Sjournals
Scientific Journals
Scientific Journal of Animal Science (2012) 1(3) 107-118

Contents lists available at Sjournals
Scientific Journal of Animal Science
Journal homepage: www.Sjournals.com

Original article

Effect of graded levels of Mexican sunflower leaf (*Tithonia diversifolia Hemsl. A. Gray*) meal on the feed intake of ewe during the entire gestation period of 150 days

A.H. Ekeocha[a,*], P.O. Fakolade[b]

[a]*Department of Animal Science, University of Ibadan, Ibadan, Nigeria.*
[b]*Department of Animal Science, Osun State University, Osogbo, Nigeria.*

[*]Corresponding author; Department of Animal Science, University of Ibadan, Ibadan, Nigeria.

A R T I C L E I N F O

Article history:
Received 19 August 2012
Accepted 16 September 2012
Available online 20 September 2012

Keywords:
Mexican sunflower leaf
Feed intake
Gestation period

A B S T R A C T

A 150 – day feeding trial was conducted to evaluate Mexican Sunflower leaf (MSL) as dietary fiber source in sheep diets. Straight diets were formulated to contain the MSL at dietary levels of 0%, 15%, 30% and 45% as replacement for wheat bran. Sixteen (16) West African dwarf ewe weighing 17.50 to 17.88kg were allotted to the 4 diets containing four replicates per treatment with 1 ewe per replicate in a completely randomized design (CRD). Ewes were given *ad libitum* access to feed and water and routine vaccination and medication followed standard procedures. Parameters measured were changes in feed intake during early, mid and late pregnancy and Feed Conversion Ratio (FCR). Data were analyzed using descriptive statistics and ANOVA. There were significant ($p<0.05$) differences in concentrate dry matter intake (CDMI) from pre-pregnancy phase (181.80 - 536.80g/day) through early (210.50 – 621.50g/day), mid (225.80 – 666.70g/day) and late pregnancy (195.20 – 576.30g/day) with animals in treatment B having the highest CDMI while animals on treatment D having the least. Contrarily, there were significant ($p<0.05$) differences in grass dry matter intake (GDMI) from pre-pregnancy phase (130.65 – 215.95g/day) through early (151.28 – 243.72g/day), mid (162.28 – 268.23g/day) and late pregnancy (140.28 – 231.86g/day) with animals in treatment C having the highest GDMI during pre-pregnancy, mid and late pregnancy and animals in treatment D having the highest during early pregnancy while animals in treatments A and B having the least. Total Dry Matter Intake (TDMI) increased from pre-pregnancy phase (392.30 – 695.00g/day) through early (454.20 – 804.80g/day), mid (487.20 – 863.30g/day) and decline during late pregnancy (420.70 – 746.20g/day) with animals in treatment B consistently having the highest TDMI while animals in treatment D having the least. The results in this study for feed conversion ratio though best for animals in diets B (15%MSL) did not differ statistically. The feed conversion trends observed in this study suggested that sheep gained weight in relation to their feed intake. At parturition mean weight of animals on diet B was highest (26.03kg) while mean weight of animals on diet D was lowest (22.80kg) (*P>0.05*). The results of this study suggest that Mexican Sunflower Leaf Meal could suitably replace Wheat bran in the diets of pregnant ewe up to 30% level of inclusion without eliciting any adverse effect.

1. Introduction

Sheep and goats display unique ability in Nigeria (Abiola and Onwuka, 1998). This may probably be one of the reasons why they represent about 63-70% of the total grazing domestic livestock in the country (Gefu and Adu, 1984). They are mostly kept for meat and are estimated to contribute about 11% of the domestic meat supply (Adu and Ngere, 1979).

