Some reproductive and gynecological characteristics of Morkaraman ewes

Research Article

Bekir Yılmaz[1a]
Buket Boğa Kuru[2b]
Mushap Kuru[3c]

[1]Ministry of Agriculture and Forestry, Iğdır, Türkiye
[2]Department of Animal Breeding and Husbandry, Faculty of Veterinary Medicine, Kafkas University, Kars, Türkiye
[3]Department of Obstetrics and Gynecology, Faculty of Veterinary Medicine, Kafkas University, Kars, Türkiye

ORCİD-
[a]0000-0002-5477-0380
[b]0000-0002-7170-270X
[c]0000-0003-4409-251X

Correspondence
Mushap KURU
mushapkuru@hotmail.com

Article info
Submission: 26-01-2022
Accepted: 11-05-2022
Online First: 15-12-2022
Publication: 31-12-2022

e-ISSN: 2548-1150
doi prefix: 10.31797/vetbio
- http://dergipark.org.tr/vetbio

ABSTRACT

The aim of this study is to determine some reproductive parameters and gynecological and lamb yield characteristics in Morkaraman ewes in Iğdır province, Türkiye. Reproductive parameters and fertility characteristics of Morkaraman ewes were recorded in two breeding seasons. Clinically healthy 600 Morkaraman ewes were used. Estrus duration was statistically different in the first and second breeding seasons (P=0.034). The estrus rates were 95% and 97% in the seasons, respectively (P=0.211). According to the breeding seasons (first and second year), lambing rate was 90.7% and 92%, infertility rate was 5% and 3%, placental retention rate was 2.6% and 1.5%, uterine infection rate was 8.2% and 6.6%, vaginal and uterine prolapse rate was 1.8% and 2.2%, follicular cyst rate was 1.3% and 0.7%, mastitis rate was 3.7% and 2.2%, insufficient milk production rate was 2.6% and 3.6%, abortion rate was 3.2% and 4.5%, dystocia rate was 4.4% and 5.4%, congenital anomaly rate was 1.1% and 1.5%, twinning rate was 10.7% and 12%, birth weight in singleton was 3.8 kg and 3.6 kg, birth weight in twins 3.2 kg and 3.3 kg, survival rate was 94.4% and 96.5%, respectively (P>0.05). In conclusion, Morkaraman ewes show high reproductive performance, do not have many gynecological problems, and are more likely to have single births.

Keywords: Birth, ewes, gynecological, lamb, Morkaraman, reproductive

INTRODUCTION

Sheep breeding is carried out extensively or semi-extensively in small family-type farms in rural areas, depending on geographic and climatic conditions. Small ruminants are raised intensively when snowfall begins in the Eastern provinces, Türkiye. Morkaraman ewes have adapted to harsh winter condition, poor quality pasture, high altitude plateau and is a great breed for small family-type farms (Akçapınar, 1994; Kaymakçı, 2016).

Morkaraman (also known as Red Karaman), is the second most abundant of sheep breeds in Türkiye (15.8% of ewes, 17.1% of local breed ewes). The body color is reddish-brown. The nose and mouth area can be light in color, and the head and feet can be darker. Morkaraman is a fat-tailed native sheep breed and the tail end-piece form is "S" shaped (Kaymakçı, 2016; Yalçin, 1986). Live weight is 50-60 kg in ewes, live weight in rams is 60-70 kg, greasy fleece weight is 1.5-2.5 kg, lactation period is 150-160 days, twin birth rate is 8-30% in Morkaraman ewes. Lambs can give 20-25 kg of carcass in 3-month fattening after weaning (Akçapınar, 1994; Yalçin, 1986; Yilmaz et al., 2013).

How to cite this article
Yılmaz, B., Boğa Kuru, B., Kuru M. (2022). Some reproductive and gynecological characteristics of Morkaraman ewes. *Journal of Advances in VetBio Science and Techniques, 7*(3), 274-282.
https://doi.org/10.31797/vetbio.1063461

In Morkaraman ewes, gestational length is 148.9-150.1 days (Akçapınar & Kadak, 1982; Odabaşıoğlu et al., 1996), estrus rate 100%, pregnancy rate 92%, birth rate 88%, twinning rate 26.7-30%, litter size 1.1-1.35 (Akçapınar et al., 1984; Odabaşıoğlu et al., 1996; Özbey & Akcan, 2000), lamb birth weight is 4.0 kg and survival rate in lambs is 93% (Odabaşıoğlu et al., 1996). In Morkaraman ewes, lactation milk yield is 40-77.6 kg (11.6-148 L), milk fat ratio 6.6-7.3% (3.9-8.4%) and lactation period 117-143.8 (68-173) days (Akçapınar, 1994; Yilmaz et al., 2013). In a study, the duration of lactation, milk yield and daily milk yield in Morkaraman ewes were determined as 137 days, 88.3 L, 645 mL, respectively (Kırmızıbayrak et al., 2005).

