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Effect Of Dry Season Supplementation Of West African Dwarf Goats In The Nigerian Guinea Sananna Zone: A Case Study Of Anyigba, Kogi State

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Abstract: ***Twenty seven growing female West African Dwarf (WAD) goats between the ages of six to eight months were used for a study designed to evaluate the effect of dry season supplementation of West African Dwarf goats in the Nigerian Guinea Savanna zone with respect to Anyigba, Kogi State. The experiment consisted of three treatment groups, each in three replicates of three goats. The treatment groups reflected the three different supplementation groups: Treatment 1 (TI or control) i.e. no supplementation at all and fed only on grasses; Treatment 2 (T2) – supplemented with AlbIzia icebbeck and Treatment 3 (T3) – supplemented with Parkia biglobosa leguminous fodders. The experiment was framed in a completely Randomized Design. Blood samples were collected from two goats per replicate at the beginning of the experiment for the determination of baseline haematology and serum biochemical constituent values and at the end of the experiment. Results showed significant effect of treatments (P < 0.05) on daily weight gain and feed conversion ratio. Daily feed intake was not affected by treatments. The physiological parameters of body temperature, respiration rates and pulse rates were also not affected by treatments (P > 0.05). Treatments, however significantly reduced white blood cells and serum biochemical constituents of creatinine, uric acid and cholesterol. It was concluded that the leguminous fodders fed could be a dependable feed resource of high quality which can be used to develop sustainable feeding systems and also increase productivity of West African Dwarf goats, particularly in the study area. It was recommended that the research plots already developed on the farm should be maintained for a sustainable fodder production programme that would support all- year- round growth of West African Dwarf goats in the Nigerian Guinea Savanna zone.***

Keywords: goats, season, savanna, physiology, performance, fodder

I. INTRODUCTION

Nutrition and management have been described by Nuru (1985) to be the most important of the various factors which curtail the productivity of West African Dwarf goats. Feed has also been singled out (Schoenian, 2009) as the largest cost associated with raising goats. Feed has a large influence on herd production. Late gestation and lactation are the most critical periods for doe nutrition. It is therefore desirable to ensure that goats are well fed both qualitatively and quantitatively for optimal productivity. The need to provide Nigerians with adequate animal protein sources cannot be overemphasized. A major challenge to West African Dwarf goats' feeding is the seasonality of available feed resources particularly in the Nigerian Southern and Northern Guinea Savanna Zones. The natural forage resources are inadequate to support existing large animal units. This is reflected in part by severe weight losses and mortality, especially during the dry season. Moreover, the actual quality and quantity of crop residues, agro-industrial by- products and wastes that could be utilized for feeding small ruminants are unavailable and unknown (Ademosun, 1985). Belewu *et. al*. (2008, 2010) attested to the use of leguminous species in livestock feeding. However, the various species tested were those growing in the

wild. How these species would perform at both seedling and sapling stages in providing supplementary feeds for dwarf goats on a sustainable basis remain uncertain.

This research work was initiated to tackle a major challenge to West African Dwarf goats' feeding, that is, the seasonality of available feed resources particularly in the Nigerian Southern and Northern Guinea Savanna zones. The natural forage resources are inadequate to support existing large animal units. This is reflected in part by severe weight losses and mortality, especially during the dry season. Moreover, the actual quality and quantity of crop residues, agro-industrial by- products and wastes that could be utilized for feeding small ruminants are unavailable and unknown (Ademosun, 1985). Belewu, *et. al*. (2008, 2010) attested to the use of leguminous species in livestock feeding. However, the various species tested were those growing in the wild. How these species would perform at both seedling and sapling stages in providing supplementary feeds for dwarf goats on a sustainable basis remain uncertain. It was envisaged that the findings of this research will support supplementation of dry season feeding with legume fodders which have relatively high percentage crude protein as a means of ensuring availability of feed all-year-round for West African Dwarf Goats and, consequently increase their productivity.

