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Reproductive performance and body condition score of Deccani sheep during various physiological stages in different farming systems

S A KOCHAWAD¹, TRAGHUNANDAN², KSARJAN RAO³, K KONDAL REDDY⁴, NNALINI KUMARI⁵, DBV RAMANA⁶, SANJEEV KUMAR⁷, L R MEENA⁸ and S P SINGH⁹

College of Veterinary Science, Rajendernagar, Hyderabad, Telangana 500 030 India

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ABSTRACT

The research was carried out to study the effect of different farming systems on reproductive traits and body condition score in Deccani sheep. Ewes (36), 9–12 months of age, were divided in to 3 groups, viz. intensive (T1), semi-intensive (T2) and extensive farming system (T3) with 12 ewes in each group following completely randomized design. The results revealed that, body weight at puberty in intensive group (17.6 kg) was significantly higher than extensive (16.3) group. Age at puberty in extensive group was significantly higher (338 days) than intensive group (290 days). The conception rate in intensive group was 75%, which was higher than semi-intensive and extensive (58.3 and 66.6% respectively). Intensive group had achieved significantly higher body weight at lambing (24.74 kg) than semi-intensive (23.12 kg) and extensive (22.23 kg). Birth weight of lambs in intensive group (2.5 kg) was significantly higher than semi-intensive (1.98 kg) and extensive groups (1.82 kg). Length of estrus cycle and duration of oestrus differed nonsignificantly in different farming systems. BCS values were significantly higher during pregnancy in intensive group. BCS near parturition (48 h near) and BCS 3 months (post-parturition) was significantly higher in intensive as compared to semi-intensive and extensive. BCS (48 h after parturition) was significantly higher in intensive and semi-intensive systems with respect to extensive system. It can be concluded that reproductive traits and body condition score were higher in intensive system compared to other systems because care of life stages through provision of concentrate feed, with minimal body energy loss can be assured in intensive farming system.

Key words: Body condition score, Deccani sheep, Farming systems, Reproduction

Small ruminants play an important role in the agricultural economy of India. They produce milk, meat, skins, excellent manure and coarse wool by consuming poor quality roughages (Nimbkar 1993). Marwari and Deccani are the most important sheep breeds in number and distribution (Sana *et al.* 2015). Deccani breed is medium in size, well suited to the extreme temperatures of the Deccan peninsula,

because of capability of long distance migration. Reproductive performance of sheep is an important economic trait in enhancing the overall productivity and is strongly influenced by environment. Reproduction in sheep is also influenced by external factors such as social and sexual interactions and nutritional status (Nawito *et al.* 2015). BCS technique can be a potential management tool for the farmers to improve the animal performance (Kenyon *et al.* 2014). It is important to have information about BCS in all physiological stages for preparing the feeding programs to increase lamb production by indigenous sheep breeds (Sezenler *et al.* 2011). Ewes with lower BCS will exhibit lower reproductive performance compared to ewes with greater BCS (Kenyon 2014). Therefore, the present study was conducted to document the effect of different farming systems on reproductive traits and body condition score in Deccani sheep during different life stages and set targeted body condition score for Decani sheep.

MATERIALS AND METHODS

Deccani ewes (36), 9 to 12 months old, were selected for the study. Deccani ewes were reared under intensive farming system (T1), semi-intensive (T2) and extensive

Present address: ¹Scientist (sanjiv_kochewad@yahoo.com), ICAR-Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh, India; ²Associate Dean (drtrn@rediffmail.com), College of Veterinary Science, Korutla, Telengana, India; ³Dean of Student Affairs (kapasarjanreddy@gmail.com), Sri Venkateswara Veterinary University, Tirupati, Andhra Pradesh, India; ⁶Principal Scientist (damarla97@gmail.com), ICAR-Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad, Telangana, India; ⁷Scientist (bhanusanjeev@gmail.com), ICAR-National Dairy Research Institute, Karnal, Haryana, India; ⁸Principal Scientist (lrmeena63@gmail.com), ⁹Assistant Chief Technical Officer (spspdfsr@gmail.com), ICAR-Indian Institute for Farming Systems Research, Modipuram, Meerut, Uttar Pradesh, India; ⁴Associate Dean (adcvschyd@tsvu.nic.in), ⁵Associate Professor and Head (nalini_reddy123@yahoo.co.in), Department of Animal Nutrition.

