Effect of Flushing on Nutrient Utilization and Reproductive Performance of Ewes Grazing on Community Rangeland

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ABSTRACT : The present study was undertaken to evaluate the effect of flushing of ewes with concentrate pellets just before the mating season on their nutrient utilization and reproductive performance on farms. Forty-eight Malpura ewes, 1-5 years old were randomly divided into 2 groups of 24 each (G1and G2). Ewes in both the groups were grazed on natural rangeland from 07.00 to 18.00 hr followed by night shelter in animal shed. G1 ewes were maintained on sole grazing while G2 ewes, in addition to grazing, received concentrate pellets at the rate of 1.5% of their body weight. The mean biomass yield of the community rangeland was 0.46 ton DM/hectare. The intakes of DM (g/kg $W^{0.75}$), DCP (g/kg $W^{0.75}$) and ME (MJ/kg $W^{0.75}$) were higher ($p<0.01$) in G2 as compared to that of G1 being 86.5, 10.2 and 1.15 and 57.5, 4.7 and 0.75, respectively. The digestibility of DM, OM, CP, NDF and hemicellulose were also higher ($p<0.01$) in G2 as compared to that of G1 being 57.2, 76.7, 78.9, 51.9 and 81.6 and 50.8, 68.7, 68.4, 45.4 and 74.4, respectively. The conception rate was higher (79.2%) in flushed ewes as compared to that of non-flushed (66.7%). Five of the pregnant ewes died and another 5 aborted in G1 while in G2, 5 ewes aborted with no mortality. The lambing was higher (73.7%) in G2 than that in G1 (37.5%). The birth weight of lambs was higher ($p<0.05$) in G2 (3.47 kg) than that in G1 (2.95 kg). Further, the birth weight of male lambs was higher (3.28) than that of female lambs (3.14). It is concluded that the biomass yield of the community rangeland in semi-arid region of India is low and insufficient to meet the nutrient requirement of ewes prior to mating season. However, concentrate supplementation at the rate of 1.5% of body weight to ewes during this critical stage enhanced their plane of nutrition, reproductive performance, body condition and birth weights of lambs. ***(Asian-Aust. J. Anim. Sci. 2006. Vol 19, No. 4 : 521-525)***

Key Words : Flushing, Nutrient Utilization, Reproductive Performance, Ewes, Community Rangeland

INTRODUCTION

Indian rangelands are covered with a wide variety of vegetation viz. grasses, bushes, forbs, shrubs and trees. The limited concentrate supplementation in addition to free grazing on community rangeland substantially improves production performance of ewes (Chaturvedi et al., 2001; Chaturvedi et al., 2003). It is widely accepted practice in sheep husbandry to provide ewes with extra energy supply (flushing) for 2-3 weeks prior to and during breeding, for the purpose of increasing the number of lambs produced. Failure to flush the ewes may result in delayed estrus activity and ovulation (Gunn et al., 1979), fertilization failure (Restall et al., 1978) and embryonic mortality (Rhind et al., 1989). In another report, the litter weight increased by extending the flushing period from 17 to 34 days, whereas the effect on litter weight was minimal (Sormunen-Cristian and Jauhiainen, 2002), but flushing does not always improve the lambing performance (Crocker et al., 1985). The information on the effect of flushing on nutrient utilization and reproductive performance of ewes in farmers' fields is limited. The present study was therefore, undertaken to evaluate the effect of flushing of ewes with concentrate pellets just before the mating season on their nutrient utilization and reproductive performance on farms.

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MATERIALS AND METHODS

Location of the study area

The present study was carried out on a farmer's sheep flock maintained on natural rangeland at Bheepur village of district Tonk, Rajasthan, about 10 km from the Central Sheep and Wool Research Institute, Avikanagar, located in hot semi-arid region of the country at 75°28' E latitude and 26°17' N longitude and 320 meter above sea level.