AIMS AND OBJECTIVES

- ✓ This research entailed raising plots of leguminous tree species in order to provide fodder for supplementary feeding of West African Dwarf goats in the area of study.
- ✓ To determine the performance and physiological response of West African Dwarf goats supplemented with *Albizia labbeck and Parkia biglobosa* fodders during the dry season

II. MATERIALS AND METHODS

EXPERIMENTAL LOCATION

The experiment was carried out at two different locations in the University: the production of the legume fodders was done at the Crop Production Teaching and Research farm while the feeding trial on animals was done at the Teaching and Research Unit of the Department of Animal Production, Anyigba. Anyigba is located in the Derived Savannah of Nigeria on Latitudes $7^{o}15^{1}$ and 7^{0} 29^{1}N of the equator and Longitudes $7^{o}11^{1}$ and $7^{0}32^{1}$ E of the Greenwich meridian (Akpata, 1986; Ifatimehin *et al.*, 2006).

CROP MANAGEMENT

Two species of legume fodders: *Albizia labbeck and Parkia biglobosa* were raised in two different plots for the experiment. Prunings fed to the animals were weighed fresh, sub- sampled and oven-dried to determine the dry matter weight. Samples for analysis for the macronutrients were air-dried, ground and sieved using 2 mm sieve.

EXPERIMENTAL GOATS AND THEIR MANAGEMENT

Twenty seven growing female West African dwarf (WAD) goats between the ages of 6 – 8 months were used for the study. The goats were purchased from Anyigba and kept in well-ventilated individual cages in a pen with cemented floor. The pen was disinfected with izal solution before the arrival of the animals. A prophylactic treatment was given to the animals. *PPR* vaccine was also administered against *peste des petit ruminants* (PPR). The goats were dewormed with albendazole and were treated against ecto-parasites using ivomec. The experiment lasted for fifty-six (56) days. Fresh clean water was supplied daily *Ad libitum*.

TEST INGREDIENTS AND EXPERIMENTAL DIETS

The experimental fodders, (*Albizia lccebeck and Parkia biglobosa*) were harvested from experimental plots in the crop research farm, Kogi State University Anyigba. After 7 days adaptation period, the goats were divided into three treatment groups of nine animals each in a Complete Randomized Design (CRD) and assigned to one of the three experimental diets (T1 (*grasses*), T2 (*Albizia*) and T3 (*Parkia*)). Each goat was kept and fed separately during the entire period of the experiment. Supplements were given to the goats between 8:00am and 9:00am while grazing was between 10am and 1pm. Cutting of supplementary forages was done a day before feeding the forage to the animals. Cutting was done at 30% of the plant height to ease regrowth of the plant. Upward cutting was done using a machete and carried to the farm for use as supplements

III. DATA COLLECTION

PERFORMANCE PARAMETERS

Performance parameters measured were feed intake, body weight gain and feed conversion ratio.

FEED INTAKE was determined on daily basis as already indicated in the feeding procedure

BODY WEIGHT GAIN was determined by weighing the goats at the beginning of the experiment and weekly thereafter.

FEED CONVERSION RATIO was computed as ratio of mean daily feed consumption to mean daily weight gain.

COLLECTION OF BLOOD SAMPLES FOR LABORATORY ANALYSIS

At the beginning and end of the experiment, 3ml each of blood samples was collected from two goats per replicate via their jugular vein puncture using hypodermic syringes. The blood was drawn into EDTA coated bottles for haematological indices analysis of Packed Cell Volume (PCV), Heamoglobin (HB), Red Blood Cells (RBC), White Blood Cells (WBC), Mean corpuscular volume (MCV) and Mean corpuscular Heamoglobin Concentration (MCHC). Blood samples analysed for Serum parameters of Total Protein (TP),

Albumin, Globulin, Glucose, Cholesterol and Uric Acid were drawn into plain, uncoated bottles

MEASUREMENT OF PHYSIOLOGICAL PARAMETERS

Body temperature was determined by inserting a clinical thermometer into the rectum of the animals at a depth of 5cm with the bulb touching the mucosa wall of the rectum for one minute using a stop watch. It was then removed and read (Okpe, *et al*., 2004; Aye, 2007; Okpe, 2017).

Respiration rate was taken by counting the flank movement of the animals for an uninterrupted period of one minute using a stop watch (Okpe, *et al*., 2004; Aye, 2007; Okpe, 2017). A stopwatch was used to time the counts. This procedure was carried out before taking the pulse rate and rectal temperature to avoid excitement.

