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Nutrient utilization and reproductive performance of flushing ewes grazing on Community rangeland

O H CHATURVEDI[1], S K SANKHYAN[2] A SAHOO[3] and S A KARIM[4]

Central Sheep and Wool Research Institute, Avikanagar, Rajasthan 304 501 India

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Our 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 (Chaturvedi *et al.* 2001, Chaturvedi *et al.* 2003) and reproduction (Chaturvedi *et al.* 2006, Islam *et al.* 2007) performance of ewes. 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 under farmer's field is limited. The present study was therefore, undertaken to evaluate the effect of flushing of ewes with concentrate just before the mating season on their nutrient utilization and reproductive performance at farmers' field.

The present study was carried out on farmer's sheep flock maintained on natural rangeland at Malpura Sub-Division of district Tonk, Rajasthan, about 5 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. The feeding experiment was conducted for 30 days extending from the late summer to the onset of the monsoon (mid-June to mid-July 2009). Twenty Malpura and Kheri ewes, 2–4 years old were selected and randomly divided into 2 groups of 10 each (G1 and G2). Ewes in both the groups were grazed on natural rangeland from 07.00 to 18.00 hour (hr) followed by night shelter in animal shed. G2 ewes were maintained on sole grazing while ewes in G1, in addition to grazing received concentrate mixture (Table 2) @400 g/day/ewe. Body weight of the ewes was recorded at end of the supplementation period. The reproductive performance of the ewes was also recorded.

The biomass yield of the community rangeland was assessed (Papanastasis, 1977). The vegetation cover of the community rangeland consisted *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). 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 hr. 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 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.

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

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

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 rams

Present address: [1]Senior Scientist (omharichaturvedi @yahoo.co.in),[2]Principal Scientist, [3]Principal Scientist and Head, [4]Director.

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) × (1-IVDMD Coefficient)

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

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

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 0.52 tonne DM/ha, 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. The chemical composition of the range and the diet was assessed. The representative range samples contained (Table 2) 6.5 CP, 72.4 NDF, 49.2 ADF and 7.28 ADL (% DM basis) whereas the diet contained higher proportion of CP (10.9) and lower contents of fibre (64.2 NDF, 44.5 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 worked out to about 9.7% and 81.0%, respectively.

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

Attributes	June	July	Average
Dry bulb temperature (°C)			
0830 hr	30.7	28.9	28.9
	(21.5–33.5)	(25.5–34.0)	(23.5–33.8)
1430 hr	39.8	34.7	37.3
	(30.0–45.0)	(30.0–44.0)	(30.0–44.5)
Minimum temperature (°C)			
0830 hr	27.1	26.6	26.9
	(20.5–32.0)	(24.0–32.0)	(22.3–32.0)
1430 hr	27.1	26.6	26.9
	(20.5–32.0)	(24.0–30.0)	(22.3–31.0)
Maximum temperature (°C)			
0830 hr	41.2	35.8	38.5
	(37.0–46.0)	(31.0–44.0)	(34.0–45.0)
1430 hr	40.8	34.9	37.9
	(36.0–45.0)	(30.0–44.0)	(33.0–44.5)
Relative humidity (%)			
0830 hr	63.6	76.3	70.0
	(47.0–78.0)	(46.0–96.0)	(46.5–87.0)
1430 hr	53.3	57.8	55.6
	(35.0–75.0)	(32.0–89.0)	(33.5–82.0)
Wind velocity	6.7	6.0	6.4
(km/hr)	(2.5–14.0)	(1.5–11.4)	(2.0–12.7)
Total rainfall	0.74	3.6	2.2
(mm) in 24 hr	(0.0–12.0)	(0.0–52.0)	(0.0–32.0)
Sunshine (hr)	8.8	5.9	7.4
	(0.3–11.6)	(0.3–11.7)	(0.3–11.7)

Figures in parenthesis show the range of the item.

The intake and digestibility of nutrients in ewes was studied. There was significant (P<0.01) difference in total DM intake between the supplemented (G1) and non-supplemented (G2) group. The DMI (2.39% 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 G1 were higher than the recommended standard for reproductive ewes (ICAR 1985). In general, the digestibility coefficients of DM, OM and CP were higher (P<0.01) in supplemented group (G1) as compared to that of non-supplemented group, G2 (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 G2 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 flushed and non-flushed ewes was assessed. All the ewes conceived in flushed and non-flushed group with 100% conception rate, however, days of conception after flushing were lesser (P<0.01) in flushed (23.4) as compared to non-flushed (32.8) ewes (Table 3). The body weights of flushed (G1) and non-flushed (G2) ewes differed (P<0.05) 31.73 and 28.02 kg, respectively, while body weights of ewes before flushing were almost similar in G1 and G2 (Table 3). These findings are in close agreement with earlier results of Islam *et al.* (2007). One of the pregnant ewes aborted in G2 while there was no such incidence in G1 (Table 3). Abortion in case of non-flushed group was a clear reflection of their poor nutritional status as they were not able to meet their nutrient requirements from sole grazing. The lambing rate (%) on the basis of ewes conceived was also higher (100) in G1 than that of G2 (90), due to better nutrition and health status of the ewes. These results corroborate the earlier findings (Naqvi *et al.* 2011) that lambing rate increased to 91.6% in the ewes supplemented with concentrate in comparison to 72.7% in non-supplemented control group. It is known that ovulation rate in ewes with moderate body condition, increases on feeding above their energy requirement, few weeks prior to mating. Goats maintained under extensive browsing on native shrubs with adequate access to *Acacia* and *Prosopis* pods species

