

Distribution of Births by Akkaraman Sheep According to Time of Day

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ABSTRACT

This study was conducted on 693 lambs born between 2019 and 2021 in an Akkaraman sheep farming registered with the 'National Small Ruminant Breeding Project' in Çankırı Province. The study aimed to investigate the distribution of lamb births throughout the day and the relationship between birth times and lamb sex, birth type, birth year, and lamb mortality at birth. For this purpose, the 24 hours of the day were divided into four equal segments of six hours each: 1. night (00:01-06:00), 2. morning (06:01-12:00), 3. afternoon (12:01-18:00), and 4. evening (18:01-00:00). Lamb births occurred most frequently at night, accounting for 39%, followed by morning (23.1%), evening (20.2%), and afternoon (17.7%). It was observed that lamb births were highest during the night for both female (42.8%) and male (35%) lambs, as well as for single (42.0%) and twin (30.9%) births. It was noted that births in 2019 (42.0%) and 2020 (30.9%) occurred most frequently during the night, while in 2021 (29.4%), they occurred most frequently in the evening. The highest rate of lamb mortality at birth was observed during the afternoon hours (4.1%). According to the Chi-square (χ^2) analysis results, the effect of birth type ($P=0.023$) and birth year ($P=0.001$) was significant, while the effect of gender and lamb mortality at birth was found to be not significant. The study indicates that lamb births in Akkaraman sheep are concentrated during the night, providing an opportunity for farmers to be prepared during birth, and to increase lamb health and farm productivity.

Akkaraman Koyunlarında Günün Saatlerine Göre Doğumlarının Dağılımı

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ÖZET

Bu çalışma, Çankırı İlinde "Ülkesel Küçükbaş Hayvan Islahı Projesi"ne kayıtlı bulunan bir Akkaraman koyunculuk işletmesinde 2019-2021 yıllarında doğan 693 kuzu üzerinde gerçekleştirilmiştir. Çalışmada koyunların doğumlarının gün içindeki dağılımını ve doğum saatlerinin kuzu cinsiyeti, doğum tipi, doğum yılı ve doğum anında kuzu ölümlerini araştırılması amaçlanmıştır. Bu amaçla günün 24 saatlik zaman dilimi 1. gece (00:01-06:00), 2. sabah (06:01-12:00), 3. öğle (12:01-18:00) ve 4. akşam (18:01-00:00) olmak üzere altışar saatlik 4 eşit dilimi bölünmüştür. Kuzu doğumları en yoğun olarak %39 oranla gece saatlerinde gerçekleştiği, bunu sırasıyla sabah (%23.1), akşam (%20.2) ve öğle saat dilimleri (%17.7) takip etmiştir. Cinsiyete göre dişi (%42.8) ve erkek (%35) doğan kuzular ile doğum tipine göre tekiz (%42.0) ve ikiz (%30.9) doğan kuzuların doğumlarının gece saatlerinde en yüksek olarak gerçekleştiği tespit edilmiştir. 2019 (%42.0) ve 2020 (%30.9) yıllarında doğan kuzuların doğumlarının gece saatlerinde 2021 yılında (%29.4) ise akşam saatlerinde en yüksek olarak gerçekleştiği gözlemlenmiştir. Doğum anında kuzu ölüm oranlarının öğle saat dilimlerinde %4.1 ile en yüksek oranda olduğu tespit edilmiştir. Ki-kare (χ^2) analizi sonuçlarına göre doğum tipi ($P=0.023$) ve doğum yılının ($P=0.001$) etkisi önemli, cinsiyet ve kuzu ölümlerinin etkisi önemsiz bulunmuştur. Araştırma, Akkaraman koyunlarında doğumların gece saatlerinde yoğunlaştığını göstermekte olup, bu bilgiler yetiştiricilerin doğum zamanında hazır olma, kuzuların sağlığını ve işletmenin verimliliğini artırma fırsatı sunduğunu göstermektedir.