In commercial sheep enterprise, 90% of the breeding stock comprises of ewe and traits of importance are reproduction in ewe and growth rates in lambs (Mbap and Ikechi, 1998). Blaxter (1967) reported that voluntary intake is an important determining factor for ruminant performance and showed that differences in voluntary intake are generally genetically controlled. Variation in voluntary intake within animals is negligible since sheep eat to constant fill and the mechanism involved is purely digestive tract distension which is a function of the digestibility of the feed and its passage rate through the reticulo-rumen (Blaxter and Wainman, 1961). Forbes (1968) reported that growth of the uterus in pregnant ewe till mid gestation has little change in rumen volume but afterwards; rumen volume appeared to be depressed. This suggests that depressed roughage intake that takes place in late pregnancy in ewe could partly be as a result of physical restriction. Flushing should be done 7-10days before breeding and maintained until animals are bred. Flushing is the process of increasing the nutritional intake of a female animal so that it can produce more ova and therefore increase the possibilities of obtaining more fertilized oval. The beneficial effect of this practice has been attributed to the increase in metabolism and the high level of nutrients in the blood stream, which elicit the release of larger than normal quantities of gonadotropins, resulting to maturation of more ripe follicles. However, these beneficial effects are pronounced only in ewes in bad condition (Marshall and Potts, 1924). In literature it was reported elsewhere that weight of the lamb is influenced by age, size and nutrition of the dam, gestation length, sex of the offspring and litter size. Lambs weighing more at birth under similar management and feeding regimes generally record higher subsequent gains and reaches slaughter weight earlier (Keen and Henning, 1949). Males are heavier than females at birth and single lambs weigh heavier than twin lambs (Adebambo, 1970). Late gestation and lactation are the most critical periods for ewe and doe nutrition with lactation placing the highest nutritional demands on ewes/does (Forbes, 1970a). Deficiencies, excesses and imbalances of vitamins and minerals can limit animal performance and lead to various health problems. This study was conducted to assess the response of WAD ewe to MSLM-based rations during pregnancy.

2. Materials and methods

2.1. Experimental site

This study was carried out at the sheep unit of the University of Ibadan Teaching and Research farm.

2.2. Plant materials (Mexican sunflower)

Mexican sunflower "*Tithonia diversifolia*" leaf obtained at the Teaching and research farm, University of Ibadan was harvested at approximately 4 weeks by slashing and carrying after the onset of rains. The stems were cut 50 cm above the ground and sorted into leaves (Tarawali *et al*., 1995). The stems were sun-dried on a clean cemented platform until crisp. The leaves were partially ground and packed into sacks, weighed and stored in a silo. The samples were bulked together and manually mixed to obtain as uniform a product as possible. A representative sample was collected from it for proximate analysis. The MSLM sample was oven dried at 105^{0}C for 24 hours (to constant weight), milled and stored in air tight, sealed polythene bags prior to chemical analysis. The Mexican sunflower leaf meal used in this study contained (%) crude protein, 16.3; crude fiber, 21.8; ether extract, 2.8; ash, 14.7; and nitrogen free extract, 44.4.

2.3. Pen management

The pen and metabolic cages were swept and dusted. They were later fumigated with Izal (Saponated cresol) at the ratio of 1:200 water and also with diazintol (diazinon) at the rate of 2ml/liter of water (diazintol a strong and broad spectrum insecticide, acaricide and larvicide). Wood shavings were later spread on the floor of individual pens including the adaptation and spare pens; the wood shaving was changed fortnightly till the end of the trial.

2.4. Experimental design and treatments

Sixteen WAD sheep aged 11 - 12 months were divided into four groups of four animals each. Each group was randomly assigned to one of 4 treatments and individual animals were completely randomized within the experimental pens in the unit.

The statistical model was: $\gamma_{ij} = \mu + \alpha_i + e_{ij}$

where γ_{ij} = individual observation

μ = general mean of population

α_i = treatment effect due to diets

e_{ij} = error effect

2.5. Animal feeding

The WAD sheep were fed Mexican sunflower wheat bran blended ration (Table 1). *Panicum maximum* leaves were harvested from pasture and range management unit of Animal Science Department at the Teaching and Research farm of the University of Ibadan. Leaves were allowed to wilt over-night before feeding and this was chopped manually with cutlass into 3 – 5 cm pieces just before feeding.

Panicum maximum was given to all the treatments as basal diets. Concentrate supplements were formulated so that 0% (A), 15% (B), 30% (C), and 45% (D) of wheat bran were replaced by weight with Mexican Sunflower Leaf Meal (MSLM). Feeding was done daily at 08:00 and 16:00 hrs (GMT). Fresh water was provided for each animal *ad libitum* daily. The animals were fed at 5% of body weight on dry matter basis. Proximate composition (DM, CP, CF, EE, NFE, and ash) of the forage was also determined. Thus, nitrogen free extract (NFE) = 100 – (CP +CF + EE + ash). The diet formulation and nutrient composition are shown in Tables 1, 2 and 3.