Table 2. Ingredient and chemical composition of concentrate mixture, range and diet consumed by ewes

Item	Part (%)							
Ingredient composition of concentrate mixture								
Maize	45							
Barley	45							
Groundnut cake (solvent extracted)	4							
Mustard cake	3							
Mineral mixture	2							
Common salt	1							
Chemical composition (% DM basis)								
Component	DM	OM	CP	NDF	ADF	Hemi-cellulose	Cellulose	ADL
Concentrate mixture	96.5	97.2	12.3	46.6	8.6	38.0	5.74	2.65
Range	78.2	73.6	6.5	72.4	49.2	23.2	22.1	7.28
Diet	46.7	81.2	10.9	64.2	44.5	19.7	20.2	6.45

had 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 diet may be more critical to obtain a reproductive response (Crocker *et al.* 1985).

The body weights of flushed (G1) and non-flushed (G2) ewes at parturition were almost similar. Birth weight of the lambs born from the ewes (Table 3) was marginally higher in G1 (3.78 kg) than G2 (3.53 kg). Higher birth weight in G2 lambs can be attributed to flushing of ewes with concentrate

Table 3. Intake and digestibility of nutrients in 2 groups of ewes

Item	G1	G2	SEM	Level of Significance
Body weight (kg)	32.44	30.44	1.93	NS
Metabolic body weight (kg)	13.58	12.93	0.62	NS
Nutrient Intake				
Roughage intake (g/d)	765.5	729.2	34.21	NS
Concentrate intake (g/d)	386.0	—	ND	ND
Dry matter (g/d)	1151.5	729.2	34.92	**
Dry matter (g/kg B.W)	35.71	24.08	0.76	**
Dry matter (g/kg$W^{0.75}$)	85.00	56.38	0.83	**
DCP (g/d)	91.97	49.10	2.29	**
DCP (g/kg B.W)	2.86	1.63	0.07	**
DCP (g/kg$W^{0.75}$)	6.79	3.80	0.10	**
ME (MJ/d)	15.53	9.22	0.44	**
ME (MJ/kg B.W)	0.482	0.305	0.01	**
ME (MJ/kg$W^{0.75}$)	1.147	0.713	0.01	**
Nutrient digestibility (%)				
Dry matter	55.75	52.34	0.07	**
Organic matter	67.60	59.99	0.37	**
Crude protein	70.27	61.84	0.53	**
Neutral detergent fibre	53.62	52.99	0.23	NS
Acid detergent fibre	47.63	46.93	0.47	NS
Hemicellulose	61.12	66.67	1.26	**
Cellulose	38.34	39.58	1.15	NS

ND, not detected, NS,not significant, **,(P<0.01).

Table 4. Reproductive performance of flushed and non flushed ewes

Items	Flushed (G1)	Non Flushed (G2)	SEM	Level of significance
No. of ewes	10	10	-	-
No. of ewes conceived	10	10	-	-
Conception rate (%)	100	100	-	-
No. of Abortion	0	1	-	-
Lambing (%) on conceived basis	100	90	-	-
Days of conception	23.40	32.80	1.82	**
Body weight of ewes before flushing (kg)	30.66	27.46	1.17	NS
Body weight of ewes after flushing (kg)	31.73	28.02	1.15	*
Body weight of ewes at parturition (kg)	35.85	34.18	1.03	NS
Body weight gain of ewes after flushing (kg)	1.07	0.56	0.22	NS
Birth weight of lambs (kg)	3.78	3.53	0.12	NS

NS,not significant, *,P<0.05, **,<0.01.

supplementation. Flushing significantly affected litter weight at birth and weaning (Sormunen-Cristian and Jauhiainen 2002). Present findings corroborate the earlier reports (Islam *et al.* 2007) that flushing improved reproductive efficiency of ewes. 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. Concentrate supplementation @400g/d to ewes during this critical stage enhanced their plane of nutrition, reproductive performance, body condition and birth weights of lambs.

SUMMARY

The present study was undertaken to evaluate the effect of flushing of ewes with concentrate on their nutrient utilization and reproductive performance at farmer's field.

Twenty Malpura and Kheri ewes, 2–4 years old were randomly divided into 2 groups of 10 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. G2 ewes were maintained on sole grazing while G1 ewes, in addition to grazing, received concentrate pellets @400 g/ day/head. The mean biomass yield of the community rangeland was 0.52 tonne DM/ha. The intakes of DM, DCP and ME were higher in G1 as compared to G2. The digestibility of DM, OM and CP were also higher in G1 as compared to G2. The body weights of flushed (G1) and non-flushed (G2) ewes differed. All the ewes conceived in flushed and non-flushed group with 100% conception rate, however, days of conception after flushing were lesser in flushed as compared to non-flushed ewes. The birth weight of lambs was higher in G1 than G2. 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 @400 g/day/ewe during this critical stage enhanced their plane of nutrition, reproductive performance, body condition and birth weights of lambs.

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