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INTRODUCTION

Sheep farming is closely associated with the utilization of marginal pasture and fallow lands worldwide, which are essential in various aspects such as nutrition, employment, rural development, and sociology. Sheep receive more attention compared to cattle due to their shorter gestation period, higher twinning rates, lower age at slaughter, and better utilization capacity of roughage (Uysal et al., 2024). Sheep farming constitutes a significant part of the livestock sector in Turkey, with sheep accounting for approximately 60% of domesticated animals (FAOSTAT, 2023). The majority of sheep raised in Türkiye consist of native breeds, with the Akkaraman sheep breed, which accounts for 40-45% of small ruminant stock, being most prevalent in Central Anatolia (Şahin, 2023; Sakar, 2024). Akkaraman sheep are a fat-tailed breed raised for meat and milk production, adapted to the harsh climatic conditions of the region. Typically, Akkaraman sheep graze on pastures during the spring and autumn months and utilise stubbles during the summer months (Sakar and Ünal, 2021).

Animal-derived foods play a significant role in human nutrition as they contain essential proteins, vitamins, and minerals necessary for human health (Oyan et al., 2024). Therefore, considering reproductive behaviors in sheep, it is important to enhance fertility and support the healthy lives of offspring after birth. Providing appropriate conditions immediately after birth reduces lamb losses, preserves the health of offspring, and minimizes stress and confusion during the first hours after birth (Öztürk, 2012). Unlike wild animals, the daily distribution of the birthing process in domestic animals can be influenced by both environmental factors and husbandry practices (Darwish and Abou-Ismaïl, 2017).

In various sheep breeds and rearing systems, lambing times have been reported to concentrate at different times of the day in some literature reports: Zülkadir and Karabacak (2013) and Büyüktekin et al. (2015) reported concentration during nighttime, Şahin (2023) during morning hours, Aleksiev (2007) during midday, Karabacak et al. (2012) and Öztürk (2012) during evening hours, Karabacak et al. (2015) and Darwish and Abou-Ismaïl (2017) during the dark hours of the day. Such research can contribute to optimizing the time required for herd management throughout the day and reducing the necessary manpower during lambing periods (Aleksiev, 2007).

This study aims to examine the distribution of lamb births throughout the day and the relationship between birth times and lamb sex, birth type, and birth year in Akkaraman sheep. Additionally, the study aims to determine the distribution of lamb mortality at birth throughout the day and evaluate the potential benefits of this information for lambing management and farm productivity in sheep farming.

MATERIALS AND METHODS

The animal material for this study consisted of the Akkaraman sheep breed raised in Çankırı province (40°61'N, 33°58'E; altitude 730m) within the scope of the 'National Small Ruminant Breeding Project' conducted by the General Directorate of Agricultural Research and Policies (TAGEM). The study was conducted on a total of 693 lambs born between 2019 and 2021 at a same farm.

In the farm, sheep are typically kept in the barn during the winter months. They are grazed in the pasture during daylight hours, from April to November. During the grazing season, additional feed is not provided to the sheep, and the pastures are generally of poor to moderate quality. In during winter, sheep are provided with only hay as roughage and barley and wheat grains as concentrated feed. Ram mating occurs in September-October, with additional feeding provided only to the rams. Lambing takes place in February-March.

The study was conducted on a farm in Çankırı province, which is registered in the breeding system and maintains additional records. In farms registered in the breeding system, alongside

records such as lamb identification number, date of birth, birth type, and dam number, basic parameters used in animal breeding such as birth weight and weaning weight are also documented. The farm where the study was conducted is equipped with a 24/7 camera system in the animal barns, allowing real-time monitoring of the animals by the farm owner. Pregnant ewes were placed in individual lambing pens 2-3 days before their expected parturition date. The condition of the ewes' giving birth was monitored by the breeder, and their birth times and other basic information were recorded in the farm's registry.

Within the scope of the study, the 24 hours was divided into four equal segments of six hours each. These are: 1. night (00:01-06:00), 2. morning (06:01-12:00), 3. noon (12:01-18:00), and 4. evening (18:01-00:00). Lambing times were investigated taking into account lamb gender (1. female, 2. male), birth type (singleton, twin), birth year (2019, 2020, 2021), and lamb mortality at birth (present, absent). To determine whether the distribution of births throughout the day varied according to environmental factors, a χ^2 (Chi-square) test was conducted using the Minitab-16 software package (Minitab, 2010).

Ethic: Data collection and animal husbandry procedures were carried out in compliance with Law No. 5996's Article 9 rules for animal welfare. This work did not involve the use of animals for laboratory studies. There is no violation of animal rights.

