ALI KARABACAK

High Graduate School of Karapinar Aydoganlar, University of Selcuk, Turkey

UGUR ZULKADIR

Faculty of Agriculture, Department of Animal Science, University of Selcuk, Turkey

DISTRIBUTION OF BIRTHS BY ANATOLIAN MERINO SHEEP ACCORDING TO TIME OF DAY

Abstract:

This research was conducted to investigate the relevance of lamb sex, birth type and birth rate on birth distribution within the 24-hour daily cycle in Anatolian Merino Sheep. The aim is to find solutions to any problem that could arise in this subject. In this research, birth records obtained from 981 ewes and their 1175 lambs in the private sector in Konya province in the years 2010–2011 were used as a data set. According to the results, the twin birth rate observed was 19.78% and the sex distribution was as follows; 54.54% were females and 45.46% were males. Examining the time of birth revealed the percentage of lambs born between 22:01 and 04:00 was 25.99%, while the percentage was 29.36% between 04:01 and 10:00, 25.57% between 10:01 and 16:00 and 20.08% between 16:01 and 22:00. For sheep giving birth for the first time, the highest birth rate (27.18%) was between 04:01 and 10:00, while for sheep giving birth for the second, third or fourth time the percentages were 28.88%, 31.78% and 29.26%, respectively, and the births occurred at the same time. In the business examined, 53.93% of births took place during daylight hours while 46.07% of births took place at night. The percentage of births between 22:00 and 04:00 was 25.99%.

Keywords:

Anatolian Merino, birth behavior, twin rate, time of birth

1.Introduction

In general, all activities of a living being during its lifetime are defined as ‘’behavior’’. In principle, behavior starts with birth and nutrition and is a biological term, which becomes more complicated with reproduction and learning and other complex issues. Behavior is a reaction to stimulations from the environment. The actions that can cause behavior could come from inside the living being (intrinsic) or from the outside (extrinsic). In other words, the physical and social environment is just as important as the inner circumstances (Demirören, 2002). Behavior has always been ignored when compared to qualities and quantities of animals' yields such as meat, milk, egg, hair and power. To obtain the maximum efficiency from animals, it is important to improve their environmental conditions and it is crucial to know the features of behavior that result from environmental effects (Özçalık, 2010).
By examining the behavior of animals, the most suitable environmental conditions can be provided. Also, the most efficient methods can be determined that result in unproblematic animal rearing if an animal's reactions are taken into account. The most important goal in animal husbandry is the fertility of the animals. Fertility is very crucial for the efficiency of animal husbandry. Therefore, maternal care before birth, postnatal care for the mother and the offspring and their nutrition are very important for efficiency. As a result, it is important to understand the features of animal behaviors both for efficiency and to optimize well-being for the animals. Behavior is a significant criteria for the evaluation of animal well-being; on the other hand, it is necessary to understand their different behaviors for the improvement of well-being and efficiency (Yakan et al, 2007)
(Ünal and Akçapınar, 1994) pointed out that sheep births occur at specific times of the day, particularly in quiet periods during the day. (Hudgens et al, 1986) stated that 22.1% of the births occur between the hours of 03 and 07 am, while 22.5% occur between 15 and 19 pm, according to the results of their study conducted in the US. According to (Karabacak et al, 2011), 30.25% of Akkaraman sheep births take place between 10:01 and 16:00. Even though there are a large number of studies on sheep behavior, studies on native Turkish races are quite rare. However, it is a well-known fact that animal behaviors differ according to breed and species. Particularly in Turkey, where sheep raising is an important activity, the limited number of studies is a serious deficiency.
This research was conducted to investigate the relevance of lamb sex, birth type and birth rate on birth distribution within the 24-hour daily cycle in Anatolian Merino Sheep. The aim is to find solutions to any problem that could arise in this subject.

