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Diurnal Distribution of the Time of Parturition in the Danube Fine Wool Breed of Sheep

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Abstract

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Diurnal distribution of the time of natural spontaneous births was studied in the Danube fine wool breed of sheep kept under conventional management system. All sheep were at equal age and were served by one ram from the same breed. The time of parturition was recorded in 374 ewes round-the-clock. A unimodal distribution of births was observed with a peak between 12:00 and 15:00 h when 18.2% of the sheep gave birth, and the lowest incidence of lambing (8.8%) was recorded between 0300 and 0600 h. More ewes (56.7%) lambed between 06:00 and 1800 h and less (43.3%) during the nighttime between 18:00 and 06:00 h. Type of birth and sex of the lambs did not have any noticeable effect on birth distribution. Despite the established differences in birth distribution under the management practice employed the circadian rhythm was not clearly emphasized. The results suggest that round the clock observation of the flock at lambing time is necessary in order to prevent mismothering and other problems typical for this period of the year.

Key words: sheep, parturition, diurnal distribution

Introduction

The rhythmicity, as one of the fundamental principles in the universe, influences all biological processes including reproduction. All events in the environment repeat themselves with a given frequency and possessing a functional circadian system may be very important for the reproduction and survival of the animals. But it must be taken into account that in the domestic animals seasonal diurnal rhythms might be partly affected by prevailing management systems. Although the presence of functional rhythms is well established phenomenon little is still known about the diurnal distribution of births in sheep. Such investigations could contribute to optimize the time for checking the flock throughout the day as well as to decrease the required manpower during the lambing time.

Ewes may lamb at any time of the day or night but various investigators have stated that lambing may be concentrated

at certain time. Some authors noted one ore more peaks of the time of lambing round-the-clock. Another studies (Aoki et al., 2006; Sharafeldin et al., 1971) linked the time of delivery to feeding time, pointing out that feeding schedule can influence the onset of parturition and, for example, early evening feeding tended to increase nighttime lambing (Cobb and Gonyou, 1982). George (1969) reported significant between breed differences in the distribution of lambing throughout the day. Yarney et al. (1982) also found breed effect on birth distribution in beef cattle, while Edwards (1979) noticed age related differences in diurnal distribution of calving in dairy cows. The results of Stevenson (1989) indicated that not only the farm routine, but the changes in the climatologically variables may also serve as biological cues to initiate parturition in bovine. Alexander et al. (1993) pointed out that the distribution of birth in the field has been related to topographic and other environmental factors, which together with the circadian rhythms appeared to influence the onset of parturition in sheep.

The aim of this study was to explore the hourly distribution of spontaneous live births in sheep round-the clock and its possible modulation by liter size and sex of the newborn.

Material and Methods

The observations were conducted in three consecutive years in Danube fine wool breed of sheep kept under conventional management system based on pasture rearing in summer and housing in winter when the lambing took place. During this period the same management practice was employed. The sheep flocks were kept in the same barn and offered similar type of diet, including concentrate, hay and silage, which were given two times daily-between 08:00 and 08:30 h in the morning and between 16:30 and 17:00 in the evening. The concentrate was given once daily immediately before the morning feeding. The ewes had free access to water throughout the day. All sheep were kept together to eliminate any pen effect and were moved to individual pens immediately after parturition. The breeding season was relatively short, beginning from June and continuing to the middle of July in order to eliminate considerable differences in the duration of the photoperiod during the lambing time. All sheep were at equal age and were served by one ram from the corresponding breed. Between 06:00 and 18:00 h the observation were made continuously and between 1800 to 0600 h at hourly intervals. Light was turned on between 05:00 pm to 07:00 am.

The diurnal distribution of lambing was analyzed for the effects of sex and type of birth. A χ^2 test was applied for the diurnal variation in lambing.

