

Effective factors on survival rate of Malya lambs (11/16 Akkaraman × 5/16 Deutsches Merinofleischschaf)

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Received: 5 March 2015; Accepted: 10 June 2015

Key words: Birth weight, Malya lamb, Maternal age, Survival rate

The main factor affecting the profitability ratio in sheep breeding is the high number of lamb births in a year and the high survival rate of these lambs. Lamb deaths cause huge economic losses in sheep breeding (Thomas 2011). Profitability depends on the survival rate of born lambs and can be largely determined by the number of lambs sold per ewe (Kelly and Lindsay 1987). Some factors affecting survival rate are the effects of sheep breed (Köprücü 1976, Thieme *et al.* 1999, Thompson *et al.* 2004), breeding region (Thieme *et al.* 1999), breeding year and mating season (Köprücü 1976, Schoeman 1990), lamb birth-coat (Hatcher *et al.* 2009), cold and damp weather (Safari *et al.* 2005), and lamb sex (Köprücü 1976, Binabaja *et al.* 2013). According to Slee *et al.* (1991), relationship between birth-coat type and cold resistance occurs by genes affecting both of them, not primarily by direct effect of coat insulation. There is a higher survival rate in female than male lambs (Köprücü 1976, Hatcher *et al.* 2009, Safari *et al.* 2005, Brien *et al.* 2009, Binabaja *et al.* 2013). Cloete *et al.* (2001) reported a higher rate in male lambs. Therefore, the objective of the present study was to compare the effects of some factors on the survival rates of Malya lambs.

This experimental study was conducted between February 2012 and August 2012 with Malya lambs born in Malya state farm in Middle Anatolia Region, Turkey. In this study, 302 lambs at different sex, birth weight, maternal age and birth type were used. Birth weight of lambs was determined by using digital weighing (100 g, with a capacity of 300 kg).

To calculate the survival rates of lambs, the number of dead lambs was determined until 180 d of age. Excess of male lambs than those needed for the breeding of the farm were sold after 6 months of age; therefore, this study was carried out until 6 months of age. The survival rates at 30 d, 60 d, 90 d, 120 d, and 180 d of age were calculated. Three groups were formed for birth weight (lower than 4 kg, between 4.1 and 4.9 kg and more than 5 kg). Four age groups for maternal age were formed beginning from 2 years old and ending at 5 years and older. The effects of twins,

maternal age, birth weight and sex on lamb survival rate were investigated using the chi-square test. The statistical analysis was performed with Minitab (1998) to investigate the factors affecting the survival rate of lambs. The differences between the means in significant groups were compared applying the Tukey test.

The effect of birth weight on survival rate was statistically significant except for 30 d of age in all age periods ($P \leq 0.05$), and the survival rate was lower for lambs with lower birth weight than 4 kg than those having higher birth weight (Table 1).

The effects of lamb sex, birth type and maternal age on survival rate were statistically not significant ($P > 0.05$). It can be said that lamb deaths were more before weaning, 21.57% of lambs died between weaning and 180 d of age, and 78.43% of these deaths occurred before weaning at 120 d of age (Table 2).

Differences in terms of survival rate in many studies may be caused by having different genetic characteristics of breed and breeding under different care, feeding and management conditions. Survival rate of Merino breed lambs until weaning was reported between 88 and 89.1% in Marmara and Aegean regions (Çetin and Akçapınar 2005, Ceyhan *et al.* 2009). Survival rate for Akkaraman lambs was reported between 89.5 and 100% in Middle and East Anatolia with steppe climate (Akçapınar *et al.* 2000, Yildiz and Denk 2006). It can be said that survival rate at Akkaraman breed lambs was slightly higher than Merino lambs.