Strong body condition, rapid adaptation to the environment and resistance to cold climate are the most important characteristics of Morkaraman ewes. There are studies on some yield characteristics of Morkaraman ewes. However, in our literature reviews, we did not find detailed studies on the reproductive and gynecological characteristics of Morkaraman ewes. The aim of this study is to determine some reproductive parameters and gynecological and lamb yield characteristics in two breeding seasons in Morkaraman ewes.

MATERIAL and METHOD

Location, animals and feeds

The ewes and rams in the study were obtained from a Morkaraman sheep farm at an altitude of 860 m in Iğdır province, Türkiye.

A total of 600 (300 in first breeding seasons + 300 in second breeding seasons) Morkaraman ewes, 2-5 years old and 50-65 kg, without any clinical problem, were used. Body condition score of ewe varied between 2.5-3.5 (1 = Extremely thin, 5 = Obese) (Kenyon et al., 2014). Fifteen Morkaraman rams with no clinical health problems and weighing 70-80 kg were used for estrus detection and mating. The ewes were grazed on the pasture in the summer and were housed in the barns when the weather was getting colder or when the snow started.

The ewes were not fed any extra feed while they were in the pasture, but in winter, the ewes were fed with alfalfa, wheat straw, corn silage, bran and barley when they were brought to the barns. In the pregnancy period, additionally, 0.4 kg ewe/day barley-wheat meal was given. Water was given ad libitum.

Two-year herd data of the study were obtained from the farm logbook. Two-year examinations of reproductive parameters and determination were made by the veterinarian. Different sheep from each other in the first and second breeding seasons were included in the study.

The estrus is the time between ewes accepting to mate and refusing to mate (Kuru et al., 2017b). The time between mating and parturition was the gestation period (Kuru et al., 2017a). Sheep were exposed to rams during the breeding season (August-December) and outside of this period rams were removed from the herd (Kuru et al., 2017b). Lambing rates were determined by recording the ewes that gave birth. The time of birth was recorded as daytime (6.00-18.00) or night (18.01-05.59) (Kuru et al., 2017a). Sheep that were not in heat or not pregnant during the breeding season were considered infertile (Bekyürek, 2017). Retained placenta was clinically diagnosed when the placenta could not separate spontaneously in the third stage of labor (12-24 hours after birth) (Fthenakis, 2004). Purulent or mucopurulent vaginal discharges in the postpartum period were diagnosed as uterine infection. In such cases, examination with vaginal speculum was also performed (Scott, 2015). If the uterus passed through the cervix and protruded from the vulva, it was diagnosed as prolapse uteri (Oral & Kuru, 2016). Sheep that continued estrus after mating or showed estrus again 2-3 days after mating were diagnosed as follicular

cysts. These sheep were examined by ultrasonography and when a Graff follicle 1.2-1.5 cm in diameter or larger was detected in the ovary, it was recorded as a follicular cyst (Khodakaram-Tafti & Davari, 2013). Swelling and pain in the breast and deterioration of milk composition (such as pus, watery, smelly, clotted) were evaluated as clinical mastitis (Menzies & Ramanoon, 2001). Insufficient milk yield was defined as less than 50-100 mL of milk during the lactation period of sheep (Kuru et al., 2017a). Births requiring all kinds of intervention were diagnosed as dystocia (Kuru et al., 2016). Lambs born between 130-140 days of gestation were diagnosed as premature. These lambs had no incisors, the claws were soft, and the belly was hairless (Şahal et al., 1994).

Some reproductive and gynecological parameters

In the study, some reproductive and gynecological parameters and lamb yield characteristics were calculated according to the formulas (Kuru et al., 2017a; 2017b; Kuru et al., 2020).

Estrus duration = The time between accepting and rejecting mating.

Gestational length = Time between accepting to mate and parturition day.

Estrus rate (%) = Sheep in heat / All sheep x 100.

Lambing rate (%) = Sheep giving birth / All sheep x 100.

Infertility rate (%) = Non-pregnant sheep at the end of the breeding season / All sheep x 100.

Placental retention rate (%) = Number of sheep detected / Number of sheep giving birth x 100.

Uterine infection rate (%) = Sheep detected / All sheep x 100.

Vaginal – uterine prolapse rate (%) = Sheep detected / Sheep giving birth x 100.

Follicular cyst rate (%) = Sheep with follicular cyst / All sheep x 100.

Clinical mastitis rate (%) = Sheep with clinical mastitis / Sheep giving birth x 100.

Insufficient milk yield rate (%) = Detected sheep / Number of whole sheep x 100.

Abortion rate (%) = Abortions / Sheep giving birth x 100.

Dystocia rate (%) = Dystocia / All births x 100.

Premature birth rate (%) = Premature birth / All births x 100.

Congenital anomaly rate (%) = Congenital anomalies / All births x 100.

Twinning rate (%) = Sheep giving birth twins / Sheep giving birth x 100.

Litter size = Total number of lambs / Sheep giving birth x 100.

Lack of maternal instincts rate – rejected of lamb = Sheep with lack of maternal instincts / All sheep x 100.

Survival rate (%) = Number of lambs alive / Number of lambs born x 100.

Time periods were recorded according to whether the sheep gave birth during the daylight (06:00-18:00) or at night (18:01-05:59).

