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Body weight changes during different physiological stages of Mecheri ewes

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ABSTRACT

A study was made in 749 animals to observe body weight changes at different physiological stages of Mecheri ewes. Effects of non-genetic factors, viz. period and season of mating, parity of the ewes and sex of the lamb were studied. The overall least-squares means for body weights of Mecheri ewes at mating and just before lambing were 23.3±0.16 and 28.3±0.16 kg, respectively, with a total weight gain of 4.98±0.08 kg during pregnancy period. Parity had highly significant effect on body weights at different months of pregnancy. The overall least-squares mean birth weight of lambs was 2.26±0.18 kg. Males had highly significantly more birth weight than females. Period and parity of the ewes had significant effect on birth weight of lambs. Body weight during lactation revealed that season of mating and parity of ewes had significant effect on body weight during lactation. Period and season of mating and parity of the ewes also had highly significant effect on weight gain of Mecheri ewes after weaning. The study on body weight at different physiological stages in Mecheri ewes revealed that the ewes gained maximum weight during the final month of pregnancy and there was a considerable reduction in body weight during lactation. Hence, during these periods Mecheri ewes should be maintained on better feeding and management that may result in increased birth and weaning weights.

Key words: Body weight, Lactation, Mecheri, Pregnancy, Sheep

Body weight of ewes does not remain constant throughout the year and changes with stage of production. Nutrient requirements are lowest for ewes during maintenance, increase gradually from early to late gestation and are highest during lactation. This indicated that besides the genetic constitution of the animal, physiological stages such as pregnancy and lactation also influence the body weight of ewes. A very few reports are available on this aspect on different sheep breeds (Mishra and Rawat 1985, Orr and Treacher 1989, Bell and Alcock 2007, Ososanya *et al.* 2007). Hence, this investigation was made to explore the effect of various physiological phases through which ewes pass to give birth and rear the lamb up to weaning on their body weights.

MATERIALS AND METHODS

Data were collected during 1996–2003 on 749 Mecheri ewes from the records of Mecheri Sheep Research Station, Pottaneri, Tamil Nadu, India. The body weight of ewes were recorded at the time of mating and then at monthly intervals up to the fourth month of pregnancy and then just before and after lambing. Afterward lambing the ewes were weighed at monthly intervals up to six months. The animals were grazed from 8.00 to 17.00 hours. In addition, ewes were supplemented with 100 to 250 g concentrate mixture. To study the effect of non-genetic factors on body weight of pregnant and lactating ewes and ewes after weaning, the data were divided into 4 periods (1996–1997, 1998–1999, 2000–2001 and 2002–2003), 2 seasons [season 1 (February to April) and 2 (August to October)] and 6 parities, i.e. 1st, 2nd, 3rd, 4th, 5th and 6th. To account for unequal and disproportionate numbers least-squares means for unequal numbers was applied. The test of all comparisons among least-squares means was carried out using Duncan's Multiple Range Test (Harvey 1979). The pregnant animals with complete records for a period of 6 months after lambing alone were considered for studying body weight of ewes before and after weaning. Animals with incomplete records due to culling, death of ewes, death of lambs and sick animals were not considered. A total of 476 ewes with complete records were analyzed. Since in period 4 (2002–2003) more ewes had incomplete records, they were not considered for analysis. The model included for analysis was $Y_{ijklm}=\mu + P_i + S_j + A_k + M_l + e_{ijklm}$, where Y_{ijklm}= lth observation belonging to ith season, jth period, kth parity and lth sex of the lamb, P_i= effect of ith period (i=1 to 4 and 1 to 3), S_j= effect of jth season (j=1 to

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2), A_k=effect of kth parity (k=1 to 6), M_l=effect of lth sex of the lamb and e_{ijklm}=the random error associated with Y_{ijklm} (Harvey 1990).

RESULTS AND DISCUSSION

Body weight changes during pregnancy

Least-squares mean (±SE) body weight at different months of pregnancy and birth weight of Mecheri lambs are presented in Table 1. Period of birth had highly significant (P<0.01) effect on body weight at the second and third months of pregnancy and also weight gain from mating to just before lambing. In general, the ewes mated during the period 2002–2003 had lower body weight gain than the other periods and maximum weight gain was observed in the period 1996–1997, being highly significant (P<0.01). The significant differences in body weight among lambs born in different periods may be attributed to differences in management, selection of rams and environmental conditions, such as the ambient temperature, humidity, rainfall, etc. The latter affects the productivity of the pasture and the availability of the nutrients to the sheep grazing on the pasture. The periodic changes in the climate were reflected as differences in body weights during different periods of the year.