Animals, feeds and reproductive performance study

The feeding experiment was conducted for 30 days extending from the late summer season to the onset of the monsoon (mid May to mid June 2003). Forty-eight Malpura ewes, 1-5 years old were selected and randomly divided into 2 groups of 24 each (G1 and G2). Ewes in both the groups were grazed on natural rangeland from 07.00 to 18.00 h followed by night shelter in animal shed. G1 ewes were maintained on sole grazing while ewes in G2, in addition to grazing received concentrate pellets at the rate of 1.5% of their body weight. Concentrate pellets contained in parts barley (15), maize (10), rice bran (15), de-oiled rice bran (20), guar korma (15), ambadi cake (7), groundnut cake (10), molasses (5), mineral mixture (1), common salt (1) and calcite powder (1). Body weight of the ewes was recorded at end of the supplementation period. The

Table 1. Meteorological observations of the location during the experimental period

Attributes	May	June	Average
Dry bulb temperature (°C)			
0830 h	30.8 (25.5-34.5)	31.4 (25.5-35.0)	31.1 (25.2-34.8)
1430 h	42.3 (39.0-44.5)	39.4 (30.0-46.5)	40.8 (34.5-45.5)
Minimum temperature (°C)			
0830 h	25.2 (21.0-31.0)	28.1 (22.0-33.0)	26.7 (21.5-32.0)
1430 h	25.0 (19.5-31.0)	28.2 (22.5-33.0)	26.6 (21.0-32.0)
Maximum temperature (°C)			
0830 h	42.0 (38.0-45.0)	40.4 (29.5-47.0)	41.2 (33.8-46.0)
1430 h	41.9 (38.5-44.0)	40.0 (29.5-46.5)	41.0 (34.0-45.3)
Relative humidity (%)			
0830 h	46.6 (29.0-72.0)	63.2 (41.0-88.0)	54.9 (35.0-80.0)
1430 h	37.0 (13.0-66.0)	40.7 (18.0-76.0)	38.9 (15.5-71.0)
Wind velocity (km/h)	6.6 (2.3-10.8)	7.9 (3.1-11.7)	7.3 (2.7-11.3)
Total rainfall (mm) in 24 h	0.32 (0.0-10.0)	1.58 (0.0-21.0)	0.95 (0.0-15.5)
Sun shine (h)	8.9 (2.6-11.2)	7.5 (0.3-10.8)	8.2 (1.5-11.0)

Figures in parenthesis show the range of the item.

reproductive performance of the ewes was also recorded.

Assessment of biomass yield and botanical composition

The biomass yield of the community rangeland was assessed (Papanastasis, 1977). The vegetation cover of the community rangeland consisted of *Cynodon dactylon*, *Desmostachya bipinnata*, *Celosia argentia*, *Cenchrus biflorus*, *Tephrosia purpuria* and *Kagler* grasses, *Zizyphus nummularia*, *Calotropis procera* and *Capparis decidua* shrubs and *Zizyphus jujuba*, *Acacia nilotica*, *Azadirachta indica* and *Prosopis cineraria* fodder trees. This botanical composition is in close agreement to those reported earlier (Chaturvedi et al., 2000; 2001; 2003).

Collection of samples and chemical analysis

Five ewes from each treatment were randomly selected for conducting a digestibility trial. The diet samples were collected for five consecutive days by hand picking method (Sankhyan et al., 1999b), while the faecal samples were collected from the rectum at 08.00 h. Subsequently, samples were mixed and pooled for individual ewes. Representative samples of concentrate mixture, range, diet and faeces were analysed for dry matter (DM) by drying them in oven at 60°C till constant weight. The above samples were subsequently ground to pass through a 1 mm sieve and were analysed for crude protein (CP) and ash (AOAC, 1990), neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) (Van Soest et al., 1991).

