evaluated and integrated into ruminant feeding, which include *Magnifera indica* 15.13% and *Newbouldia* leaves 15.57% respectively (Ikhimioya, 2005). The level of 166.2 g Kg^{-1} DM (T_5) crude protein in the study is far above 7% CP recommended for rumen microbes of tropical livestock by Minson (1990) below which there will be a deficiency in performance. Ether extract is the lipid component and the energy derived from it is utilized by the animal. The low EE (T_5) in this study is in agreement with the report of Isah *et al.* (2013); Ogunbosoye and Otukoya (2014) who worked on *Daniellia oliveri* mixtures with other feed stuffs. The NDF and ADF are moderate to high from T_1 (100% cowpea husk) to T_5 (100% *Daniellia oliveri* foliage).This is similar to the findings of Njidda (2011) who reported higher values ranging from 412.10 to 595.90 g kg^{-1} DM for NDF and 200.50 to 282.00 g kg^{-1} DM for ADF (n=37) for semi-arid browse forages. Meissner *et al.* (1991) observed that NDF level of forage above 65% can limit feed intake it is interesting to note that the browse specie of the present study is below the threshold level. The lignin content of the browse is moderate and it's within the range reported by Njidda (2011). It is also known that lignin is a component of the cell wall and deposited as part of the cell wall thickening (Boudet *et al.*, 1998).

The overall average daily weight gain was 33.92 – 64.28 g day^{-1} which was <149 – 169 g day^{-1} reported by El -Waziry *et al.* (2011) but greater than 8.0-26.8 and 17.0-28.0 g day^{-1} reported by Mukaudiwa *et al*. (2010) and Phuc *et al.* (2009) .The average daily gain (ADG) obtained in this experiment can be considered similar to the weight gain of goats reared in the semi-arid or desert as in the findings of Wampana *et al.* (2008). The high weight gain as observed in this experiment suggest a high efficiency in utilization of the experimental diet (T_1 to T_5) but better performance in terms of ADG was achieved with T_4 and T_5 which signifies a better combination of cowpea husk and *D. oliveri* at that proportion and low apparent digestibility coefficients of crude protein resulting in low intake of nutrients. ADG improved with increase in levels of *D.oliveri* foliage and the goats on T_4 (25% cowpea hus and 75% *D.oliveri*) weight gains may reflect changes in rumen fill as much as changes occurring in body tissues.

The substitution intake between cowpea husk and *D. oliveri* was observed in the present study. The DMI of the animals was high for all the treatment groups though lower compare to the values (1.91-2.09 kg day^{-1}) reported by Mokhtarpour *et al.* (2017). The high DMI observed for all dietary treatments was probably due to a better balance between energy and protein. The DMI of animals on diet T_1, T_2 and T_3 was not reflected in ADG, since T_4 and T_5 had better ADG than the other treatment groups. The gradual increase in ADG of animals on diets T_1 to T_4 could be associated with the energy content of *D. oliveri* leaf and differences that existed between the dietary treatments in CP and DE might also be a factor. This is consistent with the findings of Aregheore (2006) who reported that differences in ADG might be partly related to higher intake of N and energy. The high CP and low energy content of cowpea husk might have led to inefficient utilization of these nutrients at tissue level. Aregheore (2007) reported higher intake and utilization of the foliage in mixed diets offered to goat *ad libitum*. However the consumption of all the diets were similar. The amount of forage consumed is a major determinant of animal production from forage based diets.

The apparent digestibility of the experimental diet is shown in Table 3. In the present study the *in vivo* method was applied using goats, owing to their preference for browse forages. The comparison of the results with other data is uncertain due to different experimental conditions: the method used, animal species used and the level of browse fodder in the diet. The *Daniella oliveri* leaves were used to replace cowpea husk. The factors involved in the variation in digestibility among browse fodders include the concentration of N, cell wall content, especially lignin and tannins. A low level of CP (less than 80 g kg^{-1} DM) is shown to depress digestibility, as it is not sufficient to meet the needs of the rumen bacteria (Norton, 1998). On the other hand, low NDF content (20 to 35%) has been shown to result in high digestibility, while lignification of the plant cell wall decreases the digestibility of plant material in the rumen. Many studies (Moore and Jung, 2001) have reported a negative correlation between lignin concentration and cell wall digestibility by its action as a physical barrier to microbial enzymes. Negative correlations between tannin and protein or DM digestibility have also been studied (Balogun *et al.,* 1998; McSweeney *et al.,* 1999). Hence information on the NDF, ADF, lignin and tannin content of tree foliage is essential for the assessment of their digestibility. The high digestibility values obtained in these studies translate to high DMI, thus these high digestibility values of lignin may probably have resulted from solubilisation or detachment of this cell wall component from the browse leaves in the rumen. This agrees with the observation of Keartey *et al.* (1986) and Njidda (2011). Luginbuhl (2000) noted that goats are not able to digest cell walls as well as cattle because the feed stays in their rumen for a shorter period of time. On the other hand, (Morand-Fehr, 2005) reported similar retention time of feed particles in the whole digestive tract of sheep and goats eating the same quantity of good quality forage, but the retention time of goats receiving poor quality forage was longer. Hence sheep and goats have similar patterns of digestion of moderate to high quality forages, but goats are better in digesting forages rich in cell walls and poor in nitrogen. This seems to be related to their ability to recycle urea nitrogen (Silanikove, 2000).