In general, ewes mated during season 2 (August to October) gained more body weight than those mated during season 1 (February to April) and it was significant (P<0.01) at third and fourth month of pregnancy and just before lambing. The higher body weight of ewes during season 2 might be due to that the ewes pregnant during these months pass through a period with a favourable climate, i.e., grazing of good quality was available since they fall in the monsoon season, while those born in season 1 spent certain periods of gestation under hot-climate with poor grazing conditions.

Parity had significant (P<0.01) effect on body weight at different months of pregnancy. In general, the body weight at different months of pregnancy was lowest at first parity and highest at fourth parity. The body weight at mating and at different months of pregnancy increased linearly up to fourth parity and then reduced significantly in fifth and sixth parity. This indicated that the ewes were in the adult growth phase up to fourth parity. The total weight gain was highest at second parity and the lowest value was observed at sixth parity. Sex of the lamb did not have significant effect on body weight of ewes up to third month of pregnancy, however, afterwards, ewes bearing male lambs gained significantly higher body weight than those bearing female lambs. Ososanya *et al.* (2007) reported that the body weight of the West African Dwarf goats at mating and just before lambing as 27.08±1.0 and 34.4±0.8 with the mean weight gain during pregnancy was 4.1±0.3 kg.

The per cent increase in body weight gain of Mecheri ewes from weight at mating was 1.72, 5.15, 9.44, 13.73 and 21.46 at first, second, third, fourth month of pregnancy and just before lambing respectively. Sharma (1972) and Misra and Rawat (1985) reported higher per cent increase of body weight during pregnancy in Magra sheep and Sirohi does

Table 1. Least-squares means (±SE) for body weight of Mecheri sheep during different months of pregnancy and birth weight of lambs

Effect	N	Body weight (kg) of Mecheri sheep							
		Mating	1st month of pregnancy	2nd month of pregnancy	3rd month of pregnancy	4th month of pregnancy	Just before lambing	Weight gain from mating to fifth month	Birth weight
Overall	749	23.3±0.16^a	23.7±0.14^a	24.5±0.15^b	25.5±0.15^c	26.5±0.16^d	28.3±0.16^e	4.98±0.08	2.26±0.18
Period		NS	NS	**	**	NS	NS	**	**
1996–97	105	23.0±0.35	23.5±0.32	24.2±0.32^a	25.3±0.33^a	26.6±0.34	28.5±0.35	5.54±0.18^c	2.29±0.04^{ab}
1998–99	220	23.4±0.24	24.0±0.22	25.2±0.22^b	26.2±0.23^b	26.8±0.24	28.7±0.24	5.31±0.12^{bc}	2.35±0.03^b
2000–01	213	23.3±0.23	24.0±0.20	24.4±0.21^a	25.5±0.21^a	26.4±0.22	28.2±0.22	4.90±0.12^b	2.33±0.03^{ab}
2002–03	211	23.6±0.27	23.4±0.24	24.2±0.24^a	25.0±0.25^a	26.2±0.26	27.8±0.26	4.16±0.13^a	2.07±0.03^a
Season		NS	NS	NS	**	**	**	**	NS
1 (February-April)	480	23.2±0.27	23.7±0.19	24.4±0.19	25.1±0.20^a	25.7±0.20^a	27.5±0.21^a	4.30±0.11^a	2.28±0.02
2 (August- October	269	23.4±0.21	23.7±0.19	24.6±0.19	25.9±0.20^b	27.0±0.21^b	29.1±0.21^b	5.66±0.11^b	2.23±0.02
Parity		**	**	**	**	**	**	**	**
First	212	20.8±0.24^a	21.3±0.21^a	22.0±0.22^a	23.0±0.22^a	24.0±0.23^a	25.8±0.24^a	4.99±0.12^{ab}	2.14±0.03^a
Second	198	22.8±0.24^b	23.4±0.21^b	24.1±0.22^b	25.3±0.22^b	26.4±0.23^b	28.2±0.24^b	5.45±0.12^c	2.27±0.03^b
Third	149	24.0±0.27^c	24.6±0.25^d	25.4±0.25^d	26.4±0.26^c	27.3±0.27^c	29.2±0.27^c	5.19±0.14^{bc}	2.28±0.03^b
Fourth	96	25.0±0.34^d	25.4±0.31^e	26.2±0.31^e	27.2±0.32^d	27.9±0.33^c	29.8±0.34^d	4.80±0.18^a	2.32±0.04^b
Fifth	63	23.7±0.43^c	24.1±0.38^c	24.9±0.39^c	25.5±0.40^b	26.6±0.41^b	28.5±0.42^b	4.78±0.22^a	2.26±0.05^b
Sixth	31	23.7±0.62^c	23.5±0.55^b	24.3±0.56^b	25.7±0.57^b	26.6±0.60^b	28.3±0.61^b	4.65±0.31^a	2.29±0.07^b
Sex of the lamb	NS	NS	NS	*	*	**	*	**	
Male	365	23.5±0.20	23.9±0.18	24.6±0.18	25.7±0.19^a	26.7±0.20^a	28.6±0.20^a	5.10±0.10^a	2.30±0.02^a
Female	384	23.0±0.20	23.5±0.18	24.4±0.32	25.3±0.19^b	26.2±0.19^b	27.8±0.20^b	4.84±0.10^a	2.21±0.02^b