Results and Discussion

The data from 374 lambing were collected from natural and spontaneous live births only and the sheep that needed help during the delivery were excluded from the observation. The data, concerning the hourly distribution of parturition times for all sheep and separately for the ewes bearing single and twin lambs and according to the sex of the newborn classified by three hour intervals are shown in Figures 1 and 2. The frequency of lambing was calculated for eight three hour periods related to the time of day. The data obtained witness the existence of a diurnal trend in the incidence of spontaneous births (Figures

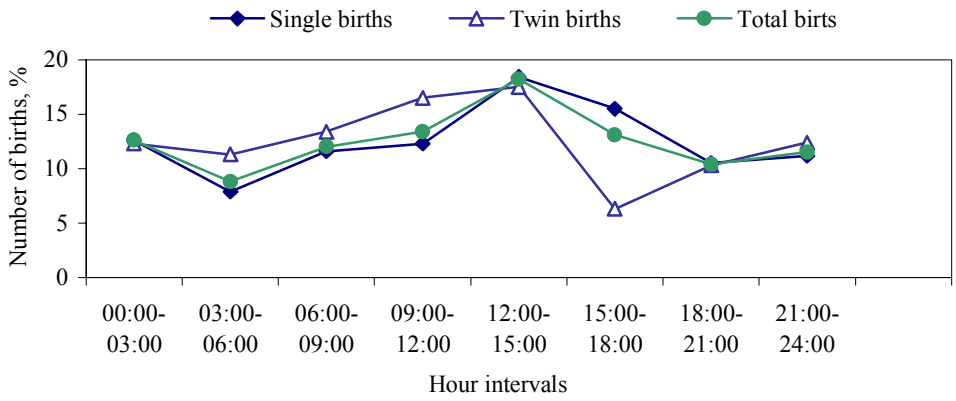

Fig. 1. Distribution of births at three hour periods: for total births and separately for ewes delivered single and twin lambs

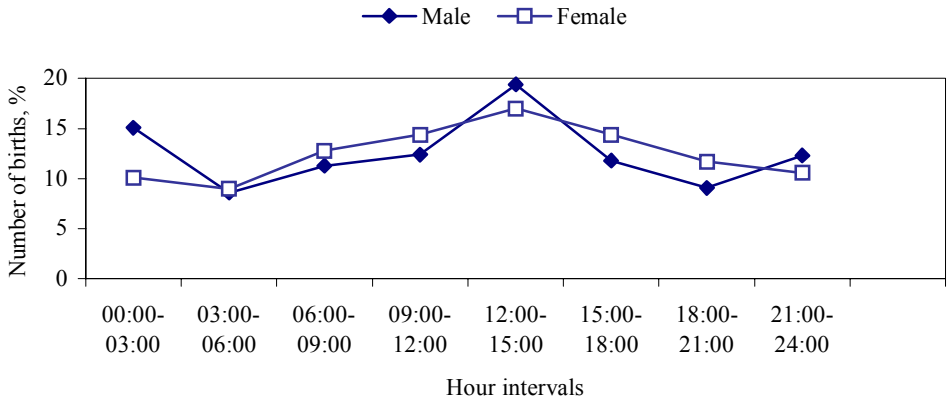

Fig. 2. Distribution of births at three hour periods in ewes delivered male and female lambs

1 and 2). A uni-modal diurnal distribution of lambing was observed independently of sex and type of birth. One peak distribution pattern was found. The maximum lambing occurred between 12:00 and 15:00 h -18.2% of the total births (P<0.001 compared to the other time periods) and the lowest percentage of birth (8.8%) was observed between 03:00 and 06:00 h. More of the lambing (56.7%, P<0.001) occurred between 06:00 and 18:00 h while during the next period (18:00 h -06:00 h), coincided with the night hours, the registered incidence of births constituted 43.3% of the total. Although the established differences in birth distribution in the present observation the circadian rhythm was not clearly emphasized, as in some other reviewed studies, which may be the result of the management practice employed, as well as the breed characteristics. Bosc et al. (1988) found an unimodal distribution of births in goats fed two times daily with the lowest number around midnight and

the highest number of births around midday. About 90 % of all births have been observed between 06:00 and 20:00 h.