Pulse rate was taken by placing a clinical stethoscope on the chest of the animals and counting the beats from the femoral artery for one minute (Pagot, 1992; Okpe, *et al.*, 2004). A stopwatch was also used to time the count. The physiological measurements were taken once a week at 7am.

STATISTICAL ANALYSIS

Data obtained were subjected to analysis of variance using the Statistical Package for Social Sciences (SPSS), Version 16 (2007). Significant differences among treatment means were identified at 5% level by Least Significant Difference (LSD).

IV. RESULTS AND DISCUSSION

PROXIMATE COMPOSITION OF SUPPLEMENTAL FODDERS

The result of the proximate composition of Grasses, *Albizia iccebeck* and *Parkia biglobosa* is presented in Table 1. Result for the dry matter content showed significant treatment effects (P < 0.05) with T1 and T3 (Grasses and *Parkia biglobosa)* having a higher dry matter content than T2 (*Albizia iccebeck*). This implies that more of *Albizia* would be required for the feeding of the animals to meet their nutrient requirements.

Crude Protein followed a different pattern with significant difference (P < 0.05) observed with *Albizia* having significantly higher values than grasses and *Parkia* respectively. The crude protein values obtained in this experiment is however, above the minimal crude protein content of 7% required for rumen functioning. The result obtained compares favorably with the crude protein values of some foliage crops that have been evaluated and integrated into ruminant feeding. They include *Bamibosa vulgaris* (22.38%) *Mangifera indica* (15.13%) and *Newbouldia leavis* (15.57%) respectively. The high CP content of *Albizia* could be attributed to the fact it is a legume and has the capacity for nitrogen fixation (Simbaya, 2000).

The result for Crude Fibre component showed that *Albizia* was significantly higher than grasses and *Parkia*. Similar results for crude fibre (19.81%-26.16%) were reported by Chandra and Mali (2014). Crude fibre fraction is a combination of the acid detergent fibre, neutral detergent fibre and lignin. ADF values usually indicate a highly indigestible fibre portion. Increased ADF and lignin values may indicate decreased digestibility of forage and nutrient availability in animals. Lignin is the indigestible fibre portion. As lignin content increases in forage, it reduces the digestibility and feed intake of an animal and also affect the performance of the animal. The variations in crude fibre values in leaves could be attributed to the differences in species of trees, stage of growth, proportion of young leaves and mature leaves (Reddy *et al*., 2009).

Results for ether extract showed significantly higher values for *Parkia*, which is higher than the 3.69% - 4.33% range reported by Adamu *et al.* (2003) from urea- treated gamba hay. Ether extract content indicates the energy level of the feed as it contributes largely to the gross energy of the diet.

Ash was not significantly affected by treatment. Observed result was higher than those reported by Adamu *et al.* (2013). This Implies that the plants are rich in minerals and could serve as a complete fodder for livestock.

Significant treatment effects (P<0.05) were observed for Nitrogen Free Extract. The result indicate considerable amount of soluble sugar present in the forages. Simple sugars, starch (found in grains) and fibre (cellulose) are the carbohydrates that are converted into volatile fatty acids (energy) by rumen flora (beneficial bacteria). NFE values recorded in this present study are closely related to the reports of Adamu *et al.* (2013). These findings provide an impetus for the utilization of these browse plants for the nutrition of WAD goats.

Nutrient	Grasses	*Albizia*	*Parkia*	SEM	LOS
Dry Matter (DM)	88.83^{a}	88.26^{b}	88.81^{a}	0.33	*
Crude Protein (CP)	18.88^{b}	19.91^{a}	18.42^{b}	0.49	*
Crude Fibre (CF)	21.66^{b}	23.82^{a}	21.90^{b}	0.97	*
Ether Extract (EE)	5.22^{a}	4.48^{b}	5.11^{a}	0.27	*
Ash	3.56	3.47	3.62	0.22	NS
NFE	41.78^{a}	36.48^{c}	39.79^{b}	1.84	*

^{a,b,c} *= Means with different superscripts along the same row show significant difference at p < 0.05; SEM = Standard Error of the Mean.*

Table 1: Proximate analysis of Grasses, Albizia and Parkia

PERFORMANCE CHARACTERISTICS

Result of Performance Characteristics of the goats fed *Albizia iccebeck*, *Parkia biglobosa* and the control group is presented in Table 2. The result showed significant (P < 0.05) effect of treatments on daily weight gain ant feed conversion ratio. Daily feed intake was however, not affected by treatments.