RESULTS

In this study conducted with the Akkaraman breed, the distribution of a total of 693 lamb births by hours of the day was examined. The hourly distribution of lamb births is shown in Figure 1.

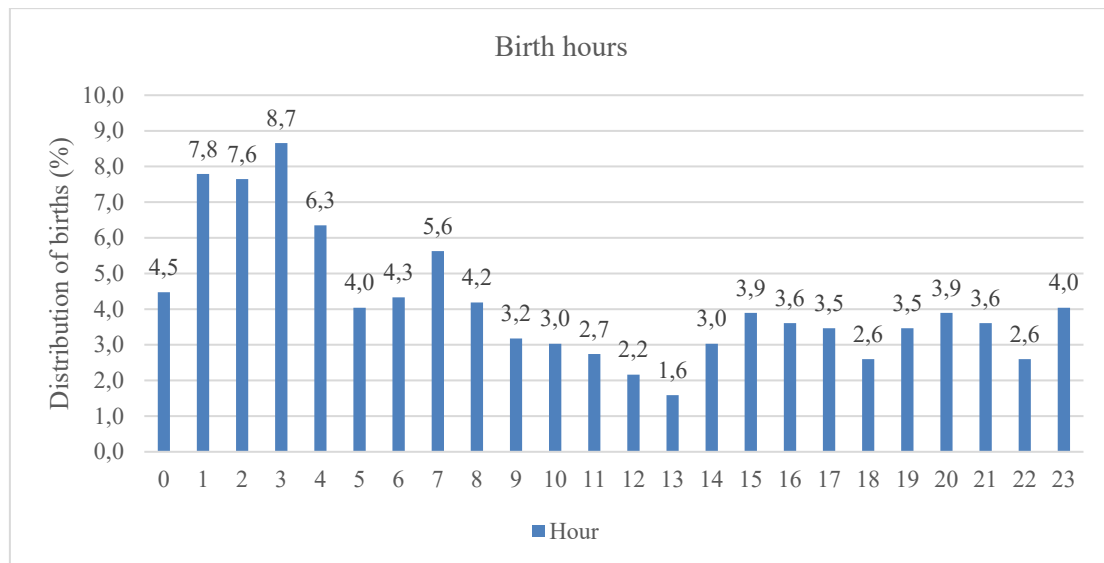


Figure 1. Distribution of Lamb Births According to Hours of the Day (%)

The distribution of lamb births by periods in Akkaraman lambs is presented in Table 1. Upon examining Table 1, it can be seen that the majority of lamb births occur during the night hours (39.0%). This is followed by the morning hours (23.1%) and evening hours (20.2%), while the least number of births occur during the noon hours (17.7%).

The births of female lambs occurred at the highest rate during the night hours (42.8%) and at the lowest rate during the noon hours (16.4%). Similarly, the births of male lambs were observed to occur at the highest rate during the night hours (35.0%) and at the lowest rate during the noon hours (19.1%) (Table 1). According to the Chi-square (χ^2) test, there was no significant difference in the

distribution of births throughout the day based on the gender of the lambs.

Table 1. Distribution of Lamb Births According to Environmental Factors During the Day

Time Period	Total (n/%)	Sex		Birth type		Birth year			Lamb death	
		Female	Male	Single	Twin	2019	2020	2021	Yes	No
1. Night (00:01-06:00)	270 (39.0)	151 (42.8)	119 (35.0)	212 (42.0)	58 (30.9)	116 (55.0)	96 (38.2)	58 (25.1)	8 (3.0)	262 (97.0)
2. Morning (06:01-12:00)	160 (23.1)	83 (23.5)	77 (22.6)	104 (20.6)	56 (29.8)	37 (17.5)	64 (25.5)	59 (25.5)	4 (2.5)	156 (97.5)
3. Noon (12:01-18:00)	123 (17.7)	58 (16.4)	65 (19.1)	89 (17.6)	34 (18.1)	27 (12.8)	50 (19.9)	46 (19.9)	5 (4.1)	118 (95.9)
4. Evening (18:01-00:00)	140 (20.2)	61 (17.3)	79 (23.2)	100 (19.8)	40 (21.2)	31 (14.7)	41 (16.3)	68 (29.4)	4 (2.9)	136 (97.1)
Total	693	353	340	505	188	211	251	231	21	672
		χ^2 : 6.489; DF:3; P:0.090		χ^2 : 9.534; DF:3; P:0.023		χ^2 : 48.327; DF:6; P:0.001			χ^2 : 0.620; DF:3; P:0.892	

n: Number of animals, χ^2 : Chi-square result, DF=Degree of Freedom, P: Significance level