2. Materials and methods

The animal material for the study came from Anatolian Merino sheep raised in a private business in Karapinar, Konya. Anatolian Merino (genotype 20% Akkaraman sheep, 80% German Mutton Merino) is a breed developed in Turkey to increase the yield of sheep. For the research, data on 981 births occurring in the business over two years were used, in particular birth type (twin or single birth rate), lamb sex, and the distribution of births during the day.
Animals in the business were mated in September and October and the births took place in February and April. The day was divided into 4 equal periods to evaluate the

distribution throughout the day; the periods were 22:01-04:00=1, 04:01-10:00=2, 10:01-16:00=3 and 16:01-22:00=4. The sex of the lambs was coded as 1= female, 2= male. Similarly, birth type was coded as single '1' and twins '2' for the analysis.
At the time of birth, the sex of the lambs, birth type and time of birth were determined and recorded. χ^2 was used for the statistical analysis of the data with the Minitab (14) software (Anonymous, 1995).

3. Results and discussion

3.1. The distribution of births in maternal age groups by year: Table 1 shows the birth distribution of different age groups according to the year. Of the animals giving birth in 2010, 33.14% were birthing for the second time; the highest rate in 2011 also occurred among sheep giving birth for the second time (33.97%). The differences between the numbers of birth were found to be statistically insignificant.

Table 1 The birth number according to years and Mother Age

Birth Number	Years	
	2010	%
1	117	22.94
2	169	33.14
3	131	25.69
4	93	18.24
Total	510	100.00
	2011	
1	89	18.90
2	160	33.97
3	127	26.96
4	95	20.17
Total	471	100.00
	2010 2011	
1	206	21.00
2	329	33.54
3	258	26.30
4	188	19.16
General Total	981	100.00

χ*2:2.589; DF:3; P:0.459*

The age group composition did not change dramatically between years and it was determined that the greatest number were found to be sheep giving birth for the second time (n=329).

3.2. Birth type distribution within years: Table 2 shows the number of birth types and rates within years. As shown in the table, the twin rate was 23.14% in 2012 and 16.14% in 2011. The average of the two years was 19.78% and χ2 analysis turned out to be significant (P<0.01).

Table 2 Birth type distribution and rate within years

	2010		2011		Total	
Birth Type	n	%	n	%	n	%
Single	392	76.86	395	83.86	787	80.22
Twin	118	23.14	76	16.14	194	19.78
Total	510	100.00	471	100.00	981	100.00

$\chi 2$*:7.566; DF:1; P:0.006*

According to (Karabacak et al, 2011) the twin rate in Akkaraman sheep is 21.85% and according to (Ozcalik et al, 2010) the twin rate in the Akkaraman breed is 8%. According to studies by (Ulker et al*,* 2004) on Karakas and Norduz sheep, the twin rate was found to be 16% and 11%, respectively. The average value of 19.78% in the current study is therefore less than the findings of (Karabacak et al, 2011) and more than those of (Ozcalik et al, 2010) or (Ulker et al, 2004). The twin rate is an important species characteristic. In particular, Romanov, Finnsheep, and Sakiz sheep are famous for their multiple birth capacity. The twin rate for the current breeds is about 20%.

3.3. The sex distribution within years: Table 3 shows the sex distribution of the lambs according to the year. In both years the percentage of female lambs is higher (56.47% and 52.44%); the average is 54.54 % but the difference between years was found to be insignificant.

Table 3 Sex distribution and rate within years

	2010		2011		Total	
	n	%	N	%	n	%
Female	288	56.47	247	52.44	535	54.54
Male	222	43.53	224	47.56	446	45.46
Total	510	100.00	471	100.00	981	100.00

$\chi 2$*:1.603; DF:1; P:0.205*

According to (Karabacak et al, 2011) the percentage of females in Akkaraman Sheep is 44.54 %; according to (Ozcalik, 2010) the percentage in the Akkaraman breed is 50 %, 52% in the Akkaraman breed according to (Colakoglu and Ozbeyaz, 1999) and 51.44% in Suffolk sheep according to (Kent, 1992). The percentage of females (54.54 %) in the current study was higher than in the above-mentioned studies. Theoretically the sex distribution should be 50 %. However, in some years the rate might differ. This deviance could depend on parental effects or nutrition (Trivers and Willard, 1973).