Type of birth in the present study did not significantly affect birth distribution although the lowest percentage of twin births took place between 15:00 and 18:00 h and the highest frequency of births was observed between 09:00 and 15:00 h. The limited data available make it difficult to conclude whether the type of birth could have any considerable effect on the distribution of parturition times in sheep. The data obtained by Younis and El-Gaboory (1978) also did not mark any detectable effect of birth type on birth distribution in Awassi sheep. Romano and Piaggio (1999) also found no differences in the distribution of kidding with regard to the number of kids.

When lambing times were examined with respect to sex of the newborn the similar patterns of the hourly distribution were found in ewes bearing single and twin lambs (Figure 2). There is not strong evidence that the sex per se could determine the onset of parturition and a possible effect on birth process could be related to birth weight, since male lambs are usually heavier than female. In this study the differences in average birth weight between male and female lambs did not exceed 0.27 kg in the different years and it could hardly affect the lambing time.

There was not any noticeable effect of the time of feeding on birth distribution although there is an assumption that the time of feeding may influence the birth process in different ways, including changes in the physical and metabolic activity and hormonal profile near to and shortly after feeding time, which could provoke the onset of delivery. In our study feed was given to the sheep by hand and it may be supposed that they did not experience too much anxiety. Cobb and Gonyou (1982) also found out an effect of the farm routine on births distribution. They established that feeding the sheep once daily at 08:00 am, at 04:00 pm or at 12:00 midnight resulted in measurable changes in the diurnal pattern of birth distribution and they concluded that the lambing time may be modified by the feeding time. In the study of Romano and Piaggio (1999) food was available to goats throughout the day and concentrate was fed in the morning and late in the evening but there was no relation between the distribution of parturitions and feeding time. In Barki sheep Sharafeldin et al. (1971) observed diurnal trend in the incidence of lambing with large proportion occurring at daytime but the lowest percentage of lambing took place between 1300 and 1400 h, which coincided with the time of the concentrate feeding. A possible explanation of the effect of time of feeding on birth distribution is the agitation from the impending time of feeding, competition between sheep and relief after feed ingestion all of which appear to affect the nervous activity and hormonal profile that combined with the photoperiod might also have some effect on the time of onset of parturition. It is well known, for example, that competition between sheep for feed, especially concentrate, could increase the plasma concentration of adrenalin and consequently alter the action of oxytocin on uterine activity, which could lead to delayed birth.

Furthermore, observations of Alexander et al. (1993), showed that 28% of the ewes gave birth between 09:00 and 14:00 h but these observations were made on pasture where other environmental factors except the photoperiod could have influenced the hourly distribution of births.

In the present study, in contrast to the outdoor environment, the light during the night time may also affect the diurnal distribution and to shift the onset of parturition. All these factors may have contributed to the relatively evenly distribution of lambing during the daily hours. All of above mentioned data witness that the time of parturition may be determined by the interplay among many exogenous and endogenous factors that could affect the parturition process and trigger the onset of parturition. Recent studies found out that the fetus may also influence the process of birth and day of parturition but has less effect on the hour of delivery during this day. The existence of 24-h rhythm in fetal plasma hormone concentrations was established in numerous investigations (McMillen et al., 1987; Simonetta et al., 1991; Zemdegs et al., 1988). There is strong evidence that in addition to maternal signals sheep fetus receives signals from the external environment and responds to photoperiodic information received *in utero* (Seron-Ferre et al., 1989). All these data suggest the presence of circadian rhythms in the fetus that are also able to shift the onset of parturition. There are currently little data available about the causal mechanisms of uterine activity rhythms and their potential role in the initiation of delivery remain still undefined.