Statistical analysis

Estrus duration, gestational length and birth weight were given as mean ± standard error (SEM). These parameters, which showed normal distribution in the Shapiro-Wilk test, were compared with the independent samples t-test according to two seasons. Other reproductive and gynecological characteristics in the two seasons were compared with the Chi-square test. SPSS® (SPSS Version 18.0, Chicago, IL, USA) program was used for statistical analysis. $P<0.05$ was considered statistically significant.

RESULTS

Estrus duration (Fig. 1a) was 33.1 ± 0.8 and 30.8 ± 0.7 hours in the first and second breeding season, respectively ($P=0.034$). The effect of years on gestational length (Fig. 1b) was not statistically significant ($P=0.219$).

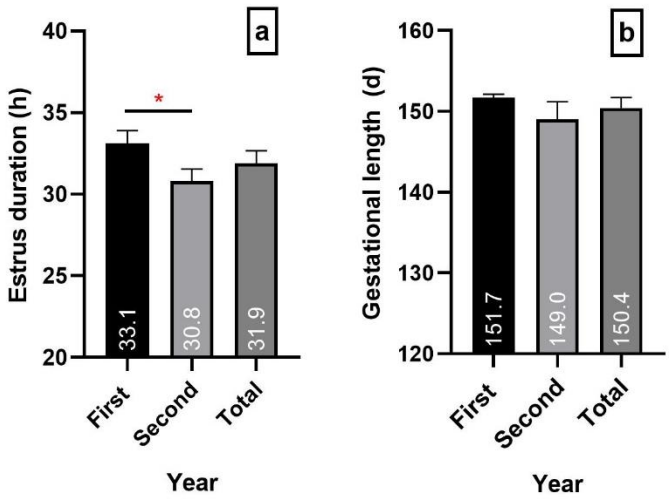

Figure 1. a: Estrus duration (h) in two breeding seasons and total value, b: Gestation length (d) in two breeding seasons and total value. *: The difference between estrus duration in the first and second breeding season was statistically significant (P=0.034).

The differences in estrus, lambing infertility, placental retention, uterine infection, vaginal-uterine prolapse, follicular cyst, mastitis, insufficient milk yield, abortion, dystocia, premature birth, congenital anomaly, lack of maternal instincts, twinning, gender, litter size were not statistically significant (P>0.05) in the two breeding seasons (Table 1).

Table 1. Parameters in two breeding seasons and their total values

Parameters	First Year % (n / Total n)	Second Year % (n / Total n)	Total % (n / Total n)
Estrus	95 (285 / 300)	97 (291 / 300)	96 (576 / 600)
Lambing	90.7 (272 / 300)	92 (276 / 300)	91.3 (548 / 600)
Infertility	5 (15 / 300)	3 (9 / 300)	4 (24 /600)
Placental retention	2.6 (7 / 272)	1.5 (4 / 276)	2 (11 / 548)
Uterine infection	8.2 (23 / 281)	6.6 (19 / 289)	7.4 (42 / 570)
Vaginal – uterine prolapse	1.8 (5 / 272)	2.2 (6 / 276)	2 (11 / 548)
Follicular cyst	1.3 (4 / 300)	0.7 (2 / 300)	1 (6 / 600)
Mastitis	3.7 (10 / 272)	2.2 (6 / 276)	2.9 (16 / 548)
Insufficient milk yield	2.6 (7 / 272)	3.6 (10 / 276)	3.1 (17 / 548)
Abortion	3.2 (9 / 281)	4.5 (13 / 289)	3.9 (22 / 570)
Dystocia	4.4 (12 / 272)	5.4 (15 / 276)	4.9 (27 / 548)
Premature birth	1.1 (3 / 272)	0 (0 / 276)	0.6 (3 / 548)
Congenital anomaly	1.1 (3 / 272)	1.5 (4 / 276)	1.3 (7 / 548)
Lack of maternal instincts	3.7 (10 / 272)	5.4 (15 / 276)	4.6 (25 / 548)
Twinning	10.7 (29 / 272)	12 (33 / 276)	11.3 (62 /548)
Gender ♂	56.8 (171/301)	58.3 (180/309)	57.5 (351 / 610)
Gender ♀	43.2 (130/301)	41.8 (129/309)	42.5 (259 / 610)
Litter size	110.7 (301 / 272)	112 (309 / 276)	111.3 (610 / 548)

The effect of year on birth weight in single lambs was statistically significant (P=0.01). Year had no significant effect on birth weight in twin lambs (P=0.229). However, birth weights

of twin lambs were statistically lower than single lambs in both the first (P<0.001) and the second (P=0.035) year (Fig. 2).