2.6. Laboratory analysis

Samples of dried MSLM and *Panicum maximum* were oven dried at 105 ^{0}C to constant weight, milled and stored in air tight, sealed polythene bags prior to chemical analysis. The nutrient composition of dried milled sample of MSLM, *Panicum maximum* leaves or branchlets and faeces were determined according to the procedure of AOAC (1990). Nitrogen content of feeds, faeces and urine were determined by the micro-kjeldahl technique using the Markham's distillation apparatus. Neutral Detergent Fiber (NDF): NDF was determined by the Van Soest and McQueen (1973) methods as the residue after the reflux with 0.5m H_2SO_4 (TetraoxosulphateVI acid) and acety/trimethy/ammonium bromide. Acid Detergent Fiber (ADF): ADF was determined by the Van Soest (1963) method as the residue after extraction with boiling neutral solutions of sodium lauryl sulphate and EDTA. The percentage hemicellulose was obtained by deducting the ADF from the NDF. The percentage cellulose was obtained by deducting the percentage lignin from the ADF. ADF residue is primarily lignocellulose. The cellulose is dissolved by using 72% H_2SO_4 (TetraoxosulphateVI acid) solution. The remaining residue consists of lignin and acid soluble ash.

2.7. Oestrus synchronisation

Oestrus was artificially synchronized in all the animals using Dinoprost tromethanine solution PGF_2 (Upjohn-Tuco products, Canada), administered intra-muscularly in two doses of 1ml given 19days apart. Rams bred at the sheep unit of Teaching and Research farm were introduced once signs of heat were detected. Mating was allowed before 08.00hrs and after 18.00hrs to minimize heat stress on the rams. All ewe were weighed at mating and monthly thereafter until parturition.

2.8. Routine observed during reproductive trial

Ewe were weighed and mated at the end of April, 2005. They were group penned and fed during the period of the reproductive trial. For the 4th week of every trimester (beginning prior to mating) each ewe was weighed individually penned and total feed intake was taken at the fifth week. Clean water was constantly available throughout the experimental period. Ewes were then reweighed and returned to their group pens. This was continued till parturition. At parturition, the dams were weighed, lambs were weighed and their sex was recorded. Thereafter lambs were weighed weekly. In the third trimester, each ewe was weighed; individually penned and total feed intake was taken at the 5th week.

Table 1
Ingredient composition of experimental ration.

Ingredients %	Rations			
	A	B	C	D
MSLM[1]	0.00	15.00	30.00	45.00
Wheat bran	45.00	30.00	15.00	0.00
Cassava peel	33.20	33.20	33.20	33.20
Palm kernel meal	10.00	10.00	10.00	10.00
Ground nut cake	10.00	10.00	10.00	10.00
Oyster shell	0.50	0.50	0.50	0.50
Bone meal	0.50	0.50	0.50	0.50
Mineral/Vit. Premix	0.30	0.30	0.30	0.30
Common salt	0.50	0.50	0.50	0.50

[1]MSLM = Mexican Sunflower Leaf Meal, A = 0% MSLM, B = 15% MSLM, C = 30% MSLM, D = 45% MSLM

Table 2
Proximate composition of experimental diet.

Constituents %	Rations			
	A	B	C	D
Dry matter	92.00	91.00	90.00	89.00
Crude protein	17.10	16.90	16.50	16.20
Crude fiber	15.70	16.40	17.00	17.50
Ether extract	3.47	3.63	3.70	3.75
Ash	8.60	9.40	10.10	11.30
NFE[1]	55.13	53.67	52.70	51.25
ADF[2]	22.54	26.70	30.85	35.01
NDF[3]	43.15	44.50	45.85	47.20
ADLs[4]	7.92	8.41	9.03	9.85
Gross energy(kcal/kg)	3829.5	3805.5	3781.0	3735.5

[1]NFE= Nitrogen free extract
[2]ADF= Acid detergent fiber
[3]NDF= Neutral detergent fiber
[4]ADL= Acid detergent lignin

Table 3
Chemical Composition of Dried Mexican Sunflower Leaf Meal (MSLM), Wheat bran and *Panicum maximum.*

Components	MSLM	Wheat bran	*Panicum maximum*
Dry matter	89.00	89.00	26.00
Crude protein (CP)	16.33	17.00	7.95
Crude fiber (CF)	21.80	8.50	31.00
Ether extract (EE)	2.81	3.50	4.00
Ash	14.68	13.01	8.90
NFE[1]	44.38	57.99	48.15
ADF[2]	42.63	25.00	42.70
NDF[3]	60.00	51.00	74.30
Hemi cellulose	17.37	26.00	31.60
ADL[4]	9.96	8.60	13.87

[1]NFE= Nitrogen free extract
[2]ADF= Acid detergent fiber
[3]NDF= Neutral detergent fiber
[4]ADL= Acid detergent lignin

Table 4
Anti nutritional factors in MSLM.