Final weight showed significant differences (P<0.05) across treatments. T2 (*Albizia iccebeck* supplement) (7616g) and T3 (*Parkia biglobosa* supplement) (7412g) which were both similar and significantly different from T1 (6718g), The variation in final weight could be attributed to the higher protein content of the leguminous forage (T3 – 19.91% and T4 – 18.84%) when compared to the grasses fed to the control group. High crude fibre in grass could have affected the final weight of the goats in the control group. Agbede and Aletor (2002) observed that high fiber contents of diets decrease nutrient digestion and utilization which can also precipitate

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metabolic dysfunction with resultant weight reduction. Higher nitrogen retention, could also have contributed to the variation in weight as digestion, assimilation and utilization have high impact on growth of animals (Brisibe *et al.*, 2009).

The same trend was observed with daily weight gain which was significantly different ($p<0.05$) across treatments with *albizia* supplemented goats having the highest value (30.32g), which was in turn, significantly higher than T3 (27.52g) and T1 (15.55g) respectively.

Daily feed intake showed no significant difference ($p>0.05$) across treatments. Results showed T2 having the highest numerical value for feed intake (232.51g) closely followed by T3 (225.5g) and then T1 (223.41g). Hetland *et al*. (2004) had earlier reported that high fiber content of diets affects gut function by increasing digesta passage rate and modulates nutrient digestibility and that high fiber decreased feed intake as a result of increased digesta viscosity which causes increased feed retention time in the gastro- intestinal tract. Dry matter content of ingesta significantly affects intake with reduction in intake as dry matter increases (Bakshi *et al.*, 2003). Most deficiencies in the intake of forages were compensated during grazing. Oyedele *et. al.* (2016) reported consistent intake of feed until nutrient requirement of goats are met in WAD goats.

Feed conversion ratio showed T2 (7.68) and T3 (8.19) been significantly better ($p<0.05$) than T1 (14.37). These show that leguminous forages could be a dependable feed resource of high quality which will help to develop sustainable feeding systems and also increase productivity of ruminants (Bakshi *et al.*, 2003). The high crude protein levels, ether extract, crude fibre, ash, and NFE values recorded in the study are also closely related to the reports of Adamu *et al.* (2013).

It is quite obvious that the browse plants studied (*Albizia iccebeck* and *Parkia biglobosa*) have high potentials as browse plants. This suggests that they could be potential sustainable feed resources that could be used in small ruminant feeding for optimum performance particularly during the dry season.

Species	Control	*Albizia*	*Parkia*	SEM	LOS
Initial weight (g)	5898	5918	5871	112.33	NS
Final weight (g)	6718^{b}	7616^{a}	7412^{a}	130.08	*
Weight difference (g)	820^{b}	1698^{a}	1541^{a}	56.97	*
Daily weight gain (g)	15.55^{b}	30.32^{a}	27.52^{a}	0.27	*
Daily Feed Intake (g)	223.41	232.97	225.51	15.22	NS
Feed Conversion ratio	14.37^{b}	7.68^{a}	8.19^{a}	1.84	*

^{a,b} = Means with different superscripts on the same row are significantly different at P > 0.05; SEM= Standard Error of Means; LOS = Level of significance

Table 2: Performance of WAD Goats fed supplements of Albizia and Parkia

PHYSIOLOGICAL RESPONSE OF THE EXPERIMENTAL ANIMALS

The result of the physiological parameters of the experimental animals are presented in Table 3. The result of analysis of variance showed that the physiological indices of the experimental animals were not affected by treatments. The mean respiratory rates of goats fed various browse plants under the semi-intensive management system ranged from 23.21 respirations/minute to 25.77 respirations/minute. The rectal temperature ranged from 39.01 to 39.77°C, while the pulse rates of goats varied from 76.14 pulse/minute to 77.31 pulse/minute.