farming (T3). The ewes in intensive system were fed with 300 g of concentrate mixture and *ad lib.* quantity of green fodder. Zero grazing practice was followed for this group. The animals in semi-intensive system were fed with 150 g of concentrate + 4 h of grazing and *ad lib.* quantity of green fodder. In extensive farming system, ewes were sent for grazing from 8.00 AM to 4.00 PM every day for the entire experimental period. Green fodder was provided *ad lib.* for all the groups. Puberty was recorded when ewe exhibited its first estrus behaviour. Date of onset of first estrus was recorded for each ewe for arriving the age of puberty (months and day). Estrus behaviour was used for identification of ewes in standing heat. Estrus duration (h) of the ewe was estimated by close observation of the onset of sexual behaviour and cessation of the mentioned sexual behaviour. The duration (days) between conception and lambing was taken as the gestation length. Conception rate (%) was calculated as percentage of number of ewes conceived upon number of ewes tupped. Body weight of ewes at different physiological stages was recorded using electronic balance. Body condition score was taken at different physiological stages in different farming systems during reproductive life stages. The body condition score was calculated based on 1 to 5 scale system with an interval range of 0.5 as per the procedure suggested by Russel *et al.* (1969). The data were subjected to analysis of variance. Comparison of means of different farming systems was made by Duncans multiple range tests as described by Kramer (1957) using SPSS 15 statistical software.

RESULTS AND DISCUSSION

Reproductive performance of Deccani ewes: Age at puberty in extensive group was significantly ($P<0.05$) higher than that in intensive group (Table 1). Means of semi-intensive group were comparable with means of intensive and extensive group. The earlier attainment of puberty of ewes reared in intensive system might be attributed to their faster growth rate. The findings of the present study were in agreement with El-Hag *et al.* (2007) who reported that increased growth rate in supplemented group reflected in early puberty and higher reproductive performance. Body weight at puberty in intensive group was significantly ($P<0.05$) higher than that in extensive group. Means of semi-intensive group were comparable with means of intensive and extensive group. In present study, the ewes attained the puberty when they achieved 50–70% of their adult body weight. The findings were in agreement with the results of Hafez (1952) who reported that the first estrus in ewe was at 69% of mature weight. The body weight range of ewes' that attained puberty in present study (16.0–19.4 kg) was in agreement with the findings of Meenakshi (2001). Non-significant difference in length of estrus cycle and duration of oestrus was observed in Deccani ewes reared under different farming systems. Quirke *et al.* (1981) reported similar findings. Highest conception rate (75%) was observed in intensive group followed by semi-intensive (58.3%) and extensive group (66.6%). Similar observations

Table 1. Reproductive performance of Deccani ewes in different farming systems

Parameter	Treatment group	Mean±SE
Age at puberty	T1	290±4.90 ^b
	T2	305±5.36 ^{ab}
	T3	303±6.31 ^a
Body weight at puberty	T1	17.63±0.40 ^a
	T2	16.75±0.84 ^{ab}
	T3	16.36±0.20 ^c
Conception rate (%)	T1	75.0
	T2	58.3
	T3	66.6
Gestation length	T1	148.88±1.14 ^a
	T2	147.57±1.17 ^a
	T3	149.37±1.19 ^a
Body weight of ewes at lambing	T1	24.74±0.36 ^a
	T2	23.12±0.24 ^b
	T3	22.23±0.52 ^c
Birth weight of lambs	T1	2.5±0.08 ^a
	T2	1.98±0.06 ^b
	T3	1.82±0.07 ^b
Length of estrus cycle	T1	16.77±0.01 ^a
	T2	17.0±0.00 ^a
	T3	17.0±0.00 ^a
Estrus duration	T1	25.33±0.40 ^a
	T2	24.42±0.29 ^a
	T3	24.37±0.74 ^a