Component	Quantity (mg/100g)
Total Alkaloid	6.32
Saponin	1.05
Oxalate	5.25
Phytate	8.81
Tannin	5.19
Glycosides	0.42
Phenol	0.53

Source: Ekeocha (2009)

2.7. Statistical analysis

The experimental design was completely randomized and the Data obtained were subjected to analysis of variance (ANOVA) using the General Linear Model (GLM) of SAS software (SAS, 1999). Treatment means were compared by Duncan test of the software.

3. Results and discussion

3.1. Reproductive performance of WAD ewe fed MSLM based diets

3.1.1. Feed intake

The proximate composition of grass (*Panicum maximum*) and the concentrate supplements were earlier presented in (Table 3). Dry Matter Intake (DMI) at pre, early, mid and late pregnancy was presented in (Table 5). Average Total DMI (g/day) increased gradually from average values of 446.85, 695.00, 500.10 and 392.30 for ewes on diets A, B, C and D in pre-pregnancy to 517.40, 804.76, 543.84 and 454.21g/day respectively for ewes on diets A, B, C and D in early pregnancy and increased further to 550.00, 863.30, 620.20 and 487.24g/day in mid pregnancy. These values declined in late pregnancy to 479.78, 746.23, 536.11 and 420.68g/day for animals on diets A, B, C and D respectively. Dietary effects on Total DMI were not significant (*P>0.05*) throughout the pregnancy phase of the experiment. However, concentrate intake and grass intake increased significantly (*P<0.05*) throughout the pregnancy phase (Table 5). Animals on diets B significantly (*P<0.05*) had the highest concentrate DM intake throughout the pregnancy phase while animals on diets D had the lowest. Contrarily, animals on diets C and D significantly (*P<0.05*) had the highest grass DM intake across the pregnancy phase. The voluntary DM intake of *P. maximum* by sheep supplemented with MSLM based diet showed significant linear trends with increasing level of supplementation (Table 5). As expected, the proportion of MSLM based diet refused increased significantly with the increasing level of supplementation. At each level of supplementation, the proportion of MSLM based diet (45% inclusion) refused in diet D was more than 15% units higher than the refusals for diets A, B and C and this elicited a significant (*P<0.05*) increase in DM intake of *P. maximum*. CP content of dried leaves (16.33%) was relatively lower than fresh and wilted leaves (25.50%). Similar reductions in crude protein content and DM loss as a result of drying have been reported for several tropical browse species (Mahynddin *et al*., 1998; Ahn *et al*., 1989).

Parachristous and Nastis (1994) reported that drying increased neutral detergent fiber and lignin contents and decreased in vitro organic matter digestibility of browse species. Palmer and Schlink (1992) also reported higher *in sacco* digestibility of fresh *Calliandra calothyrsus* leaves than oven-dried or freeze-dried leaves. Drying reduced the crude protein content of Mexican sunflower leaves which was reflected in the diet composition and depressed DM loss in WAD sheep. This is probably due to reactions (e.g. Maillard reactions) which reduced availability of nutrients during the drying process (Holmes, 1980). Such reactions might have resulted in changes in the cell-wall structure which inhibited rumen microbial adhesion and subsequent breakdown of DM in the dried MSLM Leaves. Nevertheless, drying may be encouraged for storage reasons, and also to reduce phenolic contents in some browse species (Ahn *et al*., 1989). The voluntary CDM intake of MSLM based diets in ewes on diet B was significantly higher than for ewes on treatment D throughout the pregnancy phase suggesting that diet B was preferred to diets A, C and D. There were several possible explanations for the relatively lower voluntary CDM intake of animals on diet D in particular. First, drying might have increased neutral detergent fiber and lignin contents of the forage (Papchristous and Nastis, 1994), resulting in longer rumen retention times, slower rates of passage and consequently reduced voluntary DM intake of the dried leaves. Secondly, chemical reactions during the drying process might have rendered the dry leaves more bitter and consequently less acceptable to the sheep on diet D. At all phases of pregnancy MSLM enhanced (*P<0.05*) both intake of grass and concentrate DMI when expressed on the basis of metabolic weight, while total DMI improved numerically (*P>0.05*) with increasing inclusion of MSLM.

DMI as percentage of animal live-weight varied between 2.23% and 4.02% in mid pregnancy. The DMI of animals on some dietary treatments seemed not to have been satisfied. Only voluntary DMI of animals on dietary treatments B could be said to have met the range 3-5% specified to be adequate for maintenance and production in sheep (ARC, 1985; Steele, 1996). Treatment A, C and D had below 3%.

3.1.2. Live-weight changes during pregnancy

Pattern of live weight changes of pregnant ewe fed MSLM based diets in the last six weeks of gestation is shown in Table 6. All animals on diets A, B, C and D gain weight during pregnancy indicating that DM intakes were sufficient both for maintenance and production. Weight changes during pregnancy were 5.30, 5.60, 6.58 and 8.53kg for animals on diets D, A, C and B respectively (highest for animals on diet B). This numerical increment in observed weight gain were not statistically significant (*P>0.05*).