It is widely believed and accepted that there is a large amount of lamb death in Merino breed flocks (McGuirk 1982, Safari *et al.* 2005). Survival rate is low in Merino breed in comparison with other breeds both in Turkey and the World. When Merino genotype ratio increased survival rate of lambs decreased a bit (Sandıkçıoğlu 1968, Özsoy and Vanlı 1983, Müftüoğlu 1969, Köprücü 1976). Lower survival rate in Merino and Merino crossbred can be caused by having genetically birth-coat type with more fine and short hairy, thinner skin thickness and consequently lower cold resistance. Similarly, it was reported that average survival rates were 77.5% in Merino crossbred and 72.7% in Merino lambs (Safari *et al.* 2005). Heritability of survival

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Table 1. Effects of maternal age, lamb sex, birth type and birth weight on survival rate of Malya lambs until 180 d of age

Factors	Number of lambs (head)						Survival rate (%)				
	Born alive (n)	Living at 30th days (n)	Living at 60th days (n)	living at 90th days (n)	Living at 120th days (n)	Living at 180th days (n)	Living at 30th days (%)	Living at 60th days (%)	Living at 90th days (%)	Living at 120th days (%)	Living at 180th days (%)
Maternal age							$\chi^2=0.157$ $p=0.98$	$\chi^2=0.876$ $p=0.831$	$\chi^2=2.112$ $p=0.549$	$\chi^2=2.167$ $p=0.539$	$\chi^2=4.228$ $p=0.238$
2	101	95	91	88	84	81	94.06	90.10	87.13	83.17	80.20
3	62	59	56	54	54	51	95.16	90.32	87.10	87.10	82.26
4	75	71	70	70	68	68	94.67	93.33	93.33	90.67	90.67
5	64	61	57	56	56	51	95.31	89.06	87.50	87.50	79.69
Litter size							$\chi^2=0.293$ $P=0.588$	$\chi^2=0.130$ $P=0.719$	$\chi^2=0.104$ $P=0.747$	$\chi^2=0.002$ $P=0.964$	$\chi^2=0.263$ $P=0.608$
Single	150	141	137	134	130	123	94.00	91.33	89.33	86.67	82
Twin	152	145	137	134	132	128	95.39	90.13	88.16	86.84	84.21
Lamb sex							$\chi^2=0.621$ $P=0.431$	$\chi^2=2.439$ $P=0.118$	$\chi^2=0.602$ $P=0.438$	$\chi^2=0.012$ $P=0.912$	$\chi^2=0.134$ $P=0.714$
Female	161	154	150	145	140	135	95.65	93.17	90.06	86.96	83.85
Male	141	132	124	123	122	116	93.62	87.94	87.23	86.52	82.27
Birth weight							$\chi^2=3.577$ $P=0.167$	$\chi^2=6.466$ $P=0.039$	$\chi^2=7.041$ $P=0.030$	$\chi^2=6.167$ $P=0.046$	$\chi^2=8.300$ $P=0.016$
<4 kg	60	54	50	48	47	44	90.00	83.33 b	80.00 b	78.33 b	73.33 b
4.1 – 4.9 kg	119	115	113	111	109	107	96.64	94.96 a	93.28 a	91.60 a	89.92 a
5 kg >	123	117	111	109	106	100	95.12	90.24 ab	88.62 ab	86.18 ab	81.30 ab
Total (means)	302	286	274	268	262	251	94.7	90.73	88.74	86.75	83.11

Data show mean $P < 0.05$, significant; $P > 0.05$, nonsignificant; χ^2 , value of Chi-square; a, b: The differences between the means of groups carrying various letters in the same column are significant.

rate was reported at low level and between 0.03 and 0.05 (Köprücü 1976, Safari *et al.* 2005, Brien *et al.* 2009). It can be said that effect of environmental factors on survival rate is greater than genetic factors. Selection according to high survival rate can achieve improvement at limited level. Although there are slight differences in lamb deaths between breeds and genotypes within sheep breeds, effects of environmental conditions such as care, nutrition, housing conditions and diseases are known more than genotypic effects.

Survival rate until 30 d age for Malya lambs was 94.7% and was similar to 95.97% for Akkaraman lambs (Akçapınar *et al.* 2000), between 94.2 and 96.4% for Merino lambs (Çetin and Akçapınar 2005) and 95.2% for Tuj (Öztürk and Odabaşıoğlu 2011) and lower than 99.01% for Hamdani lambs (Öztürk and Odabaşıoğlu 2011). Survival rate until 90 d age for Malya lambs was 88.74% and similar to between 86 and 89.5% for Akkaraman (Örkiz *et al.* 1984, Akçapınar *et al.* 2000) and lower than values between 89.1 and 93.6% for Merino lambs (Yılmaz and Altinel 2003, Ceyhan *et al.* 2009). Survival rate until weaning for Malya lambs was 86.75% and was lower than values reported between 91.4 and 96.2% for Malya lambs and between 96.05 and 97.64% for Akkaraman lambs in this farm previously (Çolakoglu and Özbeyaz 1999). This case showed that conditions of care, feeding and management of newborn lambs were not done well at this farm in recent years.