3.4. Time of birth within years: Table 4 shows time of births within years. A significant proportion of all births in 2010 took place between 04:01 and 10:00 (33.53%). However, the highest rate in 2011 was between 22:01 and 04:00 (26.54%). Furthermore, these differences between time of birth were found to be statistically significant (P<0.01).

On average, births mostly took place between 04:01 and 10:00. In contrast to the findings in the current study, (Karabacak et al, 2011) stated that Akkaraman sheep usually give birth between 10:01 and 16:00 (30.25%). According to the findings of a study in the US on 303 sheep, (Hudgens et al, 1986) stated that 22.1% of the sheep gave birth between 03.00 and 07.00 and 22.5% gave birth between 15.00 and 19.00.

Different researchers have reported various findings on the same issue: (Lindahl, 1964) 09:00–12:00, (Sharafeldin et al, 1971) 15:00–18:00 and 08:00–11:00, (Holmes, 1976) 01:00–07:00, (Younis and El Gaboory, 1978) 13:00–19:00 and 15:00–18:00, (Gonyou and Cobb, 1986) 04:00–08:00 and (Hudgens et al, 1986) 03:00–07:00 and 15:00–19:00.

In general, animals prefer to give birth during quiet periods of the day and in places where they will not be disturbed. In this current study, we determined that 50% of the sheep gave birth at night.

Table 4 Number of birth at different time of birth within years

	2010	
Time of birth	n	%
1	130	25.49
2	171	33.53
3	122	23.92
4	87	17.06
Total	510	100.00
	2011	
1	125	26.54
2	117	24.84
3	119	25.27
4	110	23.35
Total	471	100.00
	2010-2011	
1	255	25.99
2	288	29.36
3	241	24.57
4	197	20.08
General Total	981	100.00

χ^2*:11.413; DF:3; P:0.010*

3.5. The distribution of time of birth according to birth order: Table 5 shows the distribution of birth times according to birth order. As shown in the table, in 2010 sheep giving birth for the first time most often gave birth between 04:01 and 10:00 (32.48%), while for sheep giving birth for the second, third, or fourth times, births occurred most often between 04:01 and 10:00 again, with rates of 34.91%, 35.11% and 30.11%, respectively. In 2011, among sheep giving birth for the first or second time, the most common time of birth was 22:01–04:00 (28.09% and 28.13%); for sheep giving birth for the third or fourth time, births took place between 04:01 and 10:00 (28.35% and 28.42%).

Table 5 Distribution of time of births according to birth order within years

	2010		2011		Total	
Time of birth	First birth					
	n	%	n	%	n	%
1	30	25.64	25	28.09	55	26.70
2	38	32.48	18	20.22	56	27.18
3	28	23.93	23	25.84	51	24.76
4	21	17.95	23	25.84	44	21.36
Total					206	100.0
	117	100.00	89	100.00		0
	Second birth					
	n	%	N	%	n	%
1	44	26.04	45	28.13	89	27.05
2	59	34.91	36	22.50	95	28.88
3	37	21.89	43	26.88	80	24.32
4	29	17.16	36	22.50	65	19.76
Total			16		329	100.0
	169	100.00	0	100.00		0
	Third birth					
	n	%	N	%	n	%
1	29	22.14	34	26.77	63	24.42
2	46	35.11	36	28.35	82	31.78
3	33	25.19	30	23.62	63	24.42
4	23	17.56	27	21.26	50	19.38
Total			12		258	100.0
	131	100.00	7	100.00		0
	Fourth birth					
	n	%	N	%	n	%
1	27	29.03	21	22.11	48	25.53
2	28	30.11	27	28.42	55	29.26
3	24	25.81	23	24.21	47	25.00
4	14	15.05	24	25.26	38	20.21
Total					188	100.0
	93	100.00	95	100.00		0