Assessment of intake and digestibility

The ash free NDF was also estimated in the diet samples to calculate voluntary intake (Osbourn et al., 1970).

$$SVI\ (g\ DM/kgW^{0.75}) = 95.0\text{-}0.713\ NDFsc+4$$

Where, SVI is the sheep voluntary intake

NDFsc is the ash-free NDF of the diet sample

The *in vitro* dry matter digestibility (IVDMD) of all the diet samples was estimated by the method of Tilley and Terry (1963) except that the second stage was avoided. The rumen liquor used in IVDMD estimation was obtained from fistulated rams maintained on a Cenchrus (*Cenchrus ciliaris*) hay based diet. The faecal output was estimated by using the formula and subsequently the digestibility was calculated.

Faecal outgo (g DM/day)
= Intake (g DM/day)×(100-IVDMD)

The metabolizable energy (ME) intake was calculated as MEI = OMI (g)×19×0.82 (ARC, 1980).

Statistical analysis

The data obtained were analyzed under one way analysis of variance (ANOVA) for comparing the means using SPSS (version 10) statistical package.

RESULTS AND DISCUSSION

Meteorological conditions and biomass yield

The meteorological conditions were harsh for the sheep reproduction (Table 1). The dry bulb temperature, minimum and maximum temperature were higher than the normal and the rainfall was very low. The mean biomass yield of the community rangeland was 0.46 ton DM/hectare, which is almost similar (Chaturvedi et al., 2000; 2001) or variable (Sankhyan et al., 1999a; Chaturvedi et al., 2003) to earlier reports. These differences in biomass yield are attributed to the season, fertility of land, type of pasture, type of grazing and stocking density on the rangeland.

Chemical composition of the range and the diet

The chemical composition of the range and the diet was

Table 2. Chemical composition of concentrate pellets and diet consumed by ewes

Component	DM	OM	CP	NDF	ADF	Hemi-cellulose	Cellulose	ADL
Concentrate pellets	92.50	88.80	21.20	56.24	21.18	35.06	13.55	5.23
Diet	38.79	83.81	11.89	58.12	32.19	25.93	20.21	5.62
Range	44.81	69.91	8.28	63.39	35.66	27.73	19.79	5.49

Table 3. Intake and digestibility of nutrients in ewes grazing on community rangeland

Item	G1	G2	SEM	Level of significance
Body weight (kg)	22.24	27.88	1.06	NS
Metabolic body weight (kg)	10.23	12.13	0.36	NS
Nutrient intake				
Roughage intake (g/d)	589.0	697.0	20.69	**
Concentrate intake (g/d)	-	350	ND	ND
Dry matter (g/d)	589.0	1047.0	20.69	**
Dry matter (g/kg BW)	26.55	37.69	0.31	**
Dry matter (g/kg $W^{0.75}$)	57.55	86.50	0.57	**
DCP (g/d)	47.92	123.98	2.54	**
DCP (g/kg BW)	2.16	4.463	0.11	**
DCP (g/kg $W^{0.75}$)	4.68	10.24	0.21	**
ME (MJ/d)	7.69	13.95	0.27	**
ME (MJ/kg BW)	0.346	0.502	0.007	**
ME (MJ/kg $W^{0.75}$)	0.751	1.152	0.007	**
Nutrient digestibility (%)				
Dry matter	50.80	57.23	0.08	**
Organic matter	68.66	76.72	0.99	**
Crude protein	68.39	78.89	1.70	**
Neutral detergent fibre	45.38	51.90	0.83	**
Acid detergent fibre	22.23	22.15	2.17	NS
Hemicellulose	74.42	81.64	1.34	**
Cellulose	72.48	71.57	1.53	NS

ND = Not detected, NS = Not significant, ** $p<0.01$.

assessed. The representative range samples contained (Table 2) 8.28 CP, 63.39 NDF, 35.66 ADF and 5.49 ADL (% DM basis) whereas the diet contained a higher proportion of CP (11.89) and lower contents of fibre (58.12 NDF, 32.19 ADF). This indicates the selective grazing behaviour of sheep (Ramirez et al., 1995). About 12% CP in the diet agrees with the reports of Shinde et al. (1994) who also indicated that sheep grazing on silvipasture also maintained 13-16% CP in their diets. The calculated values of digestible crude protein (DCP) and total digestible nutrient (TDN) contents of concentrate mixture pellets worked out to about 14 and 65 per cent, respectively.