Weight loss during parturition was highest for animals on diet C (3.60kg) and decreased numerically to 3.30kg in animals on diet D. The values obtained were not consistent with dietary treatments and treatment effects on observed variation were not significant (*P>0.05*). Ewe on diet C were heaviest at mating (17.88kg) and those on diets B and D had the least mean weight (17.50kg) although no statistical significant (*P>0.05*) was observed. At parturition mean weight of animals on diet B was highest (26.03kg) while mean weight of animals on diet D was lowest (22.80kg) (*P>0.05*). However, at weaning mean weight of dams on diet B was highest (20.66kg) followed by diet C (19.00kg) > diet A (17.80kg) > diet D (17.60kg) although no statistical significance (*P>0.05*) was observed. There was no significant correlation between live-weight at mating and duration of pregnancy or live-weight at mating and lambs birth weight. This agrees with earlier observations (Orji 1976; Uwechue 2000; Ogunwole, 2004) for WAD ewe.

3.1.3. Gestation length

Estimation of gestation length was assumed to have commenced from the day of mating till the day of lambing or parturition. The values obtained for gestation lengths were 150.0, 149.5, 150.5 and 150.0 days for ewe on diets A, B, C and D respectively. However, the observed variations were only numerical but statistically insignificant (*P>0.05*). Mean gestation length in most sheep breeds varies from 144-155 days (Terril, 1968). Orji (1976) observed a range of 140-169 days for WAD sheep. Mean gestation lengths obtained for multiple births were longer than the corresponding gestation period for single birth. This observation however is at variance with that reported by Uwechue (2000) that sheep with multiple births have shorter gestation periods.

3.1.4. Parturition

All births took place unassisted. Most lambing was in the night. All foetal membranes were recovered with none consumed by the ewe. No mortality was recorded at birth.

3.1.5. Type of birth and sex indication

Of the four ewes per treatment, all ewes on diet B had single birth while animals on diets A, C and D had one ewe-lamb each with twin birth (Table 7). Twinning rate vary greatly and range from 20% (Hill, 1960) to 87% (Ngere, 1975), Taiwo (1979) obtained 51.9% and Ademosun (1973) reported 27% as twinning rates.

Significant differences due to treatment (*$P<0.05$*) were obtained for sex of lambs from animals fed diets A, B, C and D. All lambs from animals fed diets B and C were male, while 80% of lambs obtained from diets A and D were male. The proportion of male lambs far exceeds the female lambs (84.2%): (15.8%).

3.1.6. Lamb birth weight

The birth weight of lambs is significantly affected by nutritional status of ewe during pregnancy (Adu and Olalokun, 1979). The mean lamb birth weights were 1.59kg, 1.65kg, 1.80kg and 1.80kg for animals on diets D, A, B and C respectively. Diets B and C had mean lamb weight of 1.80kg. The numerical increase in these values was however not statistically significant (*$P>0.05$*). There is a high variability in reported values for birth weight in WAD ewe. ILCA (1979) reported an average of 1.80kg. Ngere and Aboagye (1981) reported a birth weight of 1.30kg in Ghana while Ngere *et al* (1979) reported 1.50kg in Ibadan. The values obtained here compared favourably with the former reports (1.80kg) but disagrees with the latter scholars. Odubote (1990) reported 2.80kg; Opasina and David-West (1989) reported 2.12kg for WAD lambs while Tizikara and Chiboka (1990) reported a range of 3.06kg to 4.07kg for the gravid uterus. Ogunwole (2004) reported a range of 2.10kg to 3.48kg for WAD sheep. The variations observed in birth weight could be due to variations in feed offered. The correlation between the ewe live-weight closest to lambing and the lamb's birth-weight were not significant (*$P>0.05$*).

4. Conclusion

Inclusion of Mexican sunflower leaf meal up to 30% level in the diets of pregnant ewe improved the overall performance in terms of nutrient intake. All dietary treatments sustained pregnancy with no reported case of pregnancy toxemia. Therefore MSLM could suitably replace wheat bran in the diets of pregnant ewe up to 30% level of inclusion without eliciting any adverse effect.

Table 5

Dry Matter Intake and Feed Conversion of Pregnant Ewe Fed MSLM Based Diets.