$\chi 2$*:17.834; DF:21; P:0.659*

According to Ozcalik's study (2010) on Akkaraman sheep, the first birth is most often between 10:00 and 16:00, the second and thirds birth are between 16:00 and 22:00 and the fourth, fifth and sixth births are mostly between 04:00 and 10:00. (Ozdemir and Altin, 2007), in their study on Karya sheep, pointed out that birth order has no effect on time of birth. Depending on birth order, the increase in maternal instinct might affect the time chosen by the sheep. Furthermore, young animals are shyer and older ones are used to the conditions of the place where they live; hence, we think this might have an effect on their choices for time of birth.

3.6. Sex distribution in different times of birth: Table 6 shows the sex distribution with different times of births. In 2010, 29.25% of females were born between 22:00 and 04:00 and 32.58% of males were born between 04:01 and 10:00. In contrast, 26.32% of females were born between 04:01 and 10:00 while 28.47% of males were born during 22:01–04:00. The differences were not statistically significant.

Table 6 Distribution of sex according to time of birth within years

Time of birth	2010				2011			
	Sex				Sex			
	Female	%	Male	%	Female	%	Male	%
1	93	29.25	92	29.68	69	25.94	80	28.47
2	89	27.99	101	32.58	70	26.32	71	25.27
3	76	23.90	62	20.00	64	24.06	62	22.06
4	60	18.87	55	17.74	63	23.68	68	24.20
Total	318	100.00	310	100.00	266	100.00	281	100.00

χ^2*:10.134; DF:9; P:0.340*

According to the study of (Karabacak et al, 2011), Akkaraman sheep gave birth to 61.2% of males and 52.8% of females between 04:01 and 16:00; in total, 58% of sheep were born in the same period. (Ozcalik, 2010) stated that Akkaraman male (54.5%) and female (52%) lambs were born from 16:01 to 04:00, and in total 53.12% of the lambs were born from 16:01 to 04:00 of day.

3.7. Birth types at different time of births: Table 7 shows the distribution of birth types at different times of birth within years. In 2010 the twin rate was at its highest level between 22:01 and 04:00 (46.61%) while in 2011 it was highest between 22:01 and 04:00 and between 04:01 and 10:00 (31.58% and 31.58%, respectively). The differences were found to be significant (P<0.01).

Table 7 Distribution of birth type in different time of births within years

Time of birth	2010				2011			
	Single	%	Twin	%	Single	%	Twin	%
1	75	19.13	55	46.61	101	25.57	24	31.58
2	152	38.78	19	16.10	93	23.54	24	31.58
3	106	27.04	16	13.56	112	28.35	7	9.21
4	59	15.05	28	23.73	89	22.53	21	27.63
Total	392	100.00	118	100.00	395	100.00	76	100.00

χ^2*:76.372; DF:9; P:0.000*

In the study, most of the twin births (46.61% and 31.58%) took place between 22:01 and 04:00. (Karabacak et al 2011) indicated in their study that most twin births took place in the third or fourth time period. According to the same researchers, birth type plays an important role in time of birth. This finding is compatible with the findings of the current study. However, some researches signify that birth type has no effect on time of birth (Akoz et al, 2011; Ozcalik, 2010; Younis and El-Gabour, 1978). The findings of the current study are incompatible with that claim.

3.8. Distribution of birth types in different birth orders: Table 8 shows the distribution of birth types in different birth orders. In 2010 the highest twin rate was among sheep giving birth for the second time (39.83%); in 2011 the highest twin rate was again found to be among sheep giving birth for the second time. The differences were found to be statistically significant (P<0.01).