Table 2. Distributions of death rate of Malya lambs in different periods

Period	Live (n)	Death (n)	Death (%)
Between birth and 30 d	286	16	31.37
Between 30 and 60 d	274	12	23.53
Between 60 and 90 d	268	6	11.765
Between 90 and 120 d	262	6	11.765
Between 120 and 180 d	251	11	21.57
Means		51	100

Although effect of maternal age on survival rate of Malya lambs was statistically nonsignificant ($P > 0.05$), survival rate in weaning was the lowest with 83.17% at lambs born from 2 years old mothers and the highest with 90.67% at lambs born from 4 years old mothers. Survival of lambs from 2 year old dams is the poorest. These findings are in agreement with some studies (Thompson *et al.* 2004, Köprücü 1976, Özsoy and Vanli 1983, Cloete *et al.* 2001, Hatcher *et al.* 2009, Binabaja *et al.* 2013). However, Koncagül *et al.* (2012) reported that survival rate at lambs of 2 years old ewes and 6 years old ewes were higher than other ages. It can be said that survival rate of lambs increased with increasing of maternal age and slightly reduced in very elderly mother. Although statistically non-significant, survival rate at lambs born from 2 years old mothers was lower than other age groups. This may be caused by less milk yield of 2 years old mothers and lower birth weight of

their lambs. Because of more milk yield at 4 years old mothers and higher birth weight of their lambs, survival rate of lambs at 4 years old mothers may be higher.

Effects of sex and litter size on survival rate were nonsignificant ($P>0.05$) and in agreement with previous research (Özsoy and Vanlý 1983). This situation showed effective factors on survival rate were other factors such as care, feeding of shelter conditions, and diseases. Factors such as maternal age, lamb sex and litter size can be considered as predisposing factors on survival rate because of low birth weight in multiborn lambs, females, and lambs of young mothers. Although Cloete *et al.* (2001) reported survival rate for male lambs until weaning was higher than females, and some authors reported higher survival rate in females than male lambs (Köprücü 1976, Hatcher *et al.* 2009; safari *et al.* 2005, Brien *et al.* 2009), effect of lamb sex on survival rate was non-significant in this study as it was expected. Survival rate did not differ between male lambs and female lambs in this study, this is in agreement with previous researches (Odabapioğlu *et al.* 1996, Mengistie *et al.* 2011).

Effect of birth type or litter size on survival rate was nonsignificant ($P>0.05$), survival rate of single lambs shows tended to be higher than twin lambs. Lower survival rate in twins than single lambs may be due to effects of low birth weight, sharing of twin lambs milk of their mothers and competition for limited milk until weaning. Twin lambs have lighter birth weight than single lambs and drink less milk than single lambs. Effect of litter size on survival rate was significant and survival rate for single lambs higher than twins in a lot of studies (Köprücü 1976, Örkiz *et al.* 1984, Cloete *et al.* 2001, Brien *et al.* 2009, Vatankhah and Talebi 2009, Hatcher *et al.* 2009, Kerslake 2010, Mengistie *et al.* 2011, Binabaja *et al.* 2013). In this study, effect of litter size on survival rate was statistically nonsignificant and similar to Ceyhan *et al.* (2011). Although it was expected that twin lambs have lower survival rate than single lambs, effect of litter size on survival rate was nonsignificant in this study. It can be said that ewes are fed good and ewes give milk enough to can feed 2 lambs in this farm. Kerslake (2010) reported lightest triplet born lambs had greater capacity to lose heat and had a reduced capacity to produce when compared to higher twin born lambs. Twinning was mostly seen in older ewes with high milk yield and good nutrition of sheep and lambs, hence negative effect of litter size could not be shown in this farm.

