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UTILIZATION OF MEXICAN SUNFLOWER LEAF MEAL-BASED DIETS BY PRE WEANED WEST AFRICAN DWARF LAMBS

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SUMMARY

Studies were conducted using 16 West African Dwarf (WAD) lambs selected from 16 ewes brought to heat (Oestrus) by synchronization and served by 2 rams. The experimental animals were placed at 6 weeks of age and were fed with Panicum maximum plus concentrate diet mixture of Mexican Sunflower Leaves (MSL) and Wheat Bran (WB) such that 0, 15, 30 and 45% of wheat bran was replaced by weight with MSL gravimetrically in diets A, B, C and D respectively. The experiment lasted for seven weeks. Feed and water were provided ad libitum and routine vaccination and medication were administered. Parameters measured were weight gain, dry matter intake, weaning weight and Feed Conversion Ratio (FCR). The Dry Matter Intake - DMI (g/day) was highest for lambs on diet C (156.94) followed by B (156.53), A (154.29) and D (152.04) g/day respectively. This increase was numerically higher than observed values for animals on treatments A and B but statistically significant ($P<0.05$) when compared with animals on treatment D. This trend was observed for weight gain and weaning weight. Values obtained for FCR (2.30, 2.33, 2.30, and 2.38) for lambs on treatments A, B, C and D respectively were not significant ($p>0.05$). Results from this study showed that 30% MSLM-based diet was acceptable to the pre-weaned lambs as it supported dry matter intake, optimum weight gain, weaning weight and feed conversion ratio before diminishing return sets in.

Key-words: performance, sunflower, pre-weaned lambs, West African Dwarf Sheep

INTRODUCTION

Undernourishment in sheep has been reported to manifest among lambs in form of reduced birthweight, retarded growth rate and increased mortality (Ogunwole, 2004; Adu and Olaloku, 1979). Oyedipe (1981) further explained that nutrition of growing ruminants is one of the single most important factor influencing growth, onset of puberty, litter size and survival rates of the young ones. A departure from the growth of lambs is likely to set in as from the third week of life when the milk yield of ewe starts to decline (Adu, 1975). It is clear from the research findings that early weaned lambs cannot survive on pasture alone. In view of this, the provision of creep feeding would be necessary as soon as the lambs are able to nibble on solid foods. Such provision should be palatable, nutritionally adequate, low in fibre and highly digestible. In addition to the enhanced growth of lambs, creep feeding encourages rumen development, a condition that increases the subsistence of the lambs on solid foods (Adu, 1975).

Wheat bran (WB) in Nigeria about 15 – 20 years ago had little or no value but presently, due to high cost of conventional energy sources, population explosion and poor protein intake in the country, WB in Nigeria presently is a major source of energy for ruminants. In order to reduce the high cost of production of beef, milk and other products, there is need for replacement of some percentages of WB with Mexican sunflower leaf meal (MSLM). Mexican sunflower (MS) is readily available in Nigeria, although, it has a long history of existence but it has always been considered as a weed and often time, it's left to rot on the farm after weeding and sometime burnt. Apart from the environmental pollution associated with burning, it also contributes

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to the depletion of ozone layer. Therefore, there is the need to think of the alternative use of MS by incorporating it into the diet of sheep at a level that will not be detrimental to the animal benefit. The need to find alternative protein source for ruminant animal in attempt to reduce cost has necessitated the inclusion of MS meal in the diet of ruminants.

Therefore, this study examines the effects of using Mexican Sunflower leaf meal-based diets in the nutrition of pre-weaned WAD lambs.

MATERIAL AND METHODS

Ration Formulation: The Mexican Sunflower (*Tithonia diversifolia)* used for this trial was harvested at the Teaching and Research farm, University of Ibadan at approximately 4 weeks by slashing and carrying after the onset of rains. The shoots were cut 50cm above the ground and sorted into leaves (Tarawali et al., 1995). The stems were sun-dried on a clean, cemented platform until crisp. The dried leaves were milled using a hammer mill with a sieve size of 3.36 mm to produce leaf meal. The samples were bulked together and manually mixed to obtain homogenous product as possible. The MSLM sample was oven dried at 105˚C for 24 hours (to constant weight), milled and stored in air tight sealed, polythene bags prior to chemical analysis. A representative sample was collected from it for proximate analysis using standard methods (AOAC, 1990) to determine the nutrient composition. 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.

