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Full Length Research Paper

Effects of the maternal behavior score (MBS) on weaning weight and litter survival in sheep

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This study intends to describe the differences concerning maternal behavior score between the different genotypes and groups of the age of dam in less selected Norduz, Karaka , and Ile-de-FrancexAkkaraman (G1)xKaraka crosses, and also aims to determine the effects of Maternal Behavior Score (MBS) on weaning weight and survival of lambs in genotypes studied. Experimental subjects were 92 heads of the 2, 3 and 4 years-old of the Norduz, karaka and Ile-de-FrancexAkkaraman (G1)xKaraka crosses. The MBS was scored on a 5-point scale based on the distance a ewe retreats from her lambs when the shepherd is tagging them. Within 24 h of birth, maternal behavior score was evaluated, and survival of the lambs was calculated from birth to weaning and at the same time measured the weaning weight in lambs. We detected that in the ewes lambing the first time MBS were lower than those that they were lambed before (P < 0.01). Similarly, there were the significant differences between genotypes; less selected Norduz sheep had higher maternal behavior score than Karaka and Ile-de-FrancexAkkaraman (G1)xKaraka crosses (P < 0.01). The effects of the maternal behavior on weaning weight and survival of the lambs were not found, statistically. It is concluded that with intense improvement programs in genotypes, a reduction regarding maternal behavior score is observed. In other words, the intense improvement programs in extensive animal breeding reduce the maternal ability in sheep.

Key words: Maternal ability, MBS, behavior, survival, weaning weight, litter survival, sheep.

INTRODUCTION

In domesticated animal breeding, maternal ability from behavioral characteristics is an important trait such as meat, milk, wool and reproduction. Recently, a great deal of research has been performed concerning behavior characteristics due to both economic causes and animal welfare. For the economic reasons, maternal ability is an important factor to be investigated because in sheep breeding the neonatal or postnatal mortality has been steady worldwide, especially for fecund sheep. As for animal welfare, this serves to comprehend the nature of maternal behavior in domesticated animals, indicating that animal welfare and animal amnesty has a worldwide rising appeal (Kilgour, 1998). In general, animal breeding programs are re-established based on nature behavioral strategies of the domesticated animals (Addae et al., 2000; Grandinson, 2005; Caroprese et al., 2009).

In maternal ability, breed and litter size are two important factors that can affect behavioral relations between mother and young (Oppong-Anane, 1991; Nowak, 1992; Nowak et al., 1996; Weary and Chua, 2000; Awotwi et al., 2001). In the same way, age of dam in domesticated animals is a crucial factor that can affect the behavioral interactions between mother and young, and also for the survival of the lambs (Everett-Hincks et al., 2005). Recent studies have clearly demonstrated that ewes lambing for the first time are more easily disturbed behaviorally than those that have been lambed before. This situation also varies based on the breed. Merino ewes, for instance, were characterized by more lamb

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Table 1. The effect of the age of dam and genotype on MBS in sheep.

Age of dam (years)	MBS		
	2 (%)	4(%)	5(%)
2	17 (18.48)	6 (6.52)	2 (2.17)
3	8 (8.70)	17 (18.48)	8 (8.70)
4	7 (7.61)	8 (8.70)	19 (20.65)
Genotypes			
Norduz	12 (13.04)	14 (15.22)	23 (25.00)
Karaka	10 (10.87)	5 (5.43)	5 (5.43)
Ile-de-FrancexAkkaraman (G1)xKaraka crosses	10 (10.87)	12 (13.04)	1 (1.09)

desertions and non-co-operative postures during the initial sucking attempts of the lambs and that these traits were particularly marked in older precipitous ewes (Awotwi et al., 2000; Awotwi et al., 2001). By contrast, Asante et al. (1999) reported that there was no significant difference at recognizing their lambs, although primiparous ewes exhibited a significantly greater behavioral response to separation from their lambs than their multiparous counterparts.

