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DIURNAL DISTRIBUTION OF LAMBING IN SHEEP AND ITS RELATION WITH BEHAVIOUR AND SURVIVAL OF THE NEONATE LAMB

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ABSTRACT

A total of 348 Finnish Landrace – Rahmani crossbred ewes were used in this study to show the diurnal distribution of lambing and its relation with behaviour and survival of the neonate lamb. At birth, based on lambing distribution at twelve-hour periods, ewes were allotted into either day light time group which included ewes that lambed during the day light hours (from 6.00 am to 6.00 pm) or night time group which included ewes that lambed during night hours (from 6.00 pm to 6.00 am). Data recorded included time of birth, neonatal behavioural progress, body temperature of neonatal lambs over the first 3 days of life and lamb mortality rates from birth to weaning. Significantly more ewes lambed during the night time than throughout the day light hours. Neither litter size nor birth weight of lambs had a significant effect on time of parturition. However, ewe parity had a significant effect on lambing time. With respect to neonate lambs, night time born lambs were less active at birth and denoted a decrease in their body temperature over the first 3 days of life with higher mortality rates from birth until weaning specifically during the first week of birth compared to day light born lambs. It could be concluded that, more lambing occurred during the night time than during the day light time. Litter size and birth weight of lambs did not appear to affect the time of parturition, whereas significant differences in lambing time were observed with regard to parity. Moreover, exposure to cold disrupted the behavioural patterns of the neonate lambs, decreased their ability to maintain body temperatures and increased mortality rates.

Keywords: *Lambing, lamb, neonatal behaviour, temperature, survival.*

INTRODUCTION

The time of the start of parturition has been shown to depend on cues arise from both the maternal and fetal side (Flint et al., 1986). The fetal cue to parturition is particularly well established in ruminants. Studies carried out on sheep and goats highlighted the effects of hormonal signals coming from the fetal brain (Bazer and First, 1983; Seron-Ferre et al., 1993). Flint at al. (1979) demonstrated that fetal cortisol has a controlling role over the time of parturition. Higher levels of cortisol have been demonstrated to influence the start of labour as cortisol affects the synthesis of placental steroids (Thorburn and Challis, 1979) which can ultimately increase the synthesis of placental estrogen (Flint et al., 1977). Evidence for a maternal influence on the time of parturition is drawn particularly from observations on the diurnal distribution of the time of birth (Heap et al., 1977) and also from the modification of the hormonal changes seen at parturition (Lincoln and Porter, 1979).

Two patterns of parturition timing have been demonstrated in domestic animals: uniform spread over the day, such as in sheep (Lindahl, 1964; George, 1969; Younis and El-Gaboory, 1978) or shifted to a specific period of the day, such as during night in mares (Rossdale and Short, 1967) or during daylight hours as in goats (Lickliter, 1985; Bosc et al., 1988). Currie and Thorburn, (1977) suggested that there are different perinatal events that are essential for the onset of labor, and various mechanisms are concerned with offering a close synchronization of these events. Similarly, some environmental factors have been demonstrated to operate on the synchronous triggering of parturition (Alexander et al., 1993). On the other hand, contrary to wild animals, diurnal distribution of the birth process in domestic animals might be affected by both the environmental factors and the husbandry practices implemented.

One of the most obvious constraints on the profitability of sheep flocks around the world is lamb mortality. Although there are many potential causes of mortality from birth until weaning, most lamb deaths occur within the first few days of life and are largely due to hypothermia or starvation (Nowak et al., 2000; Mellor and Stafford, 2004; Nowak and Poindron, 2006). Perinatal lamb mortality (lambs dead at birth or dying within 24 hours of birth, Nash et al., 1996) is unacceptably high in many areas of the world (Rowland et al., 1992), highlighting the importance of this perinatal period with regards to survival. Exposure to cold often contributes to this (Starr, 1981; Haughey, 1991; Plush, 2013). It has been shown that sudden changes in weather even if short-termed may produce profound changes in mortality rates (Slee, 1981). Exposure to cold or to cold and starvation can cause lamb deaths, and the differences in response of animals to these stressors could affect their viability (Obst and Evans, 1970; Arnold and Morgan, 1975; Slee, 1981; Henderson, 1991). It was believed that it was only the ewe that played a role in the early establishment of the bonding process (Gubernick, 1981), but Nowak and Lindsay (1990) have shown that the behaviour of the lamb is also essential as that of the ewe for forming the ewe-lamb bond to ensure its survival.