Table 8 Distribution of birth types of different birth order within years

Birth order	2010				2011			
	Single	%	Twin	%	Single	%	Twin	%
1	109	27.81	8	6.78	81	20.51	8	10.53
2	122	31.12	47	39.83	132	33.42	28	36.84
3	102	26.02	29	24.58	104	26.33	23	30.26
4	59	15.05	34	28.81	78	19.75	17	22.37
Total	392	100.00	118	100.00	395	100.00	76	100.00

$\chi 2$*:36.621; DF:9; P:0.000*

According to (Karabacak et al, 2011) in their study on Akkaraman sheep, birth order has an important effect on birth type. This finding is compatible with the results of the current research. (Kaymakcı and Sonmez, 1992) signified that the twin rate is at its highest with the third and fourth births and the rate decreases after this age. In the current study the twin rate in the first birth is less; this finding is also compatible with the general inclination.

3.9. Sex distribution of lambs obtained from different birth orders: Table 9 shows the sex distribution of lambs obtained from different birth orders within years. In 2010, the highest female lamb rate was seen with sheep giving birth for the second time (30.50%); the highest male rate was again in sheep giving birth for the second time (38.39%). The same situation was observed in 2011 (34.21% and 34.52%). Upon statistical analysis, these differences were found to be insignificant.

Table 9 Sex distribution of lambs obtained from different birth orders within years

Birth order	2010				2011			
	Female		Male		Female		Male	
	n	%	N	%	n	%	n	%
1	69	21.70	56	18.06	46	17.29	51	18.15
2	97	30.50	119	38.39	91	34.21	97	34.52
3	94	29.56	66	21.29	76	28.57	74	26.33
4	58	18.24	69	22.26	53	19.92	59	21.00
Total	318	100.00	310	100.00	266	100.00	281	100.00

$\chi 2$*:10.801; DF:9; P:0.29*

3.10. Sex and birth type distribution at the beginning and end of the lambing period: Table 10 shows sex and birth type distribution according to the phase of the lambing periods within years. Male and female birth rates were pretty similar for sheep that became pregnant at the beginning of reproduction season; these differences were found to be insignificant. The male birth rate was higher than the female rate for sheep that became pregnant at the end of the propagation period (52.33% males). The twin rate among sheep that became pregnant at the beginning of the propagation period was relatively higher than in sheep that became pregnant at the end of the same period (21.31% twins). These differences were found to be statistically significant ($P<0.01$).

Table 10 Sex and birth type distribution according to lambing periods within years

	Sex				Birth type			
Lambing period	Female	%	Male	%	Twin	%	Single	%
February 2010	197	49.37	202	50.63	80	25.08	239	74.92
March 2010	116	50.65	113	49.35	38	19.89	153	80.11
February 2011	218	50.46	214	49.54	66	18.03	300	81.97
March 2011	48	41.74	67	58.26	10	9.52	95	90.48
Khi-square	3.033	DF=3	P=0.387	Khi-square	13.312	DF=3	P<0.004	
				Average values				
February	415	49.94	416	50.06	146	21.31	539	78.69
March	164	47.67	180	52.33	48	16.22	248	83.78

(Kent, 1992), states that the beginning versus the end of the lambing period is an important factor in sex rates. At the start of the lambing period, more male lambs are born (51.43%) but at the end of this period the male rate was reported to be 43.59%. In the current study, the male birth rate was found to be higher at the end of the season. Hence, there is an incompatibility between these findings.

3.11. Birth type distribution in different sex groups: Table 11 shows the sex distribution of lambs according to birth types within different years. Of twin lambs born in 2010, 46.19% were female while in 2011, 46.71% were female. Of twin lambs born in 2010, 53.81% were male while 53.29% of twins born in 2011 were male. The differences were found to be insignificant.
(Kent, 1992) stated in his study on sheep that 47.73% of twins were male while 56.23% of singles were male, indicating an incompatibility between this study and the current study.