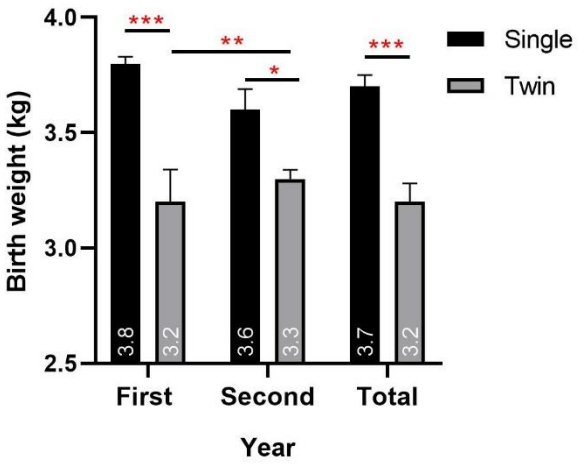

Figure 2. Birth weight (kg) in single and twin lambs in two breeding seasons and total values. *: In the second breeding season, the statistically significant difference between single and twin lamb birth weights was significant (P=0.035). **: The statistical difference between birth weight of single lambs in the first and second breeding season was significant (P=0.01). ***: The statistical difference was significant between the birth weight of the single and twin lambs in the first breeding season and total data (P<0.001).

The survival rate of Morkaraman lambs born in the first breeding season was 94% in the first month and 97.5% in the second month. The survival rate of Morkaraman lambs born in the second breeding season was 94.8% in the first month and 95.6% in the second month. In general, the survival rate was high in the Morkaraman lamb (Table 2).

Table 2. Survival rate of Morkaraman lambs born in two breeding seasons and total values.

Parameter	Season	First month after birth % (n / Total n)	Second month after birth % (n / Total n)	Total % (n / Total n)
Survival rate (%)	First	94 (283/301)	97,5 (276/283)	95.7 (559 / 584)
	Second	94,8 (293/309)	95,6 (280/293)	95.2 (573 / 602)
	Total	94.4 (576 / 610)	96.5 (556 / 576)	95.5 (1132 / 1186)

The Morkaraman ewes gave birth more frequently at night during the two breeding seasons. In the total of two seasons, ewes birth at a rate of 55.85% at night and 46.16% in the daytime (Fig. 3).

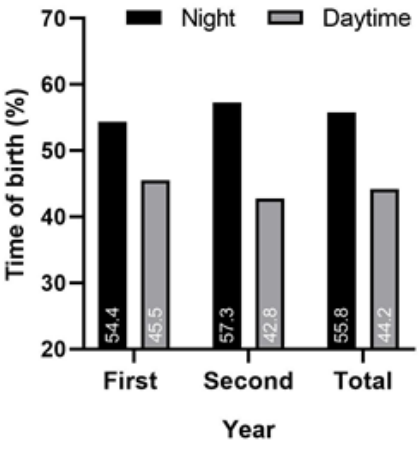

Figure 3. Night or daytime birth rates for two breeding seasons and total values (%). Night: Between 18:00 and 06:00 (h). Daytime: Between 05:59 and 18:01 (h).

DISCUSSION

Sheep breeding can provide an excellent economic gain for families living in rural areas. Many sheep breeds raised in Türkiye and genetic diversity is also high. There are many sheep breeds have been adapted to different feeding methods and different climate and environmental conditions in Türkiye. Morkaraman sheep is also adapted to the harsh climatic and environmental conditions of Eastern Anatolia and is the second most abundant sheep breed in the region. There are generally studies on fattening performance and some yield characteristics about Morkaraman sheep, but there is not enough information about the reproductive and gynecological characteristics. Therefore, in this study, some reproductive and gynecological parameters and lamb yield characteristics of Morkaraman ewes were determined in two breeding seasons.

Sheep are seasonally polyestrous. Behavioral signs of estrus in ewes last 1-2 d and average 35-36 h (Gordon, 1997). The duration of estrus in British ewe breeds is 30 h and may be 10 h shorter in young ewes. The duration of estrus in Merino ewes is 48 h (Robinson & Noakes, 2019). Estrus duration is 37 (Kutluca et al., 2006) or 41-45 h (Emsen & Yaprak, 2006) in Morkaraman ewes. In our study, the estrus duration was between 30-33 h according to two breeding seasons in Morkaraman ewes. Our result was consistent with the duration of estrus in sheep but was shorter than the reported in Morkaraman ewes (Emsen & Yaprak, 2006; Kutluca et al., 2006). This may be due to the use of external hormone injection for estrus synchronization in studies.

The gestation length is generally 143-150 days in ewes (Pugh & Baird, 2012). The gestation length is between 149-151 days in Merinos and Rambouillet ewes (Gordon, 1997), 147-153 days in Menz ewes (Mukasa-Mugerwa & Lahlou-Kassi, 1995), 148.9-154.2 days in Morkaraman ewes (Akçapınar & Kadak, 1982; Gimenezdiaz et al., 2005; Odabaşıoğlu et al., 1996). The gestation lenght in our study was between 149-151 days and it was compatible with the studies. The estrus rate was 89.6% in Ramlıç ewes (Ceyhan et al., 2010), 100% in Kıvırcık ewes (Koyuncu & Akgün, 2018), 92.5% (Emsen & Yaprak, 2006) and 100% (Özbey & Akcan, 2000) in Morkaraman ewes. The lambing rate was 69.4% in Ramlıç ewes (Ceyhan et al., 2010), 76.1% and 81.3% in Horro and Menz ewes, respectively (Berhan & Van Arendonk, 2006), 91.8% in Dorset ewes (Brash et al., 1994), 100% in Kivircik ewes (Koyuncu & Akgün, 2018), and 80%-95% in Morkaraman ewes (Emsen & Yaprak, 2006; Esenbuğa & Dayıoğlu, 2002; Özbey & Akcan, 2000). In our study, the estrus rate was between 95% and 97%, the birth rate was between 90.7% and 92%, and according to the results, it can be said that the reproductive ability of Morkaraman ewes was high.