This study was primarily intended to define the differences relating to maternal behavior score among genotypes and groups of age of dam in less selected Norduz, Karaka , and Ile-de-FrancexAkkaraman (G1)xKaraka genotypes, and also aimed to determine the effects of maternal behavior score (MBS) on weaning weight and survival of lambs in genotypes examined.

MATERIALS AND METHODS

Data were obtained from 92 heads of the two, three and four-years-old female Norduz, Ile-de FrancexAkkaraman (G1) and Karaka crosses. Norduz and Karaka sheep are the native genotypes reared in of the region East Anatolia of the Turkey. Ile-de-FrancexAkkaraman (G1)xKaraka genotypes were obtained by crossing Ile- de FrancexAkkaraman (G1) rams and Karaka ewes to improve the carcass and meat characteristics in Karaka sheep. And also Karaka sheep has been selected for some production characteristics for years, whereas Norduz sheep is less-selected.

Information on ewes and their lambs was recorded within 24 h of birth. Shepherd recorded the identity of ewes and tagged their lambs. At this time, simultaneously, following the shepherd, an observer recorded the distance of the ewe from its lambs and awarded each ewe on MBS. MBS was evaluated on five-point scale, as follows: Ewe flees at the approach of the shepherd, shows no interest in the lambs and does not return. (1) Ewe retreats further than 10 m but comes back to her lambs as the shepherd leaves them; (2) Ewe retreats to such a distance that tag identification is difficult (5-10); (3) Ewe retreats but stays within 5 m; (4) Ewe stays close to the shepherd during handling of her lambs (5). MBS, however, was converted as MBS 2, MBS 4, and MBS 5 because in MBS 1 and MBS 3 groups, number of the animals was quietly low (O'Connor et al., 1985; Everett-Hincks et al., 2005). Thus, MBS 1 and MBS 2 were combined as MBS2, and also MBS 3 and MBS4 were evaluated as MBS 4.

All analyses were performed using the statistical software SAS (2010). Maternal behavior score, age of dam, genotype, and litter survival frequencies were tabulated and compared by 2 (chi-square) analysis using Proc Freq. The weaning weight of lambs was analyzed by analysis of variance using Proc General Linear Model. Maternal behavior score was analyzed by ordinal logistic regression methodology and obtained odds ratios using Proc Logistic (Ye ilova and Yilmaz, 2007). Stepwise procedures were used to select the most appropriate models for maternal behavior score prediction.

RESULTS

The effects of age of dam and genotype for maternal behavior score are shown in Table 1. Table 1 clearly indicates that maternal behavior score (MBS) is affected by the age of dam and genotype factors ($P<0.01$). When evaluated according to age of dam, it appears those two years-old ewes have a lower maternal behavior score than 3 and 4 years-old ewes. Seventeen ewes out of twenty five had maternal behavior score 2, for the rest of them maternal behavior score were 4 and 5. When the age of dam rises, maternal behavior score mutually shows an increase (Table 1 and Figure 1).

Also, in Table 1, when differences between genotypes are evaluated, it is clearly observed that Norduz genotype has higher maternal behavior score compared to the other genotypes ($P < 0.01$). Particularly, Ile -de-FrancexAkkaraman (G1) xKaraka genotypes had a low maternal behavior score (Table 1 and Figure 2).

The effect of age of dam and genotype, maternal behavior score on litter survival of lambs are shown in Table 2. Table 2 apparently shows that the effects of age of dam, genotype, and maternal behavior score on litter survival of lambs are not significant, statistically. However, although the differences are not statistically significant between genotypes concerning litter survival, especially litter survival was too low at Ile-de-FrancexAkkaraman (G1)xKaraka crosses (78.26%). It was 93.88 and 90.00% for Norduz and Karaka genotypes, respectively. Additionally, the effects of type of birth and sex of lamb on maternal behavior score were not significant, statistically ($P > 0.05$).