Table 11 Sex distribution of lambs according to birth types within years

	2010				2011			
	Single		Twin		Single		Twin	
	n	%	n	%	n	%	n	%
Female	209	53.32	109	46.19	195	49.37	71	46.71
Male	183	46.68	127	53.81	200	50.63	81	53.29
Total	392	100.00	236	100.00	395	100.00	152	100.00

χ^2*:3.777; DF:3; P:0.287*

4. Conclusion

The effect of birth order and time of birth on the distribution of birth type, and within births at the beginning and end of the lambing period, sex and birth type distributions were found to be statistically significant (P<0.01).
Most births take place during dark times of the day or at night. To prevent the death of lambs during birth, particularly in sheep giving multiple births, animals should be kept under control at these times of the day and necessary precautions should be taken. When the necessary measures are taken, deaths can be decreased dramatically and this could contribute to the profitability of the business.

References

Akoz, M., Zulkadir, U., & Karabacak, A. (2011). The Distribution within days of births in Saanen goats and the effect of some environmental factors on birth weight of kids with bearing weight of goats. *Bahri Dagdas International Agricultural Research İnstitute Journal, Journal of Animal Research,* 18 (1): 7-13, ISSN:1309-3967.

Colakoglu, N., & Ozbeyaz, C. (1999). Comparison of some production traits in Malya and Akkaraman sheep. *Turkish Journal of Veterinary and Animal Sciences,* 23**:** 351-360.

Demiroren, E. (2002). Animal behavior. *Aegean University Agricultural Faculty Publication* Nu: 457. 278, Bornova, İzmir/TURKEY.

Gonyou, H. W., & Cobb, A. R. (1986). The influence of time of feeding on the time of parturition in ewes. *Canadian Journal of Animal Sciences*, 66: 569-574.

Holmes, R. J. (1976). Relationship of parturition behavior to reproductive efficiency of Finnsheep. *New Zealand Society of Animal Production,* 36: 253-257.

Hudgens, R. E., Albright, J. L., & Pennington, J. A. (1986). Influence of feeding time and diet on time of parturition in multiparous ewes. *Journal of Animal Sciences*, 63: 1036-1040.

Karabacak, A., Zulkadir, U., & Akoz, M. (2011). Some reproductive behavior of Akkaraman sheep. *7. National Animal Sciences Congress,* 14-16 September 2011, Adana/TURKEY.

Kaymakcı, M., & Sonmez, R. (1992). Sheep breeding. *Hasat publishing, Animal series,* 3, pp:405.

Kent, J. P. (1992). Birth sex ratio in sheep over six lambing season. *Behavioral Ecology and Sociobiology,* 30: 3/4, pp:151-155.

Lindahl, I. L. (1964). Time of parturition in ewes. *Animal Behavior,* 12: 231-234.

Ozcalık, O. (2010). Distribution of birth within a day of Akkaraman sheep. MSc. Thesis, *University of Selcuk Graduate School of Natural and Applied Sciences, Department of Animal Sciences*, Konya/TURKEY.

Ozdemir, S., & Altın, T. (2010). Maternal behaviors of the Karya type sheep at the partum and early postpartum. *Journal of Animal Production,* 48 (1): 14-20.

Sharafeldin, M. A., Ragab, M. T., & Kandeel, A. A. (1971). Behavior of ewes at parturition. *Journal of Agricultural Sciences,* 76: 419–422.

Trivers, R. L., & Willard, D. E. (1973). Natural selection of parental ability to vary the sex ratio of offspring. *Science,* 179: 90-92.

Ulker, H., Gokdal, O., Aygun, T., & Karakus, F. (2004). Comparison of some reproductive traits of Karakas and Norduz sheep. *Yüzüncü Yıl University Journal of Agricultural Science,* 14 (1): 59-63.

Unal, N., & Akcapinar, H. (1994). Behavior of sheep. *Journal of Animal Research,* 4 (2); 113-123.

Yakan, A., Unal, N., & Akcapınar, H. (2007). Behavior at the goats. *Journal of Lalahan Livestock Research Institute,* 47 (1): 39-47.

Younis, A. A., & Gaboury, L. A. H. (1978). On the diurnal variation in the lambing and time for placenta expulsion in Awassi Ewes. *Journal of Agricultural Science* (Cambridge), 91(7): 57- 60.