Shearing Pregnant Ewes to Improve Lamb Birth Weight Increases Milk Yield of Ewes and Lamb Weaning Weight*

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ABSTRACT : Milk yield, lamb birth weight and weaning weight responses to shearing during winter in sheep were investigated. A total of 46 Karayaka ewes were allocated into two treatment groups. Pregnant ewes in one group were shorn on day 100 of gestation (Shorn, n=24) and the remaining ewes were left unshorn to serve as controls (Unshorn, n=22). The ewes were maintained on pasture during the day and housed in the evenings. Lamb birth weight, weaning weight and ewes' daily milk yield in fifteen dayintervals until weaning (75 days) were recorded. Shearing ewes on day 100 of pregnancy increased gestation length ($p<0.01$) compared to unshorn ewes (147.8±0.45 vs. 145.9±0.42 days). Birth weights of lambs from shorn ewes on day 100 of their pregnancy were higher ($p<0.01$) than those from unshorn ewes (3.7±0.11 vs. 3.2±0.07 kg). Shearing pregnant ewes increased ($p<0.05$) the lamb weaning weight at day 75 post-lambing (23.6±1.10 vs. 19.5±0.91). It also increased milk yield ($p<0.05$). Milk yields on day 75 of lactation were 302±33 and 425±25 g per day for unshorn and shorn ewes on day 100 of pregnancy, respectively. Lamb survival at weaning was higher ($p<0.05$) in lambs from shorn ewes compared to those from unshorn ewes. In conclusion, shearing pregnant ewes in winter months enhanced milk yield, lamb birth weight, lamb weaning weight and lamb survival. It is suggested that increasing both lamb birth weight and subsequent milk yield of dams by shearing ewes on day 100 of pregnancy during winter may improve postnatal lamb viability. ***(Asian-Aust. J. Anim. Sci. 2004. Vol 17, No. 12 : 1669-1673)***

Key Words : Ewes, Pregnancy Shearing, Milk Yield, Lamb Birth Weight, Weaning Weight

INTRODUCTION

Shearing ewes during pregnancy with a view to increasing lamb survival rate has been shown to increase lamb birth weight in a number of studies (Vipond et al., 1987; Black and Chestnutt, 1990; Morris and McCutcheon, 1997; Morris et al., 2000; Revell et al., 2000; Kenyon et al., 2002a,b; Revell et al., 2002). Among these studies, the magnitude of lamb birth weight response was not consistent in either single- or twin-born lambs. While some studies reported that shearing during pregnancy selectively improved twin born lamb birth weights (Morris and McCutcheon, 1997; Revell et al., 2000), some showed that it also increased the birth weight of single born lambs (Morris et al., 2000; Kenyon et al., 2002a,b; Revel et al., 2002). Kenyon et al. (2002a) reported that the birth weight response to pregnancy shearing in a pastoral farming system is greatest when the unshorn dam gives birth to a lamb(s) of low birth weight, which also may explain the different magnitude of birth weight response to pregnancy shearing in various studies. Such observations may be practically important in pregnancy shearing applications for some of the local sheep breeds across the world that genetically have low lamb birth weights (Assan et al., 2002). Ewes that have low lamb birth weights may give high responses to pregnancy shearing and potentially higher lamb survival may be obtained at weaning.

Shearing pregnant ewes has been shown to be associated with the changes in fetal glucose concentration (Thompson et al., 1982) and maternal concentrations of glucose, corticosteroids, glycerol, non-esterified fatty acids (Thompson et al., 1982), thyroid hormone (Clarke et al., 1997; Morris et al., 2000), insulin (Symonds et al., 1986; Revell et al., 2000) insulin like growth factor 1 (IGF-1) and IGF binding protein (IGFBP; Revell et al., 2000). These metabolites may change partitioning of nutrients towards gravid uterus and mammary gland development as reported by Jopson et al. (2002) that pregnancy shearing can alter body composition as well as lamb birth weight. Although the mechanism responsible for the birth weight response has yet to be determined, the changes in the concentrations of these metabolites and hormones have been proposed to be responsible for the increased lamb birth weight in lambs from shorn dams (Revell et al., 2000). These changes may also affect mammary gland development during pregnancy in shorn dams. It is known that mammary gland growth occurs during pregnancy for the preparation for the subsequent lactation and the rate of growth accelerates exponentially as the pregnancy advances (Swanson and Poffenberger, 1978; Knight and Wilde, 1993; Knight, 2000). The growth of mammary gland during pregnancy takes place under the control of hormones and metabolites (Forsyth, 1996; Waldes et al., 1998; Sejrsen et al., 1999). Therefore it is possible that shearing pregnant ewes may increase milk yield in the subsequent lactation.