More than 90% of ewes have a high fertility rate during the breeding season (Scott, 2015). Infertility rate was determined as 6.46% in Morkaraman ewes (Gimenezdiaz et al., 2005), 7.7% in Norduz ewes, 8.9% in Karakaş ewes (Ülker et al., 2004) and 9% in Karagül ewes (Erol & Akçadağ, 2009). In our study, the rate of infertility in Morkaraman sheep was between 3% and 5%, and this rate was lower than in some studies. Infertility is affected by many factors such as season, feeding, lameness, infectious diseases, abortions, and dystocia. Morkaraman ewes do not have much infertility problems and many of them become pregnant during the breeding season.

Placental retention can be caused by selenium or vitamin A deficiency, infectious abortion (e.g., toxoplasmosis, chlamydiosis, listeriosis), obesity, hypocalcemia, dystocia, and is between 1.25% and 1.6% in ewes (Fthenakis, 2004; Fthenakis et al., 2000). We determined an average of 2% placental retention rate in two breeding seasons in Morkaraman ewes. This situation may be affected by factors such as dystocia and abortions. Uterine infections between 4.04% and 5.06% (Khodakaram-Tafti & Davari, 2013; Saberivand & Haghighi, 2006) were detected in ewes in the slaughterhouse. In our study, uterine infection was an average of 7.4%. Uterine infections, which are very low in sheep and goats, may increase after aseptic intervention of dystocia by breeders.

Preparturient vaginal prolapse can be seen in the last month of pregnancy and its incidence is around 1% in ewes. The uterine prolapse rate is 0.1% in ewes (Oral & Kuru, 2016; Scott, 2015). In our study, the rate of vaginal-uterine prolapse in Morkaraman ewes in two breeding seasons was between 1.87% and 2.22%. Cystic ovarian disease is more common in goats than ewes. The incidence in small ruminants can range from 0.01% to 2.4% (Palmieri et al., 2011; Pugh & Baird, 2012; Regassa et al., 2009). In our study, follicular cysts rate in two breeding

seasons was 0.7% to 1.3%, and the rates were consistent with the literature.

The prevalence of clinical mastitis is between 1% and 3% in ewes (Menzies & Ramanoon, 2001). Clinical mastitis should be below 5% in sheep herds (Bergonier et al., 2003; Pugh & Baird, 2012). In our study, the incidence of mastitis was between 2.17% and 3.68%. Colostrum may be insufficient for lambs in 30% of ewes that give birth to twins or triplets and in 10% of ewes that give birth to single (Nowak & Poindron, 2006). In small ruminants, the colostrum after parturition to be less than 50-100 mL is known as insufficient milk yield. Insufficient milk yield was determined as 5.6% in Gurcu goats (Kuru et al., 2017a). In our study, the insufficient milk yield in two breeding seasons was between 2.6% and 3.6%. Insufficient milk yield problem was observed more frequently in primiparous ewes.

Small ruminants have a higher abortion incidence compared to other farm animals, and the overall abortion rate is 5% (Pugh & Baird, 2012). Abort rate is 2.5% in Karakaş and Norduz ewes (Ülker et al., 2004) and 3.8% in Gıcık ewes (Çimen et al., 2003). In our study, the abortion rate was 3.9% in Morkaraman ewes. Dystocia rate in small ruminants is between 3-5%. Although dystocia is uncommon, mortality may be high in lambs in such cases (Kuru et al., 2016; Rook et al., 1990). It has been reported that 9% of lamb deaths are caused by dystocia (Refshauge et al., 2016). In our study, the average dystocia rate was 4.9% in Morkaraman ewes. Congenital anomaly rate in lambs can vary between 0.2% and 2.0%. In addition, the mortality rate can be 50% in this type of lamb (Dennis, 1993; Tuzcu, 2015). In our study, congenital anomaly rates were 1.1% and 1.5% in two breeding seasons.

The twinning rate is 8-28% (Akçapınar et al., 1982; Emsen & Yaprak, 2006; Turkyilmaz & Esenbuga, 2019) and litter size is 1.13-1.28 in Morkaraman ewes (Kayalık & Bingöl, 2015). In our study, twinning rate was 11.3% and litter size was 1.11 and our results were consistent with the literature. Birth weight of Morkaraman lambs was determined as 3.6-4.7 kg in singleton and 3.4-3.6 kg in twin (Emsen & Yaprak, 2006; Kopuzlu et al., 2014). In our study, the average birth weight in single and twin lambs was 3.7 and 3.2 kg, respectively. The birth weight of twin lambs was lower than the literature. This may be due to the younger and lower body weight of the ewes or feeding differences.