Treatments	Daily DMI Conc. (g)	daily DMI Grass (g)	Daily TDMI	CDMI g/dayWkg$^{0.75}$	GDMI g/day Wkg$^{0.75}$	TDMI Wkg$^{0.75}$	FCR	FER
Pre-pregnancy 3 days before service								
A	316.20^{ab}	130.65^{b}	446.85	74.98^{ab}	38.64^{b}	97.19	11.89	0.09
B	536.80^{a}	158.26^{b}	695.00	111.52^{a}	44.62^{b}	135.36	12.48	0.08
C	283.40^{ab}	215.95^{a}	500.10	69.07^{ab}	56.33^{a}	105.75	11.34	0.10
D	181.80^{b}	210.49^{a}	392.30	49.51^{b}	55.26^{a}	88.15	11.06	0.10
SEM	94.92	15.88	100.40	30.41	7.95	31.72	3.48	0.03
Early-pregnancy 6 weeks in gestation								
A	366.10^{ab}	151.28^{b}	517.40	83.70^{ab}	43.14^{b}	108.49	13.77	0.08
B	621.50^{a}	183.24^{ab}	804.80	124.47^{a}	49.80^{ab}	151.10	14.45	0.07
C	328.10^{ab}	215.73^{ab}	543.80	77.09^{ab}	56.29^{ab}	112.61	12.16	0.09
D	210.50^{b}	243.72^{a}	454.20	55.26^{b}	61.68^{a}	98.39	12.80	0.08
SEM	109.90	21.80	120.00	33.94	10.90	36.26	4.10	0.02
Mid-pregnancy 12 weeks in gestation								
A	392.80^{ab}	162.28^{b}	550.00	88.23^{ab}	45.47^{b}	113.57	14.77	0.07
B	666.70^{a}	196.57^{b}	863.30	131.20^{a}	52.50^{b}	159.27	14.88	0.07
C	352.00^{ab}	268.23^{a}	620.20	81.27^{ab}	66.28^{a}	124.28	13.12	0.08
D	225.80^{b}	261.45^{a}	487.20	58.25^{b}	65.02^{a}	103.70	13.74	0.08
SEM	117.90	19.72	124.71	35.78	9.34	37.32	4.21	0.02
Late-pregnancy 18 weeks in gestation								
A	339.50^{ab}	140.28^{b}	479.80	79.09^{ab}	40.76^{b}	102.52	13.52	0.08
B	576.30^{a}	169.92^{b}	746.20	117.62^{a}	47.06^{b}	142.77	13.40	0.08
C	304.30^{ab}	231.86^{a}	536.10	72.86^{ab}	59.42^{a}	111.41	11.72	0.09
D	195.20^{b}	225.50^{a}	420.70	52.22^{b}	58.19^{a}	92.89	12.60	0.09
SEM	101.91	17.06	107.83	32.07	8.39	33.46	3.81	0.03

^{ab}means on the same row with different superscripts differ significantly (*P<0.05*) . S.E.M: Standard error of mean.

BW = Body weight, TDMI = Total dry matter intake, CDMI = Concentrate dry matter intake, GDMI = Grass dry matter intake, Conc. = Concentrate, FER = Feed efficiency ratio, FCR = Feed conversion ratio.

Table 6

Reproductive performance of WAD ewe fed MSLM based diets.

Parameters	A(0%MSLM)	B(15%MSLM)	C(30%MSLM)	D(45%MSLM)	SEM
Initial wt before growth trial (kg)	14.10	14.00	14.30	14.00	2.78
Wt at mating (kg)	17.63	17.50	17.88	17.50	3.48
Wt at parturition (kg)	23.23	26.03	24.45	22.80	3.95
Wt after parturition (kg)	19.80	22.46	20.85	19.50	3.59
Gestation length (days)	150.00	149.50	150.50	150.00	0.82
Lamb birth wt(kg)	1.65	1.80	1.80	1.59	0.38
Wt loss during parturition (kg)	3.43	3.57	3.60	3.30	0.42
Wt gain during pregnancy (kg)	5.60	8.53	6.58	5.30	0.97
Wt of dam at mid lactation (kg)	18.80	21.46	19.50	18.43	3.41
Wt of dam at weaning (kg)	17.80	20.66	19.00	17.60	3.27
Wt changes during lactation (kg)	-2.00	-1.80	-1.85	-1.90	0.40

SEM: Standard error of mean.