Sample Analysis: The Mexican Sunflower leaves were screened for some bioactive compounds (alkaloid, saponin, oxalate, phytate, tannin, glycosides and phenol) by the method of Sofowora (1996). The proximate composition (crude fat, crude protein and ash) on dry weight basis was determined by AOAC (1990). Protein (N $\times$ 6.25) content was determined using the micro-kjeldhal method. Energy is determined using digital bomb calorimeter, model: ballistic. Neutral detergent fiber (NDF), acid detergent fiber (ADF), and acid detergent lignin (ADL) were determined by the methods of Van Soest et al (1991). Phenol and tannins were determined by the method described by Makkar (2000). Tannic acid (Sigma-Aldrich Chemie, Steinheim, Germany) was used as standard. Phytate content was determined by the method of Wheeler and Ferel (1971) and Igbedioh et al. (1994), while oxalate content offer the titrimetric method as modified by Ranjhan and Krishna (1980).

Animals and Management: Sixteen pre-weaned lambs of WAD sheep obtained from sixteen ewes brought to heat (Oestrus) by synchronization and served by two rams were used for this trial. The experiment lasted for 7 weeks. The sixth week after parturition, pre-weaned lambs were offered concentrate supplement equivalent to 3% of their body weight as recommended by Akinsoyinu (1974), grass (*Panicum maximum*) and water *ad libitum* until 13th week when they were weaned. 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)-based diets in a pre-weaned concentrate. Thus, nitrogen free extract (NFE) = 100 – (CP +CF + EE + ash). The diet formulation and nutrient composition are shown in Tables 1 and 3.

Record of Weight: The lamb's weight was measured and the daily lamb weight was estimated before milking of their respective dams.

Responses: Weight gain or losses were estimated weekly and feed conversion ratio obtained for each lamb using the formula:

$$\frac{\textit{Average Daily Feed Intake}}{\textit{Body Gains Unit}}$$

Laboratory or Chemical Analysis: Feed samples were determined according to AOAC (1990) whereas the gross energy was determined by Adiabatic Bomb Calorimeter.

Statistical Analysis: Data obtained were subjected to the analysis of variance (ANOVA) using the General Linear Model (GLM) of SAS software (SAS, 1999). Treatment means were compared by Duncan option of the software.

Table 1. Ingredient composition of experimental rations

Tablica 1. Sastav pokusnih obroka

Ingredients %	Rations			
	TA (0% SF)	TB (15% SF)	TC (30% SF)	TD (45% SF)
MSLM	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
Groundnut 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/vitamins	0.30	0.30	0.30	0.30
Common salt	0.50	0.50	0.50	0.50
Crude protein	14.78	14.68	14.58	14.48
Crude fiber	6.69	8.68	10.68	12.67
Ether extract	2.95	2.84	2.74	2.63
Gross energy (kcal/kg)	2380	2390	2390	2400

MSLM=Mexican Sunflower Leaf Meal; SF=Sunflower; TA=0% SF; TB=15% SF; TC=30% SF; TD=45%SF

Table 2. Chemical composition of dried Mexican sunflower leaf meal (MSLM), wheat bran and *Panicum maximum*

Tablica 2. Kemijski sastav hrane od osušenoga lista meksičkoga suncokreta (MSLM), pšeničnih mekinja i Panicum maximum

Components	MSLM	Wheat bran	*Panicum maximum*
Dry matters	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	44.38	57.99	48.15
ADF	42.63	25.00	42.70
NDF	60.00	51.00	74.30
Hemicellulose	17.37	26.00	31.60
ADL	9.96	8.60	13.87