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Table 1. Climatic conditions of field station (°C) during the experimental period

	November	December	January	February	March
Maximum	20.2	34	16.3	19.4	18.6
Minimum	-2.2	-6.4	-6.4	-1.5	-3.4
Average	11.4	8.8	3.2	5.0	6.3

Table 2. Mean (±SE) gestation length and lambing weight of ewes in shorn on day 100 of pregnancy and unshorn groups

	Unshorn		Shorn	
	No.	Mean±SE	No.	Mean±SE
Live weight				
At mating	22	41.9±1.12	24	41.4±1.02
At day 99		43.5±1.03		43.5±1.15
At post partum		45.7±0.93		48.1±1.10
Live weight changes				
Shearing to parturition		2.2±0.55		4.6±1.13
Gestation length (day)				
Single-born	19	145.8±0.46[a]	21	147.8±0.50[b]
Twin-born	3	146.3±1.33	3	148.0±0.87
Mean	22	145.9±0.42[a]	24	147.8±0.45[b]

SE: Standard error of mean. [a, b] Means within rows with different superscripts differ significantly (p<0.01).

The objectives of the present study, therefore, were to test the hypotheses that pregnancy shearing to increase lamb birth weight increases dams' milk yield in subsequent lactation and lamb survival at weaning.

MATERIALS AND METHODS

Animals and treatments

A total of 46 Karayaka ewes (41.6±0.75 kg live weight at mating) between three and six years were used in this experiment, which was conducted at Ondokuz Mayis University, Samsun field station (41.2°N), Turkey, during the winter months. Climatic conditions of field station during the experimental period are presented in Table 1. Estrus was detected using a teaser ram, and ewes were mated naturally by fertile rams during the breeding season (September) and mating dates were recorded. Ewes were weighed on day 99 of their pregnancies, stratified by age and live weight and then randomly allocated into two treatment groups. Pregnant ewes in one group were shorn exactly on day 100 of gestation (Shorn, 43.5±1.15 kg live weight, n=24) and the remaining ewes were left unshorn to serve as controls (Unshorn, 43.5±1.03 kg live weight, n=22).

Ewes were fed at nutrient requirement level of pregnant ewes (10.1 MJ metabolizable energy (ME), and 117 g crude protein (CP)/kg dry matter (DM)) as reported by Ocak et al. (2004). The ewes were maintained on pasture during the day, housed in the evenings and supplemented with 1,000 g of grass hay (containing 7.8% CP, 7.1 MJ ME/kg DM), and 350 g per day of a compound feed (containing 15.5% CP, 11 MJ ME/kg DM) during the pregnancy.

Table 3. Mean (±SE) lamb birth weight and lamb weaning weight at day 75 post lambing from unshorn and shorn ewes on day 100 of pregnancy

	Unshorn		Shorn	
	No.	Mean±SE	No.	Mean±SE
Lamb birth weight (kg)				
Single-born	19	3.2±0.08[a]	21	3.8±0.12[b]
Twin-born	6	3.1±0.10	6	3.5±0.19
Mean	25	3.2±0.07[a]	27	3.7±0.11[b]
Lamb weaning weight at day 75 (kg)				
Single-born	16	20.2±1.02[a]	21	24.6±1.27[b]
Twin-born	5	16.7±1.12[c]	6	20.1±1.59[d]
Mean	21	19.5±0.91[c]	27	23.6±1.10[d]

SE: Standard error of mean. [a, b] p<0.01, [c, d] p<0.05. Values within rows with different superscripts differ significantly.