Mortality rate in lambs and kids should be below 15% until weaning and aggressive prevention are taken in mortality above this rate (Mukasa-Mugerwa et al., 2002). The survival rate is 83.6% in Horro ewes (Berhan & Van Arendonk, 2006), 85% in Dorset ewes (Brash et al., 1994), 94.9% in Ramlıç ewes (Ceyhan et al., 2010) and 93.4% in Morkaraman ewes (Odabaşıoğlu et al., 1996). The survival rate of Morkaraman lambs 30 and 60 days after birth was determined as 100% and 93%, respectively (Özbey & Akcan, 2001). In our study, the survival rate of Morkaraman lambs 30 and 60 days after birth was 94.43% and 96.52%, respectively. According to our results, we can say that survival rate is high and mortality rate is low in Morkaraman lambs.

CONCLUSION

In conclusion, Morkaraman ewes, which is one of the local gene resources in the Eastern Anatolia Region and adapted to the harsh climate-geographical conditions, may be superior to most of the native sheep breeds in terms of reproductive performance. In addition, Morkaraman ewes has a high reproductive performance, does not have many reproductive / gynecological and udder problems, mostly gives birth to singleton and lambs have a high survival rate.

ACKNOWLEDGMENT

Ethical approval:

This study was carried out after the approval obtained from the Kafkas University Animal Experiments Ethics Committee, (HADYEK 2018/071) and the permission obtained from the Ministry of Agriculture and Forestry.

Conflict of interest: There is no conflict of interest between the authors

REFERENCES

Akçapınar, H. (1994). *Koyun yetiştiriciliği*. Ankara: Medisan Kitabevi.

Akçapınar, H., Aydın, İ., & Kadak, R. (1984). Morkaraman koyunlarının Erzurumda özel bir işletmede kuzu ve süt verimleri. *Ankara Üniversitesi Veteriner Fakültesi Dergisi*, *31*(1), 114–127.

Akçapınar, H., & Kadak, R. (1982). Bazı faktörlerin Akkaraman ve Morkaramanlarda gebelik süresi ve doğum ağırlığı üzerine etkileri. *Ankara Üniversitesi Veteriner Fakültesi Dergisi*, *29*, 392–400.

Akçapınar, H., Kadak, R., & Odabaşıoğlu, F. (1982). Morkaraman ve Kangal-Akkaraman koyunlarının döl verimi ve süt verimi üzerinde karşılaştırmalı araştırmalar. *Ankara Üniversitesi Veteriner Fakültesi Dergisi*, *29*, 379–391.

Bekyürek, T. (2017). Koyunlarda infertiliteyle seyreden hastalıkların tanı ve tedavi yöntemleri. *Türkiye Klinikleri Veteriner Bilimleri-İç Hastalıkları - Özel Konular*, *3*: 61–74.

Bergonier, D., de Crémoux, R., Rupp, R., Lagriffoul, G., & Berthelot, X. (2003). Mastitis of dairy small ruminants. *Veterinary Research*, *34*(5), 689–716. doi: 10.1051/vetres:2003030

Berhan, A., & Van Arendonk, J. (2006). Reproductive performance and mortality rate in Menz and Horro sheep following controlled breeding in Ethiopia. *Small Ruminant Research*, *63*(3), 297–303. doi: 10.1016/j.smallrumres.2005.03.003

Brash, L. D., Fogarty, N. M., & Gilmour, A. R. (1994). Reproductive performance and genetic parameters for Australian Dorset sheep. *Australian Journal of Agricultural Research*, *45*(2), 427–441. doi: 10.1071/AR9940427

Ceyhan, A., Sezenler, T., Yildirir, M., & Erdogan, I. (2010). Reproductive performance and lamb growth characteristics of Ramlıç sheep. *Kafkas Universitesi Veteriner Fakultesi Dergisi*, *16*(2), 213–216. doi: 10.9775/kvfd.2009.529

Çimen, M., Soylu, D., Soylu, İ., & Özsoy, M.K. (2003). Gıcık koyunlarında vücut ölçüleri, döl verimi ve kuzularda büyüme özellikleri. *Lalahan Hayvancılık Araştırma Enstitüsü Dergisi*, *43*(1), 29–34.

Dennis, S. M. (1993). Congenital defects of sheep. *The Veterinary Clinics of North America: Food Animal Practice*, *9*(1), 203–217. doi: 10.1016/S0749-0720(15)30681-2

Emsen, E., & Yaprak, M. (2006). Effect of controlled breeding on the fertility of Awassi and Red Karaman ewes and the performance of the offspring. *Small Ruminant Research*, *66*(1–3), 230–235. doi: 10.1016/j.smallrumres.2005.09.022

Erol, H., & Akçadağ, H. İ. (2009). Halk elinde yetiştirilen Karagül koyun sürülerinde bazı verim özellikleri. *Lalahan Hayvancılık Araştırma Enstitüsü Dergisi*, *49*(2), 91–104.

Esenbuğa, N., & Dayıoğlu, H. (2002). İvesi ve Morkaraman koyunlarının döl verim özelliklerine kimi çevre faktörlerinin etkileri. *Turkish Journal of Veterinary and Animal Sciences*, *26*(1), 145–150.