Means with similar superscript do not differ significantly; NS, Non significant; N, Number of observations; *P<0.05, **P<0.01.

Table 2. Least-squares means (±SE) for body weight of Mecheri sheep during lactation and after weaning

Effect	N	Body weight (kg) of Mecheri sheep before weaning					Body weight (kg) of Mecheri sheep after weaning			
		Lambing	1st month of lambing	2nd month of lambing	3rd month of lambing	Weight gain/ loss from lambing to weaning	Fourth month of lambing	Fifth month of lambing	Sixth month of lambing	Weight gain from weaning to sixth month
Overall	476	24.7±0.56	22.3±0.56	21.9±0.51	20.9±0.49	–3.7±0.42	21.6±0.50	22.1±0.49	22.7±0.55	1.8±0.33
Period		NS	NS	NS	NS	**	**	**	*	NS
1996–97	100	24.1±0.35	22.2±0.35	21.6±0.32	21.0±0.31	–3.1±0.26^{b}	21.2±0.31^{a}	21.4±0.31^{a}	22.8±0.34^{a}	1.7±0.20
1998–99	198	25.1±0.25	22.5±0.25	22.0±0.23	21.6±0.22	–3.5±0.19^{b}	22.5±0.22^{b}	22.9±0.22^{b}	23.4±0.25^{b}	1.8±0.15
2000–01	178	24.4±0.24	22.9±0.24	22.5±0.22	21.8±0.21	–2.5±0.18^{a}	22.0±0.21^{b}	22.7±0.21^{b}	23.4±0.23^{b}	1.6±0.14
Season		**	**	*	*	*	*	*	*	**
1 (February-April)	274	23.7±0.57^{a}	21.6±0.57^{a}	21.6±0.52^{a}	20.7±0.50^{a}	–3.0±0.43^{a}	21.9±0.51^{a}	22.4±0.50^{a}	23.0±0.56^{a}	2.3±0.33^{a}
2 (August-October	202	25.7±0.58^{b}	23.1±0.58^{b}	22.3±0.53^{b}	21.2±0.51^{b}	–4.5±0.43^{b}	21.3±0.52^{b}	21.9±0.51^{b}	22.4±0.57^{b}	1.2±0.34^{b}
Parity		**	**	**	**	**	**	**	**	*
First	112	21.9±0.61^{a}	20.7±0.60^{a}	20.6±0.55^{a}	19.6±0.53^{a}	–2.3±0.45^{a}	20.5±0.54^{a}	21.2±0.53^{a}	22.0±0.59^{ab}	2.3±0.36^{b}
Second	131	24.6 v 0.58^{b}	22.4±0.58^{c}	22.3±0.53^{c}	21.4±0.51^{cd}	–3.2±0.43^{b}	21.9±0.52^{cd}	22.4±0.51^{bc}	23.4±0.57^{c}	2.0±0.34^{b}
Third	114	25.5±0.59^{c}	23.5±0.65^{d}	22.7±0.54^{c}	21.4±0.51^{cd}	–4.1±0.44^{c}	22.2±0.52^{d}	22.7±0.52^{cd}	23.3±0.57^{c}	1.9±0.34^{b}
Fourth	64	26.1±0.66^{d}	23.4±0.65^{d}	22.7±0.60^{c}	21.6±0.57^{d}	–4.5±0.49^{cd}	22.3±0.58^{d}	23.0±0.58^{d}	23.6±0.64^{c}	2.0±0.38^{b}
Fifth	39	25.7±0.72^{cd}	22.2±0.72^{bc}	21.8±0.66^{b}	21.0±0.63^{bc}	–4.7±0.54^{d}	21.7±0.64^{c}	22.1±0.64^{b}	22.4±0.71^{b}	1.4±0.42^{a}
Sixth	16	24.2±0.94^{b}	21.8±0.93^{b}	21.4±0.85^{b}	20.6±0.82^{b}	–3.6±0.69^{b}	21.2±0.83^{b}	21.4±0.82^{a}	21.6±0.91^{a}	1.1±0.55^{a}
Sex of the lamb	NS	NS	NS	NS	NS	NS	NS	NS	NS	
Male	240	24.8±0.57	22.5±0.57	22.0±0.52	21.0±0.50	–3.9±0.42	21.6±0.50	22.3±0.50	22.8±0.55	1.8±0.30
Female	236	24.5±0.58	22.1±0.58	21.9±0.53	20.9±0.51	–3.6±0.43	21.6±0.52	22.0±0.51	22.6±0.57	1.7±0.34