A wide range of variation in digestibility is reported in tropical feeds with browse inclusion. Breman and Kessler (1995) showed a mean OMD of 0.53 in Sahelian and Sudanian zones of West Africa though OMD was not calculated in this study. Le Houerou (1980) reported a mean DCP of 510 g/kg for West African browses, with 760 g/kg for legumes. Fall (1991) reported large variations in DMD, ranging from 0.26 to 0.88 between species and plant parts. In the present study DMD (36.33 to 63.14% DM) the values tend to decrease with increase in the level of *D. oliveri* whereas CPD (26.70 to 67.33% DM) tend to increase with increase in the level of *D. oliveri*, this conform to the report of Shelton (2004) that browse forages have high level of protein and minerals. The higher N intake observed in T_5 compared to other treatment groups might probably be due to increased CP intake with increasing level of *D. oliveri* substitution in the experimental diets. The average N intake falls below to 21.99 g day^{-1} reported by Wada *et al.* (2016) for sokoto red goats fed *Parkia biglobosa* foliage and above 8.00 g day^{-1} by Wampana *et al.* (2008) for Borno white breed of goats fed browse forage (*Ziziphus mauritiana*) substituted with cowpea husk. N digestion recorded for the experimental animals were significant higher ($p<0.05$) for T_4 and T_5 (receiving 75 and 100% *D. oliveri*). This indicate that N consumed by the animals from *D. oliveri* substitution was well digested and absorbed. Total N output was low in T_5 compare to other treatment groups. The low Total N output suggests better N utilization by animals on diet T_5 (100% *D. oliveri*). The higher N output of animals on diets T_1, T_2 T_3 and T_4 suggests that more bypass protein was supplied than the animal can utilize. N retention is the proportion of N utilized by farm animals from the total N intake for body process; hence the more consumed and digested, the more the N retained and vice versa. In line with the above, it is logical to infer that the higher N absorbed and retained by animals on diets T_5 is due to higher N intake of the goats. Higher N retention by animals on diets containing 100% *D. oliveri* (T_5) relative to the control diet indicates superior N utilization efficiency by the animals on that diet. No significant difference ($p<0.05$) was observed among treatment for faecal N. Similar findings was reported by Fadiyimu *et al.*(2010) who reported that faecal N was not significantly affected by N intake. N in urine was low which indicates which indicates that N utilization was positive, this attest to the amount of N absorbed. Similar observation was reported by Fadiyimu *et al.* (2010). All the treatments gave positive N balance and N retention values, an indication that the protein requirement for maintenance in the experimental animals was adequately met by the dietary treatments.Carcass length is affected by the differential growth rate of bone, muscle and fat (Alvarez *et al.*, 2013). The present study recorded a relatively higher carcass length (46-63cm) compare to 39.15 - 46.20 cm for WAD and Red Sokoto goats of various ages reported by Attah *et al.* (2004). This may be attributed to breed difference as WAD goat is relatively smaller in size compared to Red Sokoto goat. Influence of carcass weight on linear measurements and compactness indices, conformation, and subcutaneous fat has been widely reported and explained by the differential growth rate of bone, muscle and fat. From the result of the carcass length in this study, it can be deduced that the compactness index (if measured) will be higher.