The rectal temperatures were fairly constant and fell within the normal range for goats (38.60-39.96°C) reported by Andersson and Jonasson (1993), Radostits *et al. (*1997), Aye (1998) and Aye (2007). By implication the supplementation browse fed did not exert any serious effect on the metabolic activities vis-à-vis the health status of the goats, hence, no cases of hyperthermia were observed in the goats. The respiratory rates were also not affected by the dietary treatments and this was in line with the findings of Adams and McKinley (1995). The pulse rates were fairly constant and also fell within the normal range (70-90 pulse/minute) reported for sheep and goats (Kaushish, 2010).

The diurnal changes in rectal temperature, respiratory rate, and pulse rate as observed in this study are in agreement with other studies on large ruminants (Ologun, 1986; Johnson, 1987) and on sheep and goats (Pagot, 1992). This study revealed that the West African Dwarf goats under study were not physiologically distressed by the consumption of the fodders

PARAMETERS	Albezia	*Parkia*	Control	SEM	LOS
Pulse Rate (beats/minute)	77.21	76.14^{b}	77.31	1.32	NS
Respiratory Rate (breaths/minute)	24.00	23.24	24.21	0.60	NS
Rectal Temperature (°C)	39.77	39.01	39.23	0.17	NS

SEM = Standard error of means; LOS = Level of significanc

Table 3: Physiological Response of the Experimental Animals

HAEMATOLOGICAL INDICES

Results for the Initial and final haematology of WAD Goats fed *Albizia, Parkia and grasses* are presented in Tables 4 and 5 respectively. Analysis of variance of initial haematological indices revealed that all the heamatological parameters except the mean corpuscular volume (MCV) were not affected by treatments ($P < 0.05$).

No particular pattern was also observed in the values of the parameters analyzed. A range of 32.49% - 33.71%, 10.11g/dl – 11.02g/dl, 4.44- 4.65, 2.96 – 3.59, 25.01pg – 26pg, 33.98g/dl – 34.30g/dl and 69.11fl – 72.00fl was observed for PCV, HB,WBC, RBC, MCH, MCHC and MCV respectively. Values obtained are expected as the animals had not been subjected to any experimental treatment that could evoke corresponding biological and physiological response.

Analysis of variance of haamatological indices at the end of the experiment revealed that there were no significant differences ($P < 0.05$) between all the heamatological parameters except the white blood cells (WBC), red blood cells (RBC) and mean corpuscular haemoglobin concentration (MCHC). A range of 33.5249% - 34.25% and 10.31g/dl – 11.75g/dl were observed for PCV and Hb respectively.

Results for white blood cells showed significantly higher values ($P < 0.05$) for control than the treatments. Red blood cells however, followed a different pattern with *Albizia* and *Parkia*- fed goats having significantly higher values ($P < 0.05$) than the control group. Mean corpuscular haemoglobin concentration showed significantly higher values ($P < 0.05$) for *Parkia* and *Albizia* as compared to the control.

This study reveals that all haematological indices assessed were within the normal range for PCV (21- 35%), RBC, (9.2 -

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13.5 x10^6/ml), WBC, (6.8 -20.1 x 10^3/ml) and MCHC (32 - 34.6%) reported by Daramola *et al*. (2005). Haemoglobin, white blood cells, red blood cells and mean corpuscular haemoglobin concentration were significantly higher in the *Parkia*- and *albizia*- group than in the control, with significantly lower variations (P>0.05) in the other haematological indices. White blood cells and the other haematological indices obtained in animals fed the dietary supplements were within the normal range for goats (Banerjee, 1998). Generally, the haematological indices of the goats fed *Parkia* and *Albizia* supplementation were significantly (P < 0.05) higher than those on the control diet. This implies higher utilization of the experimental diets by the animals fed *Parkia* and *Albizia*- supplemented diets.