Fthenakis, G. C. (2004). Effects of retention of fetal membranes on subsequent reproductive performance of dairy ewes. *Theriogenology*, *61*(1), 129–135. doi: 10.1016/S0093-691X(03)00188-2

Fthenakis, G. C., Leontides, L. S., Amiridis, G. S., & Saratsis, P. (2000). Incidence risk and clinical features of retention of foetal membranes in ewes in 28 flocks in southern Greece. *Preventive Veterinary Medicine*, *43*(2), 85–90. doi: 10.1016/S0167-5877(99)00088-4

Gimenezdiaz, C. A., Emsen, E., Koycegiz, F., Emsen, B., Yaprak, M., & Kutluca, M. (2005). Synchronization of estrus in fat tailed sheep using melengestrol acetate (MGA) in the breeding season. *Journal of Applied Animal Research*, *28*(1), 25–27. doi: 10.1080/09712119.2005.9706782

Gordon, I. (1997). *Controlled Reproduction in Sheep & Goats. Controlled Reproduction in Farm Animal Series - Volume 2*. USA: CAB International.

Kayalık, M. Ş., & Bingöl, M. (2015). Tüm yönleriyle Morkaraman koyunları. *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, *5*(2), 89–97.

Kaymakçı, M. (2016). *İleri Koyun Yetiştiriciliği*. İzmir: Meta Basım.

Kenyon, P., Maloney, S., & Blache, D. (2014). Review of sheep body condition score in relation to production characteristics. *New Zealand Journal of Agricultural Research*, *57*(1), 38–64. doi: 10.1080/00288233.2013.857698

Khodakaram-Tafti, A., & Davari, A. (2013). Congenital and acquired abnormalities of reproductive tract of non-pregnant ewes slaughtered in Fars province, Iran. *Iranian Journal of Veterinary Research*, *14*(2), 140–144. doi: 10.22099/IJVR.2013.1588

Kırmızıbayrak, T., Aksoy, A. R., Saatcı, M., & Tilki, M. (2005). Tuj ve Morkaraman koyunların süt verimi ve meme özellikleri ile bu özellikler arasındaki ilişkiler. *Kafkas Üniversitesi Veteriner Fakültesi Dergisi*, *11*(1), 11–15.

Kopuzlu, S., Sezgin, E., Yuksel, S., Ozluturk, A., Biberoglu, O., Esenbuga, N., Bilgin, O. C., Bayram, M., & Keskin, M. (2014). Phenotypic and genetic parameters for growth characteristics of Morkaraman sheep. *Journal of Applied Animal Research*, *42*(1), 97–102. doi: 10.1080/09712119.2013.822808

Koyuncu, M., & Akgün, H. (2018). Ekstansif koşullarda yetiştirilen Akkaraman melezi koyunlarda süt verimi

ve sütteki bazı bileşenlerin belirlenmesi. *Hayvansal Üretim, 59*(1), 33–40.

Kuru, M., Boğa Kuru, B., Kulaksız, R., Çağın Arı, U., & Oral, H. (2017a). Gürcü keçilerinin bazı reprodüktif özellikleri. *Harran Üniversitesi Veteriner Fakültesi Dergisi*, *6*(2), 119–125.

Kuru, M., Boga Kuru, B., Sogukpinar, O., Cebi Sen, C., Oral, H., & Kirmizibayrak, T. (2020). Oestrus synchronisation with progesterone-containing sponge and equine chorionic gonadotropin in Pirlak ewes during the non-breeding season: Can Toryum improve fertility parameters? *Journal of Veterinary Research*, *64*(4), 573–579. doi: 10.2478/jvetres-2020-0074

Kuru, M., Mülazımoğlu, S. B., & Kaya, D. (2016). Koyun ve keçilerde güç doğum. *Turkiye Klinikleri Veterinary Sciences-Obstetrics and Gynecology - Special Topics*, *2*(1), 74–77.

Kuru, M., Sogukpinar, O., Makav, M., & Cetin, N. (2017b). Effect of barium selenate injections on fertility of Pirlak ewes subjected to estrus synchronization during non-breeding season. *Medycyna Weterynaryjna*, *73*(8), 479–482. doi: 10.21521/mw.5758

Kutluca, M., Emsen, E., Emsen, H., & Gimenez Diaz, C. A. (2006). Postpartum reproductive activity and body weight changes in fat tailed ewes. *Journal of Animal and Veterinary Advances*, *5*(12), 1220–1222.