Means with different superscripts in column differ significantly ($P<0.05$).

were made by El-Hag *et al.* (2007) who reported that ewes supplemented with concentrate mixture had higher conception rate than those ewes which were on grazing alone. Tdkleyohannes *et al.* (2013) observed that the pregnancy rate was improved by 17% in lower concentrate group and 29% in high concentrate group over control group. There was no significant difference in gestation length of Deccani ewes reared in different farming systems. Intensive group had significantly ($P<0.05$) higher body weight at lambing than semi-intensive and extensive group. Extensive group recorded the lowest body weight at lambing compared to other groups. The findings of present study were in concurrence with findings of El-Hag *et al.* (2007) who observed that body weight at lambing was significantly ($P<0.01$) higher in supplemented group when compared to control group (grazing only). Birth weight of lambs in intensive group was significantly ($P<0.05$) higher than semi-intensive and extensive groups. Birth weight of lambs in semi-intensive and extensive group were comparable.

Body condition scores of Deccani sheep at different reproductive stages: Significantly higher BCS was recorded for intensive group than other groups at age at puberty, because intensive group achieved higher body weights at an early age when compared to other groups. Owing to access to a higher plane of nutrition in intensive group, they reached puberty at an early age. Hence, the targeted condition score for Deccani ewes for attaining early puberty

might be considered to be about 2.0. Statistically there was no significant difference among intensive, semi-intensive and extensive groups at mating with BCS of 2.33 and 2.21, respectively for intensive and semi-intensive. BCS values were significantly ($P < 0.05$) higher during pregnancy in intensive and semi-intensive group as compared to extensive group. BCS near parturition (48 h near) and BCS 3 months (post-parturition) was significantly higher in intensive compared to semi-intensive and extensive group. BCS (48 h after parturition) was significantly higher in intensive and semi-intensive compared to extensive group (Table 2). Abdel-Maged (2009) reported that low BCS (1.5) resulted in non-exhibition of estrus despite extending the breeding season for 3 months which infers the importance of BCS of ewes for their estrus activity. Maurya *et al.* (2007) study on the relationship between BCS and puberty, reproductive efficiency was also in agreement with present findings. Based on present results, the ideal BCS range suggested for Deccani ewes at mating is 2.0–2.5. Similar values of BCS at mating had been reported as optimum in Ossmi (Abdel-Maged 2009) and Kivircik ewes (Yilmaz *et al.* 2003). In present study, for intensive group, every one-unit score increase in BCS, the body weight increased by 2.4 kg from the time of puberty to the age at mating, hence the group had achieved 75% conception rate, whereas semi-intensive and extensive groups although attained desirable BCS at mating took longer time. Every one unit of increase in BCS resulted in 2.6 kg and 3.91 kg increase in semi-intensive, and extensive group at the time of mating. Significantly higher BCS was recorded for intensive and semi-intensive groups than extensive whereas intensive and semi-intensive treatments were comparable. A gain of 0.46, 0.42 and 0.25 in BCS was recorded from mating to pregnancy for intensive, semi-intensive and extensive groups, respectively. Higher BCS in intensive and semi-intensive groups had resulted in higher lamb birth weights of 2.5 and 1.98 kg for intensive and semi-intensive groups, respectively against 1.88 for extensive group. It indicated that higher BCS at the time of mating and gestation resulted in higher lamb birth weight.