At post-partum, the date of birth, body weight of ewes, litter size and weight of each lamb were recorded. The day before milk yield measurements, lambs were separated from their dams for 24 h. Lamb live weights at weaning (75 days) and lamb mortality were also recorded. Ewes were hand milked into a volumetric container twice daily (08.30 h and 16.30 h) at fifteen- day intervals until lamb weaning on day 75 of lactation and daily milk yield on test-days was recorded.

Statistical analysis

A mixed model analysis of variance was used to determine the effects of shearing, litter size and their interactions on each parameter using generalized linear model, and lamb survival data were analysed by Fisher's Exact Test (Mead and Curnow, 1990) in SPSS (1998).

RESULTS

Gestation length and live weight at lambing of ewes in shorn and unshorn group is presented in Table 2. There was no difference between live weights of ewes at lambing in shorn and unshorn groups (p=0.08). Live weight changes from shearing to parturition in shorn ewes on day 100 of pregnancy tended to be higher (p=0.06) than those of unshorn ewes. Shearing ewes on day 100 of their gestation increased gestation length (p<0.01) compared to unshorn ewes. Gestation length of single bearing ewes in the shorn group was longer than those in unshorn group (p<0.01).

Birth and weaning weights of lambs from shorn and unshorn ewes are presented in Table 3. Overall birth weights of lambs from ewes shorn on day 100 of their pregnancy were 0.5 kg higher than those from unshorn ewes (p<0.01). Twin born (p<0.05) and single born (p<0.01) lambs from shorn ewes were heavier at weaning than those from unshorn ewes. The weight differences between lambs from shorn and unshorn ewes at weaning were 3.4 and 4.4 kg for twin and single born lambs, respectively. Single born

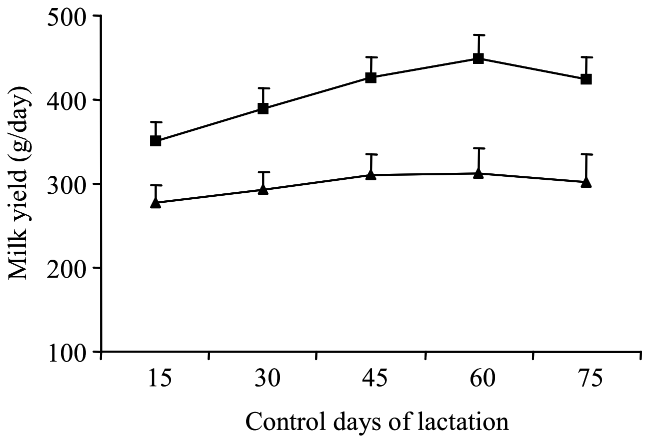

Figure 1. Milk yield (mean±SE) of the ewes in unshorn (▲) and shorn on day 100 of pregnancy (■) groups on test-days until lamb weaning.

lambs were heavier than twins and male lambs were heavier than females at birth and weaning on day 75 ($p<0.01$).

Shearing pregnant ewes on day 100 of pregnancy increased milk yield ($p<0.05$) following lambing on all test days that is, on days 15, 30, 45, 60 and 75 days of lactation (Figure 1). Estimated 75 days lactation milk yield based on the test-days results was also higher in shorn ewes compared to unshorn ewes ($p<0.01$).

Lamb survival to weaning was higher ($p<0.05$) in lambs from shorn ewes (100.0%) compared to those from unshorn ewes (84.0%). There were three single born and a twin born lamb death among those from unshorn ewes, while all lambs from shorn ewes survived. Two of the lamb deaths occurred within a week of birth, and the remaining within a month of birth. The mean birth weights of these lambs were 2.8±0.19 kg.

DISCUSSION

The results presented here showed that shearing ewes on day 100 of pregnancy increased gestation length, lamb birth weight, lamb weaning weight, dam's milk yield until weaning and lamb survival. These results confirm previous findings (Morris and McCutcheon 1997; Morris et al., 2000; Revell et al., 2000; Kenyon et al., 2002a,b; Revell et al., 2002) that shearing ewes during mid pregnancy can increase lamb birth weight. This effect of shearing on lamb birth weight was observed in single-born lambs and there was a similar trend in twin born lambs. The difference between birth weights of single-born lambs from shorn and unshorn ewes was 0.6 kg in this study, which represents a 19% response in lambs from shorn compared with those from unshorn ewes.