Conclusions

The results of this survey appear to reaffirm the contention by others that in sheep the timing of spontaneous birth follow a circadian rhythm and could not be strongly influenced by litter size and sex of the newborn as well as by the feeding schedules. In the present study although the established differences in birth distribution the circadian rhythm was not clearly emphasized. A unimodal distribution of lambing was observed with a peak between 12:00 and 15:00 h when 18.2% of sheep gave birth, and the lowest incidence of lambing (8.8% of the total births) was registered between 03:00 and 0:00 h. More of the lambing (56.7%) occurred between 06:00 and 18:00 h and less (43.3% of the total) during the night time between 18:00 and 06:00 h. Sex and type of birth did not have any noticeable effect on birth distribution since a similar pattern of diurnal dynamics was observed in all lambs regardless of their sex and type of birth. The results suggest that the sheep of the studied breed, kept under the prevailing management practice, have to be checked round the clock at lambing time in order to prevent mismothering and other management failures.

References

Alexander, G., D. Stevens, P. Baker and R. Bradley, 2003. The timing of birth in grazing Merino sheep. *Austral. J. Exp . Agric*., **33**: 557-560.

Aoki, M., K. Kimura and O. Suzuki, 2006. Influence of feeding regime on timing of parturition in beef cattle and the relationship of vaginal temperature to parturition. *Anim. Sci. J*., **77**: 290-299.

Bosc, M., P. Guillimin, G. Bourgy and P. Pignon, 1988. Hourly distribution of time of parturition in the domestic goat. *Theriogenology*, **30**: 23-33.

Edwards, S., 1979. The timing of parturition in dairy cattle. *J. Agric. Sci.*, **93**: 359-363.

George, J., 1969. Variation in the time of parturition of Merino and Dorset Horn ewes. *J. Agric. Sci*., **73**: 295-299.

McMillen, I., G. Thornburg and D. Walker, 1987. Diurnal variations in plasma concen-

trations of cortisol, prolactine, growth hormone and glucose in the fetal sheep and pregnant ewe during the late gestation. *J. Endocrinol*., **114**: 65-72.

Romano, J. and J. Piaggio, 1999. Time of parturition in Nubian goats. *Small Rum. Res*., **33**: 285-288.

Serron-Ferre, M., M. Vergara, V. Parraguez and R. Riguelme, 1989. The circadian variation in prolactin in fetal sheep is affected by the seasons. *Endocrinology*, **125**: 1613-1616.

Sharafeldin, M., M. Racab and A. Kandeel, 1971. Behavior of ewes during parturition. *J. Agric. Sci*., **76**: 419-422.

Simonetta, G., D. Walker and C. McMillen, 1991. Effect of feeding on the diurnal rhythm of plasma cortisol and adrenocorticotrophic hormone concentration in the pregnant ewe and sheep fetus. *Exp. Physiol*., **76**: 219-229.

Snedecor, G. and W. Cochram, 1967. Statistical methods, 5th ed. Ames, Iowa: *Iowa State Univercity Press.*

Stevenson, J., 1989. Relationship among climatological variables and hourly distribution of calvings in Holsteins fed during the late afternoon. *J. Dairy Sci*., **72**: 2712-2717.

Yarney, T., G. Rahnefeld, R. Parker and W. Palmer, 1982. Hourly distribution of time of parturition in beef cows. *Can. J. Anim. Sci*., **62**: 597-605.

Younis, A. and I. El-Gaboory, 1978. On the diurnal variation in lambing and time for placenta expulsion in Awassi ewes. *J. Agric. Sci*., **91**: 757-760.

Zemdegs, I., I. McMillen, D. Walker, G. Thornburn and R. Novak, 1988. Diurnal rhythm in plasma melatonin concentrations in the fetal sheep and pregnant ewe during late gestation. *Endocrinology*, **123**: 284-289.

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