Table 7: No of Lambs Lambed by each Ewe on Sex Basis

Parameters	TA(0%MSLM)	TB(15%MSLM)	TC(30%MSL)	TD(45%MSL)
Ewe 1 No of Male Lamb	1	-	-	-
No of Female Lamb	1	-	-	-
Total	2	-	-	-
Ewe 2 No of Male Lamb	1	-	-	-
No of Female Lamb	-	-	-	-
Total	1	-	-	-
Ewe 3 No of Male Lamb	1	-	-	-
No of Female Lamb	-	-	-	-
Total	1	-	-	-
Ewe 4 No of Male Lamb	-	-	-	-
No of Female Lamb	1	-	-	-
Total	1	-	-	-
Ewe 5 No of Male Lamb	-	1	-	-
No of Female Lamb	-	-	-	-
Total	-	1	-	-
Ewe 6 No of Male Lamb	-	1	-	-
No of Female Lamb	-	-	-	-
Total	-	1	-	-
Ewe 7 No of Male Lamb	-	-	-	-
No of Female Lamb	-	1	-	-
Total	-	1	-	-
Ewe 8 No of Male Lamb	-	1	-	-
No of Female Lamb	-	-	-	-
Total	-	1	-	-
Ewe 9 No of Male Lamb	-	-	2	-
No of Female Lamb	-	-	-	-
Total	-	-	2	-
Ewe 10 No of Male Lamb	-	-	1	-
No of Female Lamb	-	-	-	-
Total	-	-	1	-
Ewe 11 No of Male Lamb	-	-	1	-
No of Female Lamb	-	-	-	-
Total	-	-	1	-
Ewe 12 No of Male Lamb	-	-	-	-
No of Female Lamb	-	-	1	-
Total	-	-	1	-
Ewe 13 No of Male Lamb	-	-	-	1
No of Female Lamb	-	-	-	1
Total	-	-	-	2
Ewe 14 No of Male Lamb	-	-	-	1
No of Female Lamb	-	-	-	-
Total	-	-	-	1
Ewe 15 No of Male Lamb	-	-	-	1
No of Female Lamb	-	-	-	-
Total	-	-	-	1
Ewe 16 No of Male Lamb	-	-	-	-
No of Female Lamb	-	-	-	1
Total	-	-	-	1

References

Abiola, S.S., Onwuka, C.F., 1998. Reproductive performance of West African dwarf sheep and goats at village level in Ogun State, Nigeria. *Nig. Journ*. *Anim. Prod*. 25(1), 79-82.

Adebambo, V.O., 1970. Effect of variations of dietary energy levels on growth and carcass quality of Nigerian dwarf sheep. Ph.D Thesis, Animal Science Dept. University of Ibadan, Nigeria.

Ademosun, A.A., 1973. The development of livestock Industry In: *Nig. Ruminants Proc. Agric. Soc. Farming*, May/June pp. 16-18.

Adu, I.F., Ngere, L.O., 1979. The indigenous sheep of Nigeria. *World Rev. Anim*. *Prod.* Vol. 15, No. 3, 51-62.

Adu, I.F. and Olalokun, E.A., 1979. A note on nutrition during late pregnancy in WAD sheep. *Anim. Prod*. 28, 123-126.

Ahn, J.H., Robertson, B.M., Elliot, R., Gutteridge, R.C., Ford, C.W., 1989. Quality assessment of tropical browse legumes: tannin content and protein degradation. *Anim Feed Sci. Tech*. 27, 145-156.

AOAC, 1990. Association of Official Analytical Chemists official methods of Analysis, 15th Ed. AOAC Inc. Arlington, Virginia USA.

ARC, 1985. Agricultural Research Council. The nutrient requirement of farm animals No.2 Ruminants: Tech Rev. and Summaries, ARC, London.

Blaxter, K.L., 1967. The efficiency of energy transformations in ruminants: Energy metabolism of farm animals. EAAP. Publication 12, Oriental Press Ltd. New Castle-Upton Tyne, England.

Blaxter, K.L., Wainman, P.W., 1961. The Utilization of food by sheep and cattle. *J. Agric. Sci. Camb*. 57, 419-425.

Ekeocha, A.H, (2009). Utilization of Mexican Sunflower (*Tithonia diversifolia, Hemsley A. Gray*) By the West African Dwarf Sheep. Ph.D Thesis, University of Ibadan, Ibadan, Nigeria, 224pp.

Forbes, J.M., 1968. The physical relationship of the abdominal organs in the pregnant ewe. *J. Agric. Sci.* (Camb) 72, 119.

Forbes, J.M., 1970a.Voluntary food intake of pregnant ewe. *J. Anim. Sci*. 31, 1222.

Gefu, S.O., Adu, I.F., 1984. Understanding small ruminant production in Northern Nigeria. *World Rev. Anim. Prod*. 20(3), 35-39.

Hill, D.H., 1960. West African Dwarf sheep. Proc. 3rd Annual Conf. of Science Ass. of Nigeria. Ibadan.