NFE=nitrogen free extract, NDF=neutral detergent fiber; ADF=acid detergent fiber, ADL=acid detergent lignin, Hemicellulose=NDF– AD, NFE=(100 – CP +CF +EE +Ash)

Table 3. Chemical composition of Mexican sunflower leaf meal based concentrates fed to WAD sheep

Tablica 3. Kemijski sastav hrane s koncentratom lista meksičkoga suncokreta za ovce zapadnoafričke patuljaste pasmine

Ingredients %	Rations			
	TA (0% SF)	TB (15% SF)	TC (30% SF)	TD (45% SF)
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	55.13	53.67	52.70	51.25
ADF	22.54	26.70	30.85	35.01
NDF	43.15	44.50	45.85	47.20
ADL	7.92	8.41	9.03	9.85
Gross energy (kcal/kg)	3829.5	3805.5	3781.0	3735.5
*Metabolizable energy (kcal/kg)	3140.2	3120.5	3100.4	3063.1

NFE = nitrogen free extract; ADF = acid detergent fiber; NDF = neutral detergent fiber; ADL = acid detergent lignin; * Calculated by Ekeocha (2009), metabolisable energy = gross energy × 0.82

Table 4. Anti-nutritional factors in MSLM

Tablica 4. Antinutritivni čimbenici u hrani s listom meksičkoga suncokreta

Components	Quantity (mg/100g)
Total alkaloid	6.32
Saponin	1.05
Oxalate	5.25
Phytate	8.81
Tannin	5.19
Glycoside	0.42
Phenol	0.53

RESULTS AND DISCUSSION

The MSL (g/100 g DM) contained CP 16.3; CF 21.8; EE 2.8; Ash 14.7; and GE 1.9 kcal/g. Approximately 60.5±1.1% of the voluntary dry matter intake (VDMI) comprising of concentrate dry matter intake (CDMI) and grass dry matter intake (GDMI) came from the supplement.

Table 5 shows the estimated average daily dry matter intake from grass, concentrate and the total daily dry matter intake respectively in the period 7^{th}–13^{th} of pre-weaned lamb's life. The Pre-weaned TDMI (g/7 wks) of lambs in this study (44.04–45.47 g/kg $^{0.75}$ .d^{-1}) were similar ($p>0.05$) and within the range of values (41.45-46.36 g/kg) reported (Ifut, 1992) for WAD goats fed *Gliricidia sepium* and cassava peels. Ifut (1992) obtained 46.3 g/kg per day DM intake when WAD goat were fed sole (100%) *Gliricidia sepium* while higher values (63.5 – 86.4) were obtained when fed sole *Panicum maximum*, and combinations of *Gliricidia sepium, Panicum maximum* and cassava peels. The pre-weaned CDMI (25.30-26.96 g/$kg^{0.75}$ per day) obtained in this study were not significant ($p>0.05$) but higher than the corresponding pre-weaned daily GDMI (18.21–18.80 g/$kg^{0.75}$ per day). This is an indication that the lambs consumed or preferred more concentrates than grasses and that the MSLM-based diets are acceptable to the lambs. The GDMI increased significantly ($p<0.05$) with increasing level of MSLM in the ration.

It seems that increasing MSLM level in the diets stimulated DM consumption via increased intake of grass as observed in the trial.

Lambs on treatment C gained weight at a faster rate than lambs on treatments B, A and D in descending order of weight increment evidenced by estimated average daily weight gain (g/day) (68.16, 67.25, 67.06 and 63.85) for lambs on treatments C, B, A and D respectively. This increment in weight gain was significantly ($p<0.05$) higher than for lambs on treatment D (63.85). This suggests that the diets seemed to be adequate in meeting the nutrient requirements for growth of lambs and that the test ingredients (wheat bran and Mexican sunflower leaf meal) could replace well one another in pre-weaned lambs diets most especially at optimal level of 30% inclusion before diminishing return sets in. The values reported in this study are 6.4% higher than 64.04 g/day for pre-weaned WAD lambs in 0-90 days (Ogunwole, 2004). Adebambo (1976) cautioned on the interpretation of the growth of lambs. He observed that even at weaning in ruminants or when the character of diet is changed to the one which increases fill, weight gain per unit weight of feed consumed can be spuriously high.