Means with similar superscript do not differ significantly; NS, nonsignificant; N, number of observations, *P<0.05, **P<0.01.

respectively. Significant gains in body weight during gestation were observed from second month onwards, with maximum gain in body weight during the last month of gestation, which itself constitutes 36.1% of the total weight gain during gestation period. It is in accordance with the reports of Sharma (1972), Misra and Rawat (1985) and Gatla (1993). This indicated that the pregnant Mecheri ewes have to be maintained on better nutrition especially in the final month of pregnancy for optimum growth of lambs in the uterus. Otherwise lower birth weight and increased lamb mortality will occur.

Bell and Alcock (2007) reported that the special attention has to be given to the nutrition of pregnant ewes if mortalities are to be prevented. Growth of the foetal lamb accelerated during the final 6 weeks of pregnancy and the feeding rate needs to be increased accordingly. They further reported that the total increase in weight of the conceptus (including the foetus) during the last 6 weeks of pregnancy amounts to about 10 kg for ewes with a single lamb and more with twins. Ewes need to increase their gross live weight by this amount during the period if they are to maintain their own body condition. Under-nutrition during late pregnancy reduces the mothering instincts of ewes.

Birth weight of lambs

The overall least-squares mean birth weight was 2.26±0.18 kg. Males had significantly higher birth weight than females. Period of mating and parity of the ewes had significant (P<0.01) effect on birth weight of lambs. The birth weight of lambs was highest in fourth parity and lowest in first parity. This may be attributed to the large size of the ewe at maturity that may have influenced the size of the lamb at birth through better intrauterine environment and space. The birth weight observed in this study was lower than the values reported by Karunanithi *et al.* (2005). The increased birth weight observed by them was due to the fact that the study was based on small sample size with limited duration. However, the present study was made with large number of samples over a longer period and it reflects the actual weight of that breed.

Body weight changes during lactation and weaning

Least-squares mean (±SE) body weights of Mecheri ewes during lactation and after weaning are presented in Table 2. The body weight of the ewes reduced drastically during lactation. However, Singh and Singh (1980) reported that the ewes after parturition gained body weights slowly and steadily during lactation. Ososanya *et al.* (2007) also reported slight increase in body weight after parturition to weaning (0.8±0.0 kg) in West African Dwarf goats.

Period of mating did not have any significant effect on body weight of ewes during lactation. But season of mating had significant effect on body weight during lactation. Ewes

mated during season 2 lost significantly more weight during lactation (–4.5±0.43 kg) than those mated in the season 1 (–3.0±0.43 kg). This might be due to that the ewes mated during season 2 were exposed to hot summer months during lactation with limited availability of fodder. However, sex of the lamb did not have any significant effect on body weight of ewes during lactation. Parity of ewes had significant effect on body weight during lactation. The ewes in the first parity had significantly ($P<0.01$) lower body weight during different months of lactation than ewes with other parities. However, the overall loss of body weight from lambing to weaning was significantly ($P<0.01$) lower in first parity and higher in fifth parity. This might be due to that the ewes in the first parity have less milk yield and hence the additional energy and protein requirement have been partly supplemented by the routine feed itself, which resulted in reduced body weight loss in Mecheri ewes at first parity and also they were in adult growth period.

After weaning, body weight of the ewes increased slowly and steadily. Period and season of mating and parity of the ewes had significant ($P<0.01$) effect on weight gain after weaning. However, sex of the lamb had no effect on body weight gain of ewes after weaning. The body weight gain was significantly ($P<0.01$) higher in ewes belonging to first parity since they were in early adult growth period.

The study on body weight at different physiological stages in Mecheri ewes revealed that the ewes gained maximum weight during the last month of pregnancy and there is a consistent reduction in body weight during lactation. However, after weaning the ewes slowly and steadily gained their weight. This indicated that the pregnant Mecheri ewes have to be maintained with better nutrition at least during last month of pregnancy and during lactation. The reduction in body weight during lactation may be minimized with extra supplementation of concentrate mixture, i.e. 200 to 250 g/day. Improper management during these periods will result in increased lamb mortality due to poor birth weight, reduced milk secretion in lactating ewes and poor mothering ability. The study revealed that the existing feeding management is inadequate and needs to be improved.

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