While it was observed that the highest rate of singleton lambs was born at night (42.0%), these rates were close to each other in other periods of the day. The highest rate of twin-born lambs occurred at night and morning hours (30.9% and 29.8%), and the lowest rate occurred in the evening and noon hours (21.2% and 18.1%) (Table 1). According to the chi-square analysis results, the differences observed in the distribution of births during the day according to the type of birth were found to be significant (P=0.023).

The distribution of lamb births by year was as highest and lowest at night (55.0%) and noon (12.8%) in 2019, at night (38.2%) and evening (16.3%) in 2020, and at night (29.4%) and noon (19.9%) in 2021, respectively (Table 1). According to the chi-square analysis results, the effect of year on the birth time of lambs was found to be significant (P=0.001).

Of the 693 birth events examined in the study, 21 lambs died for some reason at or immediately after birth.

DISCUSSION

Distribution of Births During the Day

According to Figure 1, it can be observed that births peak between hours 1 and 4 at night, while they are at their lowest levels between hours 12 and 13. This indicates a daily trend in the frequency of births. In other words, it is understood that births occur more frequently at certain hours and that these births exhibit a certain pattern over time.

This indicates that the frequency of lamb births in sheep is highest during the night hours. In a study conducted with 160 Akkaraman and 95 Awassi sheep, it was found that births were concentrated during the night hours (23:01-05:00) at rates of 41.88% and 38.95%, respectively (Zülkadir and Karabacak, 2013). In another study with the Akkaraman breed, it was reported that lambs were born most frequently (33.1%) during the night hours (22:01-04:00) and least frequently (13.84%) during the evening hours (16:01-22:00) (Büyüktekin *et al.*, 2015). In a study conducted with Anatolian Merino sheep, it was found that 52.7% of births occurred at night (17:01-05:00) and 47.3% during the day (05:01-17:00) (Karabacak *et al.*, 2015). In a study with Finnish Landrace - Rahmani crossbred sheep, it was reported that the period of the day had a significant effect on lambing incidence (P<0.001), with births mostly occurring during the night hours (18:00-06:00) (Darwish and Abou-Ismael, 2017). However, opposite findings have also been reported in studies with the same breed, with Karabacak *et al.* (2012) and Öztürk (2012) finding that birth times were most concentrated

between 16:01-22:00 (30.25% and 31.2% respectively). Various physical and metabolic activities may be involved in the onset of labor in sheep. The interaction of various exogenous and endogenous factors can determine the timing of birth and therefore affect the birthing process and trigger its onset (Darwish and Abou-Ismael, 2017). The predominance of lamb births during the night hours in the study may be due to sheep preferring quieter hours of the day to avoid noise pollution or being influenced by the presence of workers during the day. Results obtained from different studies indicate that the effects of sheep breeds and perhaps geographical conditions on birth times may vary. This suggests that specific sheep breeds or region-specific factors may influence birth times.

Distribution of Lamb Births During the Day According to Some Environmental Factors

Lamb sex

In the study, the highest rate of births of both female lambs and male lambs occurred at night hours (Table 1). In various studies conducted with the Akkaraman breed, it has been reported that birth times occur most frequently during the night hours (23:01-05:00), these values were found to be in females (47.06%) and males (38.04%) by Zülkadir and Karabacak (2013), in females (27.76%) and males (28.19%) by Büyüktekin *et al.* (2015). In studies with the same breed, Öztürk (2012) found the highest lamb births in females (32.7%) between 16:01-22:00 and in males (30.8%) between 04:01-10:00 and 16:01-22:00, while Karabacak *et al.* (2012) found the highest lamb births in females (28.3%) between 22:01-04:00 and 10:01-16:00, and in males (31.8%) between 10:01-16:00. The distribution of births based on gender was found to be statistically insignificant in these literature reports. According to the study results, the concentration of birth rates for female and male lambs in similar periods indicates that the gender of the sheep does not affect the distribution of birth times.