Although effect of litter size, maternal age and sex of lamb on survival rate were nonsignificant ($P>0.05$), effect of birth weight on survival rate was significant ($P<0.05$). While survival rate of lambs having birth weight with less than 4 kg was 78.33% at weaning, survival rate for lambs having birth weight between 4 and 5 kg was 91.60%. Survival rate for lambs having birth weight more than 5 kg was 86.18%. It can be said that optimum survival rate was at lambs born between 4 and 5 kg. Similarly, Binabaja *et al.* (2013) reported lower survival rate for lambs with very high weight at birth due to dystocia. Despite Hatcher *et al.*

(2009) reported birth weight affected positively on survival rate until age of 30 d and not a positive impact between 30 d and weaning, birth weight affected number of weaned lambs and survival rate until weaning in this study. It showed that effect of birth weight on survival rate was significant until 180 d age. Lower survival rate for lambs being less than 4 kg may be due to being sensitive to disease and weak body resistance.

For all lambs that were dead by 180 d age, 54.90% of deaths were within first 60 d age (Table 2). The highest death rate is within first 60 d after birth in this study, as observation reported earlier (Binabaja *et al.* 2013). Lamb deaths between birth and weaning were observed occurring by some reasons, such as trichobezoar due to eating mother's wool, white muscle disease because of vitamin E deficiency, septicaemia and enterotoxaemia. Survival rate of lambs with lower birth weights than 4 kg was normally lower. This may be caused due to physiological starvation in uterus and lower energy reserves, less able to withstand harsh environmental conditions, greater risk of illnesses due to their weakness as reported by Binabaja *et al.* (2013). Between 120 d and 180 d after weaning, 11 head lambs died. Especially, after weaning, along with the grazing of lambs on pasture, seeing of whirling (deliba) disease in lambs at this period was one of the main causes of deaths. This disease is occurred in brain by larval form of the dog tapeworm (coenurus cerebralis) named *Taenia multiceps* (*Polyccephalus multiceps*, *Multiceps multiceps*).

The effect of birth weight on survival rate was significant ($P<0.05$). Lambs having birth weights of less than 4 kg showed lower survival rate in all age periods until 180 d. Nottle *et al.* (1998) additional feeding after start of lambing improved both lamb survival and lamb performance possibly due to an effect of lupin supplementation on colostrum and subsequent milk production. This situation showed that care, nutrition of pregnant ewes should be done well and lambs with low body weight should be given more attention after birth. However, low survival rate for lambs with very high weight at birth was reported due to dystocia (Hatcher *et al.* 2009, Binabaja *et al.* 2013). Feeding and care of pregnant ewes should be done to obtain optimal birth weight. Kerslake (2010) reported that lambs with lighter birth weight have lower plasma thyroxin concentrations, higher plasma lactate concentrations within first hours after birth and inadequate thermoregulatory capabilities. As heritability of birth weight was moderate with 0.31 (Vatankhah and Talebi 2008), birth weight could be considered as selection criteria to indirectly improve lamb survival rate and selection should be made according to the optimum birth weight.

In conclusion, this study showed birth weight was the most important factor affecting on survival rate of lambs. Survival rate of lambs be can increased by obtaining optimal birth weight with improvements in feeding and care of pregnant ewes. To reduce high lamb deaths, management works should be planned, health status well monitored in large flocks of lamb and early treatment should be done.

SUMMARY

This study was conducted to investigate effect of some factors on survival rate of Malya lambs. The survival rate of 302 lambs at different sex, birth weight, maternal age and birth type was determined. The effects of twins, maternal age, birth weight and sex on lamb survival rate until 180 d of age were investigated using the Chi-square test. The effects of twins, maternal age, and lamb sex on the survival rate were not significant, whereas the effect of birth weight was significant. The means of survival rates for 30 d, 60 d, 90 d, 120 d, and 180 d were 94.70%, 90.73%, 88.74%, 86.75% and 83.11%, respectively. Lambs having a birth weight of less than 4 kg showed a lower survival rate than those having higher birth weight. Effect of birth weight of survival rate in all age periods was statistically significant except those of 30 d. The main factor affecting survival rate until weaning was underweight at birth. Survival rate for 4 kg birth weight was the lowest limit value and the optimum birth weight value was 4–5 kg. The survival rate can increase obtaining optimal birth weight with improvements in feeding and care of pregnant ewes and additional special care of lambs with low birth weight.

ACKNOWLEDGMENT

This research was supported with project number 2011/38 by the Scientific research Project Coordination Unit of Kirikkale University. The author is grateful to assistances Scientific Research Project Coordination Unit of Kirikkale University.

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