Values obtained for FCR (2.30, 2.33, 2.30, and 2.38) referring to lambs on treatments A, B, C and D respectively were not significantly affected by treatment ($p>0.05$). The low FCR (2.30–2.38) obtained in this study is an indication of high digestibility and utilization of the experimental rations by pre-weaned lambs. This could be attributed to low fiber content (15.70–17.50%), low ADL (7.92–9.85%) of the rations, high daily weight gain (63.85–68.16 g/day) and lamb weaning weight (7.40–8.00 kg). The correlation between total DMI and total weight gain of lambs during creep feeding was positive ($r=0.839$) and highly significant ($p<0.05$) indicating that DMI from creep feed directly influenced the growth of lambs. The values obtained for FCR in the study were higher than the range of values (0.71–1.10) reported for WAD goats fed sole *Gliricidia sepium* and combinations of *Gliricidia sepium* and 30% cassava peels by Ifut (1992).

The weaning weight obtained for lambs on treatments A, B, C and D were 7.76, 7.92, 8.00 and 7.42 kg respectively. The observed variations in weaning weights on treatments A, B, and C but significantly ($p<0.05$) different from observed values in lambs on treatment D (7.42 kg) indicate that the contributory role of fermentable substrate to pre-weaned growth was mainly numerical. The weaning weight obtained in this study compared favorably with 7.79–8.59 kg of young male WAD sheep at 3 months of age (Ogunwole, 2004). Uwechue (2000) reported a mean value of 7.60–9.53 kg for WAD lambs.

Table 5. Performance characteristics of pre-weaned lambs fed MSLM based diets

Tablica 5. Karakteristike janjadi hranjene listom meksičkoga suncokreta prije odbića

Parameters	Treatment				SEM
	TA (0%SF)	TB (15%SF)	TC (30%SF)	TD (45%SF)	
Birth weight (kg)	1.65	1.80	1.80	1.59	0.38
Pre weaned CDMI in 7wks(kg)	4.48	4.52	4.51	4.28	0.16
Pre weaned GDMI in 7wks(kg)	3.08^{b}	3.15^{ab}	3.18^{a}	3.18^{a}	0.01
Pre weaned TDMI in 7wks(kg)	7.56	7.67	7.69	7.45	0.10
Pre weaned CDMI in ($g/kgw^{0.75}$ d^{-1})	26.49	26.72	26.96	25.30	1.70
Pre weaned GDMI in ($g/kgw^{0.75}$ d^{-1})	18.21^{b}	18.63^{ab}	18.80^{a}	18.80^{a}	0.41
Pre weaned TDMI in ($g/kgw^{0.75}$ d^{-1})	44.70	45.34	45.47	44.04	1.76
Pre weaned CDMI (g/d)	91.43	92.24	93.04	87.34	5.81
Pre weaned GDMI (g/d)	62.86^{b}	64.29^{ab}	64.90^{a}	64.90^{a}	1.43
Pre weaned TDMI (g/d)	154.29	156.53	156.94	152.04	5.82
Pre-weaned at 6 wks (kg)	4.42	4.69	4.63	4.24	0.19
Average daily wt gain (g/d)	67.06^{a}	67.25^{a}	68.16^{a}	63.85^{b}	0.61
Lamb weaning wt(kg)	7.76^{a}	7.92^{a}	8.00^{a}	7.40^{b}	0.04
Feed conversion ratio	2.30	2.33	2.30	2.38	0.01

ab = means on the same row with different superscripts differ significantly ($P<0.05$); SEM=standard error of mean; CDMI=concentrate dry matter intake, GDMI=grass dry matter intake, TDMI=total dry matter intake

CONCLUSION

The results from this study showed that 30% MSLM based diet were acceptable to the pre-weaned lambs as it supported dry matter intake, optimum weight gain, weaning weight and feed conversion ratio.

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