Parameters	*Albezia*	*Parkia*		Control	SEM	LOS		
Packed Cell Volume (%)	33.71	33.00	32.49		1.82	NS		
Haemoglobin (g/dl)		10.18		10.11		11.02	0.89	NS
White Blood Cells (x10^6/l)	4.55	4.44	4.65		0.40	NS		
Red Blood Cells (x10^6/l)	3.59	2.96	3.50		0.46	NS		
MCH (pg)		25.10	25.01	26.00		2.10	NS	
MCHC (g/dl)		34.30		33.98	34.19		0.62	NS
MCV (fl)		72.00^a		69.11^b		71.01^a		1.18	*

^{a,b} = Means with different superscripts on the same row are significant at P < 0.05; SEM= Standard Error of Means; NS = Not significant; MCH = Mean Corpuscular Haemoglobin; MCHC= Mean Corpuscular Haemoglobin Concentration; MCV=Mean Corpuscular Volume

Table 4: Initial Haematology of WAD Goats fed Albezia, Parkia and Grasses

Parameters	Control	Albezia	*Parkia*	SEM	LOS
Pack Cell Volume (%)	34.25	33.52	33.90	1.82	NS
Haemoglobin (g/dl)	10.31	11.75	11.61	0.82	NS
White Blood Cell (x10^6/l)	4.85^a	4.13^b	4.09^b	0.79	*
Red blood cell (x10^6/l)	2.51^b	3.69^a	3.77^a	0.33	*
MCH (pg)	25.52	25.92	26.40	2.01	NS
MCHC (g/dl)	31.42^b	34.64^a	34.71^a	0.33	*
MCV (fl)	71.03	70.23	69.45	2.16	NS

^{a,b} = Means with different superscripts on the same row differ significantly (P > 0.05); SEM= Standard Error of Means; NS = Not significant; MCH = Mean Corpuscular Haemoglobin; MCHC= Mean Corpuscular Haemoglobin Concentration; MCV=Mean Corpuscular Volume

Table 5: Final Haematology of WAD Goats fed Albezia, Parkia and Grasses

SERUM BIOCHEMICAL INDICES

Results for the initial and final serum biochemistry analysis of WAD Goats fed *Albizia, Parkia and grasses* are presented in Tables 6 and 7 respectively. Analysis of the serum parameters revealed that there was no significant difference (p<0.05) for all the parameters analyzed except for the white globulin and creatinine content.

A range of 4.58 – 4.97g/dl, 2.30 – 2.45g/dl, 178.14 – 193.91mg/dl, 5.60 – 6.77mg/dl, 55.22 – 56.12mg/dl were observed for TP, albumin, glucose, uric acid and cholesterol respectively. The non-significance (P > 0.05) observed for most of the serum biochemistry parameters could be due to the fact that the goats had not been subjected to any experimental treatment that could have evoked corresponding differentials in their serum biochemical indices.

Analysis of variance of the final serum parameters revealed that there were significant differences (P < 0.05) between all the parameters studied. The highest significant values (P < 0.05) for creatinine, uric acid and cholesterol (0.57mg/dl, 6.99mg/dl and 78.23mg/dl respectively) were observed for animals in the control group. Total protein (4.64g/dl) and globulin (2.23g/dl) were highest in the *Albizi*-fed group which was in turn, similar to the *Parkia*- fed group. Albumin (2.42g/dl) and glucose (181.1mg/dl) were highest in the *Parkia*- fed goats.

Serum total protein concentration in this study differed significantly (P< 0.05) between dietary treatments. The values, however, increased from the control to *Parkia*- and then the *Albizia*- fed goats. These values were within the normal range of 3.3 - 8.5 g/dl reported for WAD goats (Daramola *et al*., 2005) and 3.9 – 7.4 g/dl reported for goats (Ologhobo, 1992). The increase in total serum protein is an indication that the proteins in the diets were well utilized and retained in the animal's body [Ukpabi, 2007]. This observation, therefore, indicate superior quality and better utilization of the dietary protein by goats fed leguminous forages supplements.

Blood glucose levels were generally higher for goats fed *Parkia*- fodders and was closely followed by the *albizia*- fed goats. This indicates that the goats fed the supplements were marginally higher in energy than the control group. However, the range of blood glucose level obtained for goats in this study was within the normal range 160-245mg/dl reported by Ologhobo (1992). This observation in this study is in line with that of Ahamefule (2005) and it further suggests that the animals were not surviving at the expense of catabolized body tissues or gluconeogenesis (Ahamefule, 2005).