The dressing percentage differs from that of Hogg *et al*. (1991) with 49. 2% for castrates. The differences might be influenced by fatness, age, diet and the time off feed as claimed by Warmington and kirton (1990). Slaughter immediately off- feed is said to decrease the dressing percentage to about 2-3 % unitless, (Hogg *et al*., 1991). As suggested by Gokdal (2013), different goat carcass dressing percentages may be attributed to differences of age and rearing conditions. In addition, the dressing percentage may vary depending on head weight (presence of horns), skin weight (presence and weight of hair), and another variable (slaughter method and practice, relative to hot carcass weight, empty body weight or slaughter weight) taken into account in the calculations of researchers. Beside heavier carcasses and increased carcass fat, a higher plane of nutrition also typically results in a higher dressing percentage. The mean slaughter weight (11.6kg) in the study is however lower than 21.5 kg reported by (Uko *et al.*, 1999) and 22.68 kg by (Maigandi 2002) for goats of all ages, breed and sex. The high average slaughter weights of goats studied by (Uko *et al*., 1999) and (Maigandi 2002), resulted from the inclusion of old does which are almost always heavy. The present study recorded relatively lower slaughter weights than (Uko *et al.*, 1999) and (Maigandi 2002) principally because of the exclusive use of males which are usually slaughtered at young age, as fewer males are needed for breeding purposes. The body weight in the study (14-18kg) was attained between the age 7-8 months of age as compared to body weight between (10 -20 kg) attained between the age 12-18 months reported by Attah *et al*. (2004) who studied the body and carcass linear measurement of WAD goats and RSG, slaughtered at different weights. The difference in age for attainment of the stated weight might be due to the quality of the feed, breed of the animal, age and genetic manifestation of these animals as a factor to the rate of feed conversion ratio and efficiency. The internal fat is highly variable and can be influenced by genotype (Rodrigues *et al*., 2013), nutrition (Bezerra *et al*., 2010), age, slaughter weight (Al-Owainer *et al*., 2013). Kozloski *et al.* (2001) reported that goats in warm climates have their visceral areas more irrigated, facilitating fat deposition and utilization, especially in cases of insufficient energy, diet limitation and intake reduction, functioning as a thermoregulatory mechanism. The purpose of these physiological changes results in glycogen synthesis, in which glucose molecules are added to chains of glycogen or storage (Voet and Voet, 2006). In this study, deposition of total non-carcass fat was lower compared with other carcasses resulting from the lack of use of concentrate demonstrating that concentrate intake to increase non-carcass fat.

Conclusion

The study showed that at 75% of Cowpea husk replacing with 25% of *Daniella oliveri* foliage. It is therefore concluded that 75% of *Daniella oliveri* foliage replacing with 25% Cowpea husk will improve goat's performance while the cost of feeding is reduced since the foliage is available throughout the season and cost less to harvest. Animals in treatment 3 had the best dressing percentage 37.1%, the combination of *Daniellia oliveri* mixed with cowpea husk in a 50: 50 % gave the best result in terms of carcass characteristics of Red Sokoto goat.

Acknowledgement

The authors wish to thank University of Abuja, Nigeria for funding the research.

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Table 1 Chemical Composition of the Experimental diet (g/kg DM)

Parameter	T_1	T_2	T_3	T_4	T_5	SEM
Dry matter	896.3	901.6	889.40	897.80	920.80	3.16
Ash	32.30^e	46.90^d	52.98^c	55.60^b	58.90^a	2.41
Crude protein	131.0^e	134.9^d	142.4^c	154.3^b	166.2^a	1.66
Ether extract	32.90^a	25.10^b	21.11^c	12.30^d	11.20^e	0.61
NDF	325.1^e	346.1^d	369.3^c	385.1^b	475.9^a	2.14
ADF	231.6^e	251.8^d	273.1^c	286.3^b	376.3^a	3.13
ADL	81.10^e	105.0^c	121.9^a	112.3^b	91.60^d	2.16
Cellulose	150.5^c	146.8^e	149.4^d	174.0^b	284.7^a	3.16
Hemicellulose	93.50^{bc}	94.30^b	98.00^a	98.90^a	99.60^a	2.16

Means in the same row with different superscripts are significantly (P< 0.05) different. NDF: Neutral detergent fibre; ADF: Acid detergent fibre; ADL: Acid detergent lignin; SEM: Standard error of mean

Table 2: Growth performance of goats fed cowpea husk replaced with *Daniellia oliveri* foliage

Parameter	T_1	T_2	T_3	T_4	T_5	SEM
Initial weight (kg)	13.5	13.4	13.4	13.4	13.3	-
Final weight (kg)	15.4^{ab}	15.8^{ab}	16.1^a	17.0^a	16.1^a	1.47
Metabolic weight (kg)	7.76	7.92	8.03	8.60	8.03	0.82
DE Intake (MJ Kg^{-1} DM)	5.80^c	5.75^c	7.39^b	9.29^a	10.00^a	0.92
Average daily gain (g day^{-1})	33.92^e	42.85^d	48.21^c	64.28^a	50.00^b	0.002
DMI g/kg $W^{0.75}$	43.70	42.80	43.60	43.50	43.50	1.26
DMI g/day	154.0^a	149.8^b	153.9^a	153.0^a	153.3^a	2.14