The effect of the several environmental factors on weaning weight is shown in Table 3. The weaning weight

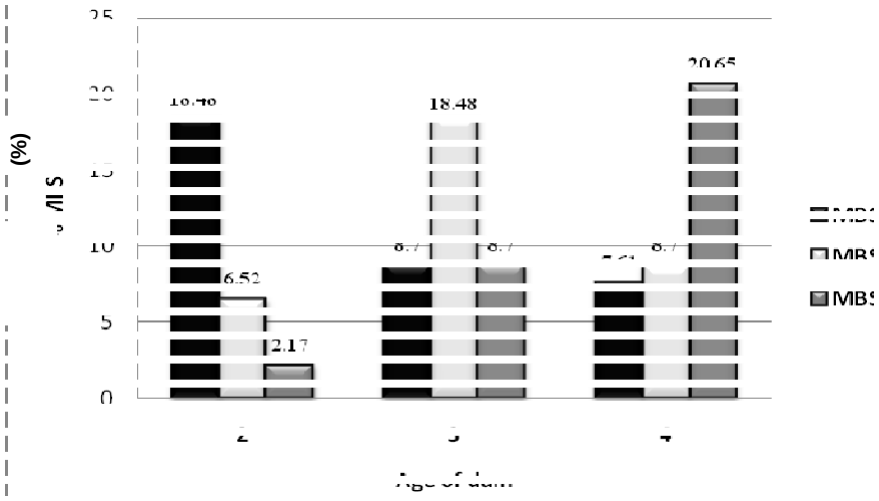

Figure 1. The effect of age of dam on MBS.

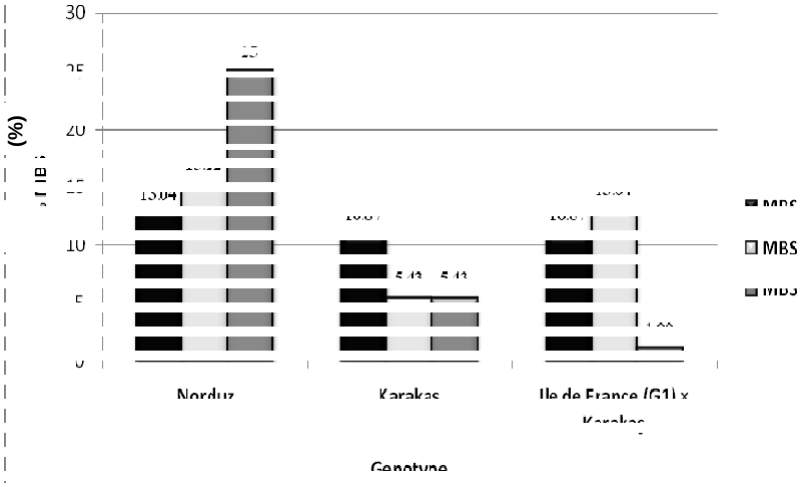

Figure 2. The effect of genotype on MBS.

Table 2. The effects of the age of dam, genotype, and MBS on litter survival in sheep.

Age of dam (years)	Litter survival (%)	
	0(%)	1(%)
2	3 (3.26)	22 (23.91)
3	3 (3.26)	30 (32.61)
4	4 (4.35)	30 (32.61)
Genotype		
Norduz	3 (6.12)	46 (93.88)
Karaka	2 (10.00)	18 (90.00)
Ile-de-France G1xKaraka crosses	5 (21.74)	18 (78.26)
MBS		
2	2 (2.17)	30 (32.61)
4	6 (6.52)	25 (27.17)
5	2 (2.17)	27 (29.35)

Table 3. The effects of some environmental factors on the weaning weight of lambs.

Age of dam (years)	Weaning weight (kg)
2	21.19±0.93[a]
3	23.22±0.66[b]
4	24.41±0.67[b]
Genotype	
Norduz	21.83±0.60[a]
Karaka	24.54±0.89[b]
Ile-de-France G1xKaraka crosses	22.44±0.79[b]
Maternal behavior score	
2	22.79±0.71
4	23.51±0.73
5	22.51±0.86
Type of the birth	
Single	25.79±0.45[a]
Twin	20.08±0.89[b]
Sex of lamb	
Male	23.76±0.63[a]
Female	22.12±0.60[b]

Values of each column followed by the different letter indicate a significant as statistical (P < 0.05).