Intake and digestibility of the nutrients

The intake and digestibility of nutrients in ewes was studied. There was a significant ($p<0.01$) difference in roughage and total DM intake between the supplemented (G2) and non-supplemented (G1) group. The DMI (2.65% of body weight) recorded in G1 was lower than the requirement of sheep (ICAR, 1985). The trends observed in the intakes of DCP and ME were similar to that of DMI, because of the supplementation schedule. DCP and ME intakes recorded in G2 were higher than the recommended standard for reproductive ewes (ICAR, 1985). In general, the digestibility coefficients of DM, OM, CP, NDF and hemicellulose were higher ($p<0.01$) in the supplemented group (G2) as compared to that of the non-supplemented group, G1 (Table 3). It is well established that supplementation in the form of concentrate mixture improves the nutrient digestibility of the total diet (McDonald et al., 1988; Chaturvedi et al., 2003). Although the digestibility of nutrients recorded in G1 ewes was similar to that of earlier reports in sheep (Shinde et al., 1998) and in goats (Bhatta et al., 2002), the nutrient intake was not sufficient to meet their requirements.

Reproductive performance of the ewes

Reproductive performance of the flushed and non-flushed ewes was assessed. The conception rate (%) was higher (79.2) in flushed ewes as compared to that of non-flushed (66.7). Five of the pregnant ewes died and another 5 aborted in G1 while in G2, 5 ewes aborted with no incidence of mortality (Table 4). Mortality and lower conception in the case of non-flushed group was a clear reflection of their poor nutritional status as they were not able to meet their nutrient requirements solely from grazing. The lambing (%) was also higher (73.7) in G2 than that of G1 (37.5), due to better nutrition and health status of the

Table 4. Reproductive performance of ewes grazing on community rangeland

Item	G1	G2
No of ewes	24	24
No of ewes conceived	16	19
Conception rate (%)	66.7	79.2
No of ewes died	5	0
No of abortions	5	5
No of ewes lambed	6	14
Lambing (%) on conceived basis	37.5	73.7

Table 5. Birth weights of lambs

Item	G1	G2	SEM	Level of significance
Male (8)	3.0 (2)	3.57 (6)	0.16	*
Female (12)	2.9 (4)	3.37 (8)	0.13	*
Pooled (20)	2.95 (6)	3.47 (14)	0.10	*
Sex	Male	Female		
Birth weight	3.28	3.14	0.10	*

Figures in parenthesis represent the sample size, * $p<0.05$.

ewes. It is known that ovulation rate in ewes with moderate body condition, and increases on feeding above their energy requirement in the few weeks prior to mating. Goats maintained under extensive browsing on native shrubs with adequate access to *Acacia* and *Prosopis* pods species had a higher percentage of multiple births (Sankhyan et al., 2001). There has been little or no response to better nutrition prior to mating (Gunn et al., 1984), because the body score of ewes and the type and composition of the feed may be more important than the quantity. The protein: energy ratio of pre-mating diets may be more critical to obtain a reproductive response (Crocker et al., 1985).

Birth weight of the lambs born from the ewes (Table 5) was higher ($p<0.05$) in G2 (3.47 kg) than that in G1 (2.95 kg). Higher birth weight in G2 lambs can be attributed to flushing of ewes with concentrate supplementation. Flushing significantly affected litter weight at birth and weaning (Sormunen-Cristian and Jauhiainen, 2002).

CONCLUSIONS

It is concluded that the biomass yield of the community rangeland in semi-arid region of India is low and insufficient to meet the nutrient requirement of ewes prior to the mating season. Concentrate supplementation at the rate of 1.5% of body weight to ewes during this critical stage enhanced their plane of nutrition, reproductive performance, body condition and birth weights of lambs.

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