Birth type

In the study, single lambs showed the highest birth frequency at night, and twin lambs showed the highest birth frequency at night and in the morning (Table 1). Similarly, Büyüktekin *et al.* (2015) reported that the distribution of birth type over time periods was statistically significant ($P<0.01$), while births were most intense between 22:01-04:00 in both birth types (single=33.41%, twins=32.52%). When the literature data are examined, there are studies conducted with the same breed in which the distribution of birth type over periods is not significant; Karabacak *et al.* (2012) reported the highest that for singletons it is between 04:01-10:00 (31.2%), and for twins it is between 16:01-22:00 hours (38.5%), Öztürk (2012) found the highest birth rates in both birth types between 16:01-22:00 (single=30.6% and twin=37.5%). While Uğur and Karabacak (2019) reported that the distribution of birth type according to periods of the day in Anatolian Merinos was insignificant, they found these rates to be highest between 10:01-16:00 in single lambs and between 04:01-10:00 in twin lambs. Şahin (2023) reported that the effect of birth type according to the period in Bafra sheep was significant ($P=0.013$), and the highest births in both singleton and multiple births occurred between 06:01-12:00. Similarities or differences in birth time according to birth type in the literature may result from different rearing environments or genetic and physiological differences between animal breeds.

Birth year

In the research, while a higher proportion of lambs were born at night in 2019 and 2020, they were born in the evening in 2021. Similar to these findings, in a study conducted with the Akkaraman breed, its effect on the number of births in different periods of the year was found to be statistically significant ($P<0.05$) (Öztürk, 2012). The fact that birth times vary from year to year shows that births in the Akkaraman breed are not concentrated in a certain period. This suggests that the birth tendencies of sheep are affected by environmental factors such as climatic factors or genetic

variations.

Lamb death at birth

The distribution of birth rates in lambs was found to be close to each other according to the periods of the day. These causes include stillbirth, the lamb being opposite in the birth canal (malpresentation), the lamb not being able to rise, paralyzed or epileptic birth, and sudden deaths immediately after birth. It is seen that the highest rate of these death cases occurs at noon (4.1%), followed by night (3%) and evening hours (2.9%), and the lowest occurs in the morning hours (2.5%) (Table 1). According to the chi-square analysis results, the differences between the parts of the day among the death cases at the time of birth were found to be statistically not significant. This shows that death cases occur close to each other at different periods during the day. Kuru *et al.* (2016) reported that the incidence of difficult birth in sheep and goats varies between 3-5% on average, and the most common cause of congenital disabilities is foetal congenital disabilities at a rate of 50-60%. Abortions in cattle and sheep cause significant economic losses in the livestock sector, and mostly infectious agents (viruses, bacteria, fungi, and protozoa) cause abortions in domestic ruminants (Şevik, 2024). Jacobson *et al.* (2020) reported that risk factors for dystocia in lambs may include malpresentation, disease, or congenital abnormalities, as well as foetopelvic disproportion, uterine inertia, and difficulty in fully dilating the cervix. Sheep with high (fat) or low live weight, as well as small-bodied first parity sheep, also increase the risk of dystocia (Şahin, 2023).

The results of the study reveal that births in Akkaraman sheep show a certain tendency during the day and are concentrated at night. While birth time did not appear to vary significantly according to lamb gender, significant differences were observed according to birth type and birth year. It has been determined that lamb mortality rates at birth occur at similar levels at different times of the day. This study provides important information about birth management in sheep breeding, and knowing the birth time of the lamb offers breeders the opportunity to be more prepared during the birth process. Thus, by providing farmers with the opportunity to increase the health of the lambs and the efficiency of the farms, animal welfare can be improved, and flock management can be facilitated.