Holmes, W.(ed.), 1980. Grass, its Production and Utilization. British Grassland Society. Blackwell Scientific Publications, London.

Keen, G.R., Henning, W.L., 1949. Birth weight and average daily gain in hot house lamb production*. J. Anim. Sci*. 8, 362-372.

Marshall, F.R., Potts, C.G., 1924. Cited by S.M. Williams 1954. Fertility in chenn Forestry sheep. *J. Agric. Sci*. 45, 202-228.

Mahyuddin, P., Little, D.A., Towry, J.B., 1998. Drying treatment drastically affects feed evaluation and feed quality with certain tropical forage species. *Anim. Feed Sci. Technol.* 22, 69-78.

Mbap, S.I., Ikechi, U.D., 1998. Production performance of sheep at two locations in Bauchi State, Nigeria. *Nig. Journ. Anim. Prod*. 25(2), 198-203.

Ngere, L.O., 1975. The improvement of livestock production in Nigeria through breeding *Nig. J. Anim. Prod.* 2, 36-43.

Ngere, L.O., Aboagye, G., 1981. Reproductive performance of the WAD and Nungua Blackhead sheep of Ghana. *Anim. Prod.* 33, 249-252. Shika, Zaria, Nigeria.

Ngere, L.O., Adu, I.F., Mani, I., 1979. Report of small ruminant breeding Subcommittee. NAPRI Bulletin 1. National Animal Production Res. Institute.

Odubote, I.K., 1990. An analysis of lambing records of West African dwarf sheep kept at Ile-Ife, Nigeria Res. Network ILRAD, Nairobi Kenya 10-14 Dec. 1990 Eds. B. Rey, SHB Lebbie and L. in *Proc. of the 1st Biennial Conf. of the African Small Rum. Reynolds* pp185-191.

Ogunwole, A.O., 2004. Evaluation of Rumen Epithelia Scrapings of Cattle for Pregnant, Lactating and Preweaned Lambs of West African Dwarf Sheep. Ph.D Thesis, Univ. of Ibadan, Ibadan, Nigeria.

Opasina, B.A., David West, K.B., 1989. Position paper on sheep and goat production Nigeria. In: sheep and goat meat production in the humid tropics of West Africa FAO of the UN, Rome, 1989 pp. 228-230.

Orji, B.I., 1976. Studies on the biology of reproduction of the Nigerian dwarf sheep. Ph.D Thesis, University of Ibadan, Ibadan, Nigeria.

Palmer, B., Schlink, A.C., 1992. The effect of drying on the intake and rate of digestion of the shrub legume Calliandra calothyrsus. *Trop. Grassl.* 26, 89-93.

Papachristous, T.G., Nastis, A.S., 1994. Changes in chemical compositions and in vitro digestibility of oesophageal fistula and hand-plucked forage samples due to drying method and stage of maturity. *Anim. Feed Sci. Technol*. 46, 87-95.

SAS, 1999. SAS/STAT Guide for personal computers. Version 6 S.A.S. Inst. Inc. Cary. New York, USA.

Steele, M., 1996. Goats, the tropical Agriculturists. CTA publication. Macmillan pp. 9-21.

Taiwo, B.B.A., 1979. Reproductive performance, growth and carcass merit of Nigerian dwarf sheep and their crosses. Ph.D. Thesis University of Ibadan, Ibadan, Nigeria.

Tarawali, S.A., Tarawali, G., Larbi, A., Harrison, J., 1995. Methods for the evaluation of forage-legume grasses, and fodder trees for use as livestock feed. ILRI *Manual J. ILRI Nairobi Kenya*. 7-15.

Terril, C.E., 1968. Reproduction of sheep. In: Reproduction in farm Animals. 2nd Edition by ESE Hafez, Rea and Febezer, Philadelphia.

Tizikara, C., Chiboka, O., 1990. Effect of ram breed and size on reproductive performance of West African dwarf ewe. *Trop. Anim. Prod. Invest.* 1, 57-65.

Uwechue, N.F., 2000. Performance and carcass quality of WAD sheep fed Siam weed (chromolaena odorate) Based Rations. Ph.D Thesis. University of Ibadan, Ibadan, Nigeria.

Van Soest, P.J., 1963. Use of detergents in the analysis of fibrous feeds. 11. A rapid method for the determination of fibre and lignin. *J. Assoc. Off. Anal. Chem*. 46, 829-835.

Van Soest, P.J., McQueen, R.E., 1973. The chemistry and estimation of fibre*. Proc. Nutr. Soc.* 32, 123-127.