In all the experimental groups, no lamb mortality was observed which indicated that ewes in all the experimental groups had enough body reserves to sustain the growth of fetus and prevent neonatal mortality. Hence, based on the results, it is suggested that the desired targeted condition score during pregnancy of Deccani ewes is in the range of 2.5–3.0, as the hormones and metabolic concentration during the chronology of changes in BCS really showed

the ewes could manage their body reserves in the BCS range of 2.5–3.0. Significantly higher BCS was recorded under intensive and semi-intensive group than extensive group during 48 h before parturition. The gain in BCS from mid to late pregnancy and 48 h prior to parturition recorded BCS gain of 0.04, 0.05 and 0.04 for intensive, semi-intensive and extensive groups, respectively indicated gain in BCS from late pregnancy to near parturition and all the experimental groups were in positive energy. BCS scores expressed as BCS loss values for intensive, semi-intensive and extensive groups were 0.45, 0.33 and 0.42 respectively 48 h after parturition. In spite of higher loss in BCS observed for intensive group, it maintained the BCS of 2.38 which was significantly higher than other groups immediately after parturition. Extensive group lost BCS by 0.42 and could not sustain the optimal range of BCS after parturition. Hence, it is recommended that the BCS should not be less than 2.5 (Table 3) for Deccani sheep immediately after parturition. If observed to be less, they need to be supplemented with high protein and calorie diets to recoup their body condition. The BCS loss of 0.17 was observed for intensive group against 0.46 and 0.33 for semi-intensive and extensive groups, respectively during 3 months after parturition. The loss in the body condition in all the groups might be attributed to the loss of body reserves through colostrums and milk feeding for the lambs till weaning. The trends in post-parturient BCS loss of present study indicated that the ewe flocks which had higher BCS during pregnancy and parturition had minimum loss in BCS. In any case the ideal BCS of adult ewe flock should not be below 2.0 for their maintenance. On the contrary, semi-intensive and extensive groups observed higher post-parturient loss in BCS which resulted in BCS below 2.0. The target condition score after parturition till weaning of lamb should be in the range of 2.0–2.5 for Deccani ewe in order to sustain their long productive life.

The reproductive efficiency in terms of age at puberty, body weight at puberty, conception rate, gestation length, body weight at lambing, birth weight of the lambs is dependent on the farming systems, wherein higher plane of nutrition and comfort of the ewe flocks results in higher performance. The lower productive performance of the Indian predominant extensive system may be supported by the supplementation of concentrates for reproductive stages and enriching the grazing resources and avoidance of inbreeding by the rotation of the superior rams. Desired targeted scores help in augmentation of their productive, reproductive and health performances. The present study

Table 2. Comparative body condition scores of Deccani ewes at different reproductive stages

Treatment	BCS at puberty (1 year)	BCS at mating	BCS during pregnancy	BCS near parturition (48 h before)	BCS (48 h after parturition)	BCS at 3 months post-parturient
T1	2.08±.056 ^a	2.33±.071 ^a	2.79±.074 ^a	2.83±.071 ^a	2.38±.065 ^a	2.21±.074 ^a
T2	1.79±.074 ^b	2.21±.074 ^a	2.63±.065 ^a	2.58±.056 ^b	2.25±.075 ^a	1.79±.074 ^b
T3	1.71±.074 ^b	2.17±.071 ^a	2.42±.056 ^b	2.46±.041 ^b	2.04±.041 ^b	1.71±.074 ^b

Means with different superscripts in column differ significantly ($P < 0.05$).

Table 3. Targeted body condition score for Deccani sheep during different reproductive stages

Reproductive stage	BCS score
Ewes at puberty	Above 2.0
Ewes at mating	2.0–2.5
Ewes during pregnancy (mid-late)	2.5–3.0
Ewes near parturition	2.5–3.0
Ewes after parturition	2.5–3.0
Ewes after parturition (immediately)	2.0–2.5
BCS post-parturient loss	0.5

indicated the ideal set targeted condition scores for different life stages and incidences. The farming community needs to be trained on the technique of BCS assessment for the continuous checking and monitoring of the productive and reproductive performance of sheep flocks.

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