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Author Contribution

Research Design (CRediT 1) Çağrı Melikşah SAKAR (50%) – Özcan ŞAHİN (50%)

Data Collecting (CRediT 2) Çağrı Melikşah SAKAR (40%) – İlker ÜNAL (30%) - Sedat BEHREM (30%)

Research - Data Analysis - Validation (CRediT 3-4-6-11) Çağrı Melikşah SAKAR (25%) – Özcan ŞAHİN (25%) - İlker ÜNAL (25%) - Sedat BEHREM (25%)

Writing the Article (CRediT 12-13) Çağrı Melikşah SAKAR (60%) – Özcan ŞAHİN (40%)

Editing and Development of the Text (CRediT 14) Çağrı Melikşah SAKAR (25%) – Özcan ŞAHİN (25%) - İlker ÜNAL (25%) - Sedat BEHREM (25%)

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Conflict of Interest

There is no conflict of interest.

Sustainable Development Goals

Does not support

REFERENCES

- Aleksiev, Y. (2007). Diurnal distribution of the time of parturition in the Danube fine wool breed of sheep. *Bulgarian Journal of Agricultural Science*, 13(6), 723.
- Büyüktekin, M., Öztürk, A. & Zülkadir, U. (2015, Eylül). *Distribution of births during the day in Akkaraman sheep*. 9th National Animal Science Congress, Konya / Türkiye.
- Darwish, R. A. & Abou-Ismael, U. A. (2017). Diurnal distribution of lambing in sheep and its relation with behaviour and survival of the neonate lamb. *Mansoura Veterinary Medical Journal*, 18(1), 365-380.
- Faostat, (2023). Statistic Database. <http://faostat.fao.org/> (Accessed date:15.12.23).
- Jacobson, C., Bruce, M., Kenyon, P. R., Lockwood, A., Miller, D., Refshauge, G. & Masters, D. G. (2020). A review of dystocia in sheep. *Small Ruminant Research*, 192, 106209.
- Karabacak, A., Zülkadir, U. & Aköz, M. (2012). Some reproductive behavior of Akkaraman sheep. *Selcuk Journal of Agriculture and Food Sciences*, 26(4), 55-59.
- Karabacak, A., Zülkadir, U. & Aytekin, İ. (2015, Eylül). *Some birth behaviors in Anatolian Merino sheep*. 9th National Animal Science Congress, Konya / Türkiye.
- Kuru, M., Mülazımoğlu, S. B. & Kaya, D. (2016). Dystolic birth in sheep and goats. *Türkiye Klinikleri J Vet Sci Obstet Gynecol-Special Topics*, 2(1), 74-77.
- Minitab (2010). Minitab 16.1.1 for Windows. State College, PA, USA: Minitab Inc.
- Oyan, O., Şenyüz, H. H. & Arköse, C. Ç. (2024). Comparison of carcass weight and carcass characteristics in some cattle breeds. *Research and Practice in Veterinary and Animal Science (REPVAS)*, 1(1), 1-8.
- Öztürk, A. (2012). The Distribution of lambings in a day of Akkaraman ewes. *Journal of the Institute of Science and Technology*, 2(2 Sp: A), 113-116.
- Sakar, Ç. M. & Ünal, İ. (2021). Determination of growth characteristics of Akkaraman lambs raised in Çankırı province. *Journal of Animal Production*, 62(1), 61-66.
- Sakar, Ç. M. (2024). The effect of climate index on growth values from birth to breeding in Akkaraman sheep. *Tropical Animal Health and Production*, 56(2), 1-11.
- Şahin, Ö. (2023). Distribution of births of Bafra sheep reared in the Mediterranean region during the day. *Black Sea Journal of Agriculture*, 6(2), 197-203.
- Şevik, M. (2024). Assessment of role of epizootic hemorrhagic disease virus in abortion in cattle and small ruminants in Türkiye. *Research and Practice in Veterinary and Animal Science (REPVAS)*, 1(1), 19-26.
- Uğur, K. & Karabacak, A. (2019). The effect of some environmental factors on diurnal distribution of births in Anatolian Merino sheep. *Selcuk Journal of Agriculture and Food Sciences*, 33(3), 227-230.
- Uysal, S., Uysal, A., Öz, C., Yörük, M. A. & Ölmez, M. (2024). Evaluation of sheep colostrums according to time after lambing by brix refractometer method and color scoring. *Research and Practice in Veterinary and Animal Science (REPVAS)*, 1(1), 27-35.
- Zülkadir, U. & Karabacak, A. (2013). Distribution of birth within a day of Akkaraman and Awassi sheep. *Journal of Animal Production Advances*, 3(4), 120-125.