Shearing ewes on day 100 of pregnancy increased gestation length approximately 2 days in the present study. A similar effect of shearing on gestation length has also been reported previously (Vipond et al., 1987; Black and Chestnutt, 1990; Revell et al., 2002; Kenyon et al., 2002a). However, it seems that the difference between lamb birth weights from shorn and unshorn ewes observed in the present study may not be solely due to the increased gestation length, given that in the last two months of pregnancy, fetal growth is approximately 150-200 g/day (Rattray et al., 1974; Chaturvedi et al., 2003; Rastogi et al., 2003), which would account for 0.3 to 0.4 kg of the 0.6 kg difference if the actual rate is 150-200 g/day in the last two days of pregnancy.

The daily milk yields of ewes were observed to be between 300 and 400 g. Although such amount of the daily milk yields seem to be low, the Karayaka sheep breed used in the present study is known to be a low milk producing sheep breed in Turkey. It is interesting that shearing during mid-pregnancy increased subsequent milk yield. To our knowledge, there has not been any report on the stimulatory effect of pregnancy shearing on milk yield in ewes. In fact, Black and Chestnutt (1990) reported that there were no effects of pregnancy shearing on subsequent milk yield and composition measured on days 15 and 30 of lactation. It is possible that higher milk yield in shorn ewes may be due to changes in maternal concentrations of metabolites and hormones in response to shearing because Jopson et al. (2002) reported that pregnancy shearing can result in loss of body fat and increased carcass lean which may alter maternal concentrations of metabolites and hormones. Changes in hormones and metabolites in response to pregnancy shearing have been implied to cause lamb birth weight differences between shorn and unshorn ewes (Revell et al., 2000) because of relationships between maternal concentrations of these hormones and fetal growth (Harding et al., 1994; Perry et al., 2002). Apart from causing an increased fetal growth, these changes might have stimulated mammary gland growth during later stages of pregnancy. There is evidence that IGF families are involved in mammary development in ruminants (Forsyth, 1996; Waldes et al., 1998; Chaiyabutr et al., 2004) and growth hormone is essential for mammary development during pregnancy (Sejrsen et al., 1999). Although we did not measure any of these hormones in shorn ewes it is possible that increased concentrations of these hormones may have stimulated mammary growth and hence increased subsequent milk yield if it is not due to a better stimulation of ewes for milk secretion by heavier lambs at birth in shorn group. Therefore the changes in mammary gland development in response to shearing during mid-pregnancy in ewes need to be determined.

Some studies reported that pregnancy shearing increased food intake in ewes (Dabiri et al., 1995; Kenyon et al., 2002b; Revell et al., 2002). However, Kenyon et al. (2000a,b) showed that the birth weight response to mid-pregnancy shearing is not due to an increase in ewe food intake. Although food intakes of ewes were not measured in the present study, the live weights of ewes at the beginning of the experiment and at lambing were similar between treatment groups. This may indicate that there are no differences between food intakes of ewes in both treatment groups. Possible relationship between shearing and food intake in ewes exposed to cold during pregnancy may imply leptin involvement in the fetal growth and lamb birth weight in shorn ewes. It is known that leptin regulates appetite and body temperature. Although there is accumulating evidence that leptin has a role in fetal growth and also in ovine mammary gland growth (Laud et al., 1999; Yuen, 1999; Chilliard et al., 2001; Bonnet et al., 2002; McFadin et al., 2002), the involvement of leptin in the birth weight response to shearing and mammary development during pregnancy which result in higher lamb birth weight and subsequent milk yield in shorn ewes, warrants further investigation.

In conclusion, the results of the present study show that shearing ewes on day 100 of their pregnancy enhances lamb birth weight and weaning weight, and increases subsequent milk yield either directly or indirectly because of increased lamb weight and behaviour, and hence a higher lamb survival obtained at weaning.

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