Serum creatinine was also significantly affected by treatments (P < 0.05). The values progressively decreased from the control to the *Albizia*- and then to the *Parkia*-supplemented goats. Values indicated that the animals were not surviving at the expense of body reserves. The creatinine level in an animal's blood increases when there is muscle wasting which results in the catabolism of creatinine phosphate (Ukpabi, 2007). The lower values obtained for diets T_2 and T_3 indicate that *Albizia* and *Parkia* protein is of good quality and was well utilized because serum creatinine concentrations are used indirectly to determine protein quality (Eggum, 1970).

Uric acid concentration was significantly higher (P < 0.05) for goats on control when compared with the values obtained for animals fed *Albizia* and *Parkia* supplents. The values obtained in this study are within the normal range of 4.36 – 9.70 mg/dl reported for WAD goats (Daramola *et al*., 2005) and 5.4 - 11.8 mg/dl (Ologhobo, 1992). High levels of urea in the blood have been reported to indicate a lowered utilization of protein, poor quality protein or excess protein catabolism associated with protein deficiency (Ahamefule, 2005; Oyawoye and Ogunkunle, 1998; Ologhobo, 1992). The low blood urea levels recorded for goats on the *Parkia* and *Albizia* supplements in this research followed the same pattern reported by Ahamefule (2005) and Ukpabi (2007). However, this observation suggests that the animals on supplements had better feed digestion and utilization of feed protein quality than the control group.

The cholesterol concentration obtained with supplements of legume fodders differed (P < 0.05) significantly from that of the control and were within the normal range of 42.7 – 100.0 mg/dl (Swenson, 1977); mean values of 72.073.36

mg/dl has been reported for goats (Ologhobo, 1992). The reduction in cholesterol level may be attributed to either the absorption of intestinal cholesterol by dietary fibre and rapid excretion or a more specific effect of other components of the browse under investigation. Ukpabi (2007) have reported low cholesterol levels in broilers, and goats when maggot meal, *Mucunapruriens*, cooked bambara nut and *Mucunaco chinchinnensis* were fed. Cholesterol is implicated in the aetiology of arteriosclerosis and other heart diseases in man (Ramos *et al*., 2003). The low blood cholesterol level resulting from the feeding of legume forages in this study may have some nutritional and health benefits.

Parameters	*Albizia*	*Parkia*	Control	SEM	LOS
Total Protein (g/dl)	4.97	4.68	4.58	0.14	NS
Albumin (g/dl)	2.30	2.43	2.45	0.21	NS
Globulin (g/dl)	2.67^{a}	2.25^{a}	2.13^{b}	0.23	*
Glucose (mg/dl)	178.14	193.91	183.20	5.57	NS
Creatinine (mg/dl)	$0.53d^{b}$	0.38^{c}	0.90^{a}	0.09	*
Uric Acid (mg/dl)	6.77	5.60	6.77	069	NS
Cholesterol (mg/dl)	55.22	55.59	56.12	4.15	NS

^{a,b,c} = Means with different superscripts on the same row differ significantly (P < 0.05); SEM= Standard Error of Means.; NS = Not significant.

Table 6: Initial Serum Biochemistry of WAD Goats Fed Albizia, Parkia and grasses

Parameters	Control	Albizia	*Parkia*	SEM	LOS
Total Protein (g/dl)	3.92^{b}	4.64^{a}	4.63^{a}	0.13	*
Albumin (g/dl)	2.02^{b}	2.41^{a}	2.42^{a}	0.19	*
Globulin (g/dl)	1.90^{b}	2.23^{a}	2.21^{a}	0.23	*
Glucose (mg/dl)	142.1^{b}	179.9^{a}	181.1^{a}	5.52	*
Creatinine (mg/dl)	$0.57d^{a}$	0.41^{b}	0.39^{c}	0.09	*
Uric acid (mg/dl)	6.99^{a}	5.82^{b}	5.79^{c}	0.43	*
Cholesterol (mg/dl)	78.23^{a}	57.91^{b}	55.54^{c}	4.15	*

^{a,b,c} = Means with different superscripts on the same are significantly different at P > 0.05; SEM= Standard Error of the Mean; LOS = Level of significance

Table 7: Final Serum Biochemistry of WAD Goats fed Albizia, Parkia and grasses

PRUNNING REGIME OF *ALBIZIA* AND *PARKIA* FODDERS

Result for the Pruning Regime of *Albizia* and *Parkia* fodders is presented in Table 8. Height of plant was significantly affected by treatment (P < 0.05) with *albizia* having the highest value (146cm) and an average of 182.20 number of leaves. This may be attributed to the genetic make-up of the plants. It has been reported (Cisse *et al*., 2002) that variation exists in terms of growth of plants with different varieties or species.