Means in the same row with different superscripts are significantly (P< 0.05) different.
DMI: dry matter intake; FCR: feed conversion ratio

Table 3: Apparent nutrient digestibility of goats fed cowpea husk mixed with *Daniellia oliveri* (g/kg DM)

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Dry matter	631.4^{a}	591.2^{b}	483.2^{c}	420.6^{d}	363.3^{e}	1.07
Crude protein	267.0^{e}	374.8^{d}	493.3^{c}	567.8^{b}	673.3^{a}	1.46
Ether extract	573.1^{e}	593.3^{d}	612.9^{c}	633.3^{b}	657.4^{a}	0.46
Neutral detergent fibre	573.0^{a}	501.6^{b}	473.3^{c}	421.4^{d}	387.6^{e}	0.63
Acid detergent fibre	113.4^{e}	143.3^{b}	174.1^{c}	193.1^{d}	211.4^{a}	1.33
Acid detergent lignin	243.4^{c}	261.4^{b}	223.1^{b}	304.1^{a}	307.6^{a}	1.46

Mean in the same row with different superscripts are significantly different (P<0.05). SEM: standard error of mean.

Table 4: Nitrogen intake and utilization of the experimental diet

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
N intake (g/day)	12.23^{b}	10.81^{c}	9.16^{c}	13.53^{b}	15.72^{a}	1.31
Faecal N (g/day)	3.48	4.68	4.81	3.81	4.29	1.72
N digestion (g/day)	8.75^{c}	6.13^{d}	4.35^{e}	9.92^{b}	11.43^{a}	1.04
N in urine (g/day)	4.56^{a}	3.63^{b}	3.82^{b}	4.88^{a}	3.32^{b}	0.6
Total N output (g/day)	8.04^{a}	8.31^{a}	8.63^{a}	8.69^{a}	7.61^{b}	0.42
N retained (g/day)	4.19^{c}	2.5^{d}	0.59^{e}	4.84^{b}	8.11^{a}	0.09
N absorbed (g/day)	8.75^{c}	6.13^{b}	4.31^{e}	9.72^{b}	11.43^{a}	0.02
N retained as % N intake	34.26^{c}	23.12^{b}	5.78	35.77^{b}	51.59^{a}	0.03
N absorbed as % N intake	71.54^{b}	56.70^{c}	47.10^{d}	71.84^{b}	72.70^{a}	0.04

Rows with different super script are significantly (P< 0.05) SEM, Standard error of means N, Nitrogen.

Table 5: Carcass characteristics of goats fed graded level of *Daniellia oliveri* foliage mixed with cowpea husk

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
WOABS	18.00^{a}	15.50^{b}	14.00^{c}	14.00^{c}	14.00^{c}	0.56
WOAAS	10.00^{c}	12.00^{a}	11.50^{ab}	12.00^{a}	12.50^{a}	0.66
Carcass Length (cm)	60.00^{c}	46.00^{d}	63.00^{a}	62.00^{b}	62.00^{b}	0.02
Carcass weight (kg)	4.90^{a}	4.00^{c}	5.20^{a}	5.00^{a}	4.50^{ab}	0.62
Weight of bone	2.49	2.65	2.63	2.20	2.01	1.23^{NS}
Weight of skin (kg)	0.80^{c}	1.05^{a}	0.90^{b}	0.90^{b}	0.85^{c}	0.02
Dressing percentage (%)	27.20^{d}	25.80^{d}	37.10^{a}	35.70^{a}	32.10^{c}	2.14
Weight of Hind leg	0.30	0.29	0.25	0.18	0.28	0.09^{NS}
Weight of fore leg	0.25	0.28	0.25	0.20	0.25	0.12^{NS}
Head	1.00	0.15	1.00	1.10	1.12	0.96^{NS}
Organ weight						
Weight of lung	0.13	0.20	0.35	0.10	0.15	0.04^{NS}
Weight of heart	0.1^{a}	0.10^{a}	0.05^{b}	0.05^{b}	0.1^{a}	0.04^{NS}
Weight of liver	0.2	0.3	0.25	0.25	0.25	0.01^{NS}
Weight of spleen	0.05	0.05	0.02	0.01	0.05	0.03^{NS}
Omental fat	0.2	0.04	0.05	0.1	0.03	0.02^{NS}
Mesenteric fat	0.01	0.01	0.02	0.01	0.001	0.0008^{NS}
Weight of kidney	0.08	0.07	0.05	0.05	0.08	0.06^{NS}

a,b,c,d: Means bearing different superscripts in a row differ significantly (P< 0.05) SEM = standard Error of means; WOABS = Weight of Animal Before Slaughter, WOAAS = Weight of Animal after Slaughter.