Menzies, P. I., & Ramanoon, S. Z. (2001). Mastitis of sheep and goats. *The Veterinary Clinics of North America. Food Animal Practice*, *17*(2), 333–358. doi: 10.1016/S0749-0720(15)30032-3

Mukasa-Mugerwa, E., Anindo, D., Sovani, S., Lahlou-Kassi, A., Tembely, S., Rege, J. E. O., & Baker, R. L. (2002). Reproductive performance and productivity of Menz and Horro sheep lambing in the wet and dry seasons in the highlands of Ethiopia. *Small Ruminant Research*, *45*(3), 261–271. doi: 10.1016/S0921-4488(02)00155-4

Mukasa-Mugerwa, E., & Lahlou-Kassi, A. (1995). Reproductive performance and productivity of Menz sheep in the Ethiopian highlands. *Small Ruminant Research*, *17*(2), 167–177. doi: 10.1016/0921-4488(95)00663-6

Nowak, R., & Poindron, P. (2006). From birth to colostrum: Early steps leading to lamb survival. *Reproduction Nutrition Development*, *46*(4), 431–446. doi: 10.1051/rnd:2006023

Odabaşıoğlu, F., Arslan, M., & Yertürk, M. (1996). Morkaraman ve Corriedale x Morkaraman (F1) kuzularda doğum ağırlığı ve yaşama gücüne, Morkaraman koyunlarda gebelik süresine bazı faktörlerin etkisi. *YYU Veteriner Fakultesi Dergisi*, *7*(1–2), 1–7.

Oral, H., & Kuru, M. (2016). Koyun ve keçilerde klinik ve deneysel reprodüktif cerrahi. *Turkiye Klinikleri Veterinary Sciences-Obstetrics and Gynecology - Special Topics*, *2*(1), 83–88.

Özbey, O., & Akcan, A. (2000). Akkaraman, Morkaraman ve İvesi koyunlarının yarı-entansif şartlardaki verim performansı I. Döl ve süt verimi özellikleri. *Veteriner Bilimleri Dergisi*, *16*(1), 109–120.

Özbey, O., & Akcan, A. (2001). Morkaraman, Akkaraman ve İvesi koyunlarının yarı entansif şartlardaki verim performansı II. Kuzularda büyüme ve yaşama gücü özellikleri. *Veteriner Bilimleri Dergisi*, *17*(1), 57–66.

Palmieri, C., Schiavi, E., & Salda, L. Della. (2011). Congenital and acquired pathology of ovary and tubular genital organs in ewes: A review. *Theriogenology*, *75*(3), 393–410. doi: 10.1016/j.theriogenology.2010.09.020

Pugh, D. G., & Baird, A. N. (2012). *Sheep & goat medicine.* Missouri: Saunders-Elsevier.

Refshauge, G., Brien, F. D., Hinch, G. N., & Van De Ven, R. (2016). Neonatal lamb mortality: Factors associated with the death of Australian lambs. *Animal Production Science*, *56*(4), 726–735. doi: 10.1071/AN15121

Regassa, F., Mengesha, D., Dargie, M., & Tolosa, T. (2009). Abattoir evidence on association between uterine and ovarian abnormalities in Ethiopian highland ewes. *Animal Reproduction Science*, *111*(2–4), 384–390. doi: 10.1016/j.anireprosci.2008.03.020

Robinson, B., & Noakes, D. E. (2019). Reproductive physiology of the female. In D. E. Noakes, T.J. Parkinson, & G. C. W. England (Eds.), *Veterinary reproduction and obstetrics* (pp.2–34).W.B. Saunders.

Rook, J. S., Scholman, G., Wing-Proctor, S., & Shea, M. (1990). Diagnosis and control of neonatal losses in sheep. *The Veterinary Clinics of North America: Food Animal Practice*, *6*(3), 531–562. doi: 10.1016/S0749-0720(15)30831-8

Saberivand, A., & Haghighi, M. (2006). Acquired reproductive tract abnormalities of ewes in northwest of Iran: An abattoir survey. *Iranian Journal of Veterinary Research*, *7*(1), 44–48. doi: 10.22099/IJVR.2006.2680

Scott, P. R. (2015). *Sheep medicine*. London: CRC Press.

Şahal, M., Kurtdede, A., İmren, H.Y. (1994). Prematüre asfeksili bir kuzuda asidozis'in sodyum bikarbonat ve glukoz ile sağaltımı. *Ankara Üniversitesi Veteriner Fakültesi Dergisi*, *41*,439–450.

Turkyilmaz, D., & Esenbuga, N. (2019). Increasing the productivity of Morkaraman sheep through crossbreeding with prolific Romanov sheep under semi-intensive production systems. *South African Journal of Animal Sciences*, *49*(1), 185–191. doi: 10.4314/sajas.v49i1.21

Tuzcu, M. (2015). Koyunların konjenital anomalileri. *Turkiye Klinikleri Veterinary Sciences- Internal Medicine - Special Topics*, *1*(3), 18–23.

Ülker, H., Gökdal, Ö., Aygün, T., & Karakuş, F. (2004). Karakaş ve Norduz koyunlarının temel üreme özellikleri bakımından karşılaştırılması. *Yüzüncü Yıl Üniversitesi Tarım Bilimleri Dergisi*, *14*(1), 59–63.

Yalçin, B. C. (1986). *Sheep and Goats in Turkey*. Food and Agriculture Organization of the United Nations.

Yilmaz, O., Cengiz, F., Ertugrul, M., & Wilson, R. T. (2013). The domestic livestock resources of Turkey: Sheep breeds and cross-breeds and their conservation status. *Animal Genetic Resources*, *52*, 147–163. doi: 10.1017/s2078633613000015