Percentage prune was not significantly (P > 0.05) affected by treatments. A range of 24.20% - 24.80% was used in the pruning operation. Prune weight was observed to be 63.30kg for the *albezia spp* which was significantly higher (P < 0.05) than the 4.3kg for *Parkia spp*. This could be attributed to the growth rate of the plant as pruning was done relative to the plant height. The *albizia spp*, being taller, tended to have higher prune weight when compared to the *parkia spp*.

Yield/hectare had significantly higher (P < 0.05) value for *albizia* spp. (1517.99kg) while *Parkia* spp. had 103.13kg. This is also a product of prune weight and the stocking density of the plant. No variation exists between plants in terms of plant number/ha, therefore height of the plants and weight of prune play significant role of the yield/ha of the plants

The amount of goats sustainable by plant/ha on a supplementary bases is dependent on the yield/ha and the daily intake of goats. Results obtained implies higher number of goats could be sustained with *albizia* (219.14) as compared to *parkia* (15.23).

Stem regrowth was significantly higher (P < 0.05) for *albizia* (3.71) than *parkia* (2.21). The result obtained is in line with reports from Marais (2001) who reported that regrowth appears to be optimised at the 4.5cm stem leaves per tiller growth of kikuyu. A relative increase in the height of the plant was observed with 137.22cm for *albizia* while *parkia* had 21.16. A corresponding result for number of leaves show a significantly higher (P < 0.05) value for *albezia* (219.41) as compared with the *parkia spp*.

Prune weight showed *albizia* with 101.41kg/ha being significantly higher (P < 0.05) than 6.99kg/ha harvested for the *parkia* spp. Yield /hectare showed significantly higher value for *albizia* as compared with the *parkia spp*.

Parameters	*Albizia*	*Parkia*	SEM	LOS
Height of Plant (cm)	146^{a}	24.63^{b}	1.11	*
Number of Leaves	182.2^{a}	16.42^{b}	0.67	*
Percentage Prune (%)	24.2	34.8	0.57	NS
Prune weight (kg/ha)	63.3^{a}	4.3^{b}	3.21	*
Yield/hectare (kg)	151.9^{a}	103.13^{b}	9.21	*
After four Weeks				
Regrowth of Stem	3.71^{a}	2.21^{b}	1.11	*
Height of Plant	137.22^{a}	21.16^{b}	9.22	*
Number of leaves	219.41^{b}	43.11^{b}	3.10	*
Prune weight	101.41^{a}	6.99^{b}	8.39	*
Yield/hectare	2431.89^{a}	167.63^{b}	13.03	*

^{a,b} = Means with different superscripts on the same row are significantly different at P < 0.05; SEM = Standard error of means; LOS = Level of significance

Table 8: Pruning Regime of Albizia, Parkia for feeding WAD Goats fed

III. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

From the study, lower crude protein and nitrogen free extract contents were observed for the grasses as compared to the *Albezia* and *Parkia* supplements. *Albezia*- supplemented goats generally had better physiological indices than the unsupplemented group. Goats fed the leguminous forages (*Albezia* and *Parkia*) showed significantly higher performance in terms of weight gain and feed conversion ratio as compared to the control animals. Those fed only grasses also had higher white blood cells and lower red blood cells indicating leucocytosis as compared to the *Albezia*- and *Parkia*- fed group. It may therefore be concluded that the leguminous fodders fed could be a dependable feed resource of high quality which will help to develop sustainable feeding systems and also increase productivity in goats particularly in the study area.

RECOMMENDATIONS

Leguminous supplementation especially of *Albezia* and *Parkia* species should be offered to goats during the dry season to ensure availability of feed all- year- round for optimum production. The research plots already developed on

the farm should also be maintained for a sustainable fodder production that will support optimal growth of West African Dwarf goats in the Nigerian Guinea Savanna zone.

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