Table 4. The parameter estimations for MBS in sheep[1].

Parameter	Estimate	Standard error	Odds ratios	Pr > X^2
Intercept				
MBS 5	-1.5115	0.3071		<.0001
MBS 4	0.4168	0.2642		0.1147
Age of dam (years)				
2	-1.5399	0.359	0.21440254	<.0001
3	0.2194	0.2876	1.24532931	0.4455
Genotype				
Norduz	1.0322	0.2948	2.80723496	0.0005
Karaka	-0.6574	0.3533	0.5181969	0.0628

[1]For all factors, a level is taken as reference based on logistic regression procedure.

of the lambs varied based on some environmental factors such as age of dam, genotype, the litter size at birth, and sex of lamb. But in this study maternal behavior score did not affect the weaning weight of the lambs, statistically (P > 0.05).

The parameter estimations for maternal behavior score are shown in Table 4. Table 4 indicates that maternal behavior score are the highest for Norduz genotype (P < 0.01), whereas there is not a difference for Karaka genotype when Ile-de-FrancexAkkaraman (G1)xKaraka crossing genotypes are referenced based on Logistic regression procedure. Likewise, in Table 4, it is observed that maternal behavior score of 5 is different from MBS 4 and MBS 2 (P < 0.01). As for age of dam maternal behavior score was too low at two aged sheep (P < 0.01).

DISCUSSION

In this present study, the effect of age of dam and genotypes on maternal behavior score (MBS) was significant, statistically. Nevertheless, the relationships

between maternal behavior score and litter survival, and weaning weight were not significant, statistically. In New Zealand sheep Dalton et al. (1980) suggested that 2 year-old ewes are culled to improve lamb survival in flocks. The same case was indicated in Suffolk and Scottish Blackface sheep (Dwyer, 2009). In that study it was demonstrated that there are significant differences between breeds for both maternal and neonatal behavior. Dwyer (2009) also reported that a high level of selection for growth characteristics alone may lead to deterioration in maternal ability unless these behaviors are specifically included in selection programs.

At the same time Lambe et al. (2001) reported that MBS significantly affects litter survival of lambs before weaning, and thus the lambs born from ewes with maternal behavior score of 1 are dying before weaning. By contrast O'Conner et al. (1985) suggested that there is an increase in MBS as litter size increased, indicating that litter size stimulates maternal ability. However, Ekiz et al. (2007) demonstrated that in Kivircik ewes there was not an increase in total maternal care, as they lambed twins. In the same study, mortality rate of twin lambs (19.2%) was significantly higher than that of single lambs (5.7%). In another study the similar result was reported by Hinc (1989). Interestingly, Everett-Hincks et al. (2005) observed that lambs born as twin for litter survival are higher than lambs born as singles, whereas this case is lowest for lambs born as triplets. In cows, Sandelin et al. (2004) showed that MBS are influenced by several sources of variation and should be considered in selection programs. They observed that dams giving birth to calves in thin body condition had higher mean MBS than dams giving birth to calves in average or fat body condition.

The lamb survival is controlled mainly by non-genetic factors. Everett-Hincks et al. (2005) reported that MBS and litter survival are under minimal genetic control. Heritability and repeatability for MBS were both 0.09. Low genetic variation for litter survival and maternal behavior score is also indicated that selection is not enough to their improvement programs and consideration should be given the environment and management techniques for improving lamb survival (Everett-Hincks et al., 2005; Everett-Hincks and Cullent, 2009).

Maternal behavior score can be measured to determine the maternal ability of sheep as a criterion. Nevertheless, it seems that maternal behavior score characteristic is determined by environmental factors rather than genetic factors, and also it has a complicated genetic process. Especially, it was a significant finding that in less-selected genotype, maternal behavior score (MBS) is higher than when compared to selected genotypes.

As a consequence, it obviously shows that intense improvement programs reduce maternal ability of sheep when compared to selected or synthetic genotypes.

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