The purpose of the present study was therefore to explore the diurnal distribution of lambing and factors influencing lambing time of Finnish Landrace - Rahmani crossbred sheep and its relation with behaviour and survival of neonate lambs.

MATERIALS AND METHODS

1. Animals:

The study was carried out using 348 Finnish Landrace – Rahmani crossbred ewes belonging to the breeding flock of Sakha Animal Production Research Station, Animal Production Research Institute, Ministry of Agriculture, Kafr El-Sheikh Governorate, Egypt. The observations were conducted on two different groups of ewes in two consecutive years; 2013 (190 ewes) and 2014 (158 ewes). Ewes were synchronized in oestrus using intra-vaginal progesterone sponges (Intervet, Egypt) for 14 days followed by an intramuscular injection of 400 IU of PMSG/ewe (Follogon, Intervet, Egypt) on the day of withdrawal of sponge, and were naturally inseminated over a 3-day mating period. Diagnosis of pregnancy was revealed by transrectal ultrasonic scanning at day 40 of pregnancy. At birth, according to the diurnal distribution of lambing at twelve-hour periods, the ewes were classified into two groups. The first group included ewes which lambed throughout the day light hours (from 6.00 am to 6.00 pm, n = 198 and 16.58°C an average ambient temperature) while the other group included ewes which lambed during night hours (from 6.00 pm to 6.00 am, n =150 and 8.39°C an average ambient temperature).

2. Management:

Throughout the period of study, all ewes were subjected to the same husbandry procedures. All ewes were kept in similar pens to eliminate any pen effect and were offered the same diet. Ewes were housed in semi-covered large pens (6 m × 20 m), in groups of 30 ewes /pen. The ewes had a free access to green fodder (Trifolium Alexandrium) and fresh drinking water. A concentrated mixture (16.6% crude protein, 12.7% crude fiber, 12.7% NDF, 10.9% ADF and 73.4% TDN) comprising 44% corn grains, 12% decorticated cotton seed, 13% soya bean meal, 29% wheat bran and 2% limestone was provided during pregnancy (400 gm daily/ewe) in the morning. This amount was increased gradually until reaching 1000 gm/ewe during the late stage of pregnancy (last 4–6 weeks). Mineral mixture was used as 10 gm ewe/day. At week 17th of pregnancy, ewes were subcutaneously vaccinated with 2 ml of Clostridia vaccine (Covexin, Schering-Plough Company). Two weeks before the expected lambing date, ewes were transferred to pens (6 m × 9 m) supplied with straw bedding in groups of approximately 10–12 ewes/pen for lambing.

3. Data recording:

Data were collected from natural and spontaneous live births only and the ewes that needed help during the delivery (n = 32 ewes) were excluded from the observation. Lambing took place from the 19th of January to the 2nd of February in 2013, and from the 21st of January to the 4th of February in 2104. Thus, there were no significant differences regarding the length of the day time and other variables of the climatic conditions during the time of parturition. Ewes were monitored continuously during the day and night and the total number of parturition in each hour of the day (day light hours versus night time hours) was recorded. Neonatal lambs were focal-sampled from expulsion until successful suckling and the latencies of specific behaviours (attempt to stand, successful stand, and successful suck) were recorded as Martin and Bateson (1993) by using video camera (Sony, 450X, Shinagawa, Tokyo, Japan). Lambs that failed to suck within one hour of birth, were assisted and their data were excluded from the study. Once the lamb stood, lamb rectal temperature was recoded in the lambing pen to avoid any disturbance to the bond formation. Rectal temperature recoding was repeated again at 24 and 72 hr of birth. Lamb birth weight was recorded within 2 hours of birth and, based on the average (3479 gm), lambs were classed into either high (above the average, n= 271) or low (below the average, n= 253) birth weight lambs (e.g. Asante et al., 1999). Parity and litter size were recorded for each parturient ewe.

4. Statistical analysis:

The percentages of ewes lambed in each group were calculated by dividing the number of ewes in each group by the total number of ewes in the study and the resultant figure was multiplied by 100. Differences between the two groups (day light time versus night time) in the incidence of parturition were tested using the Chi-square test (Petrie and Watson, 2006). To test the parity, litter size and lamb birth weight effect on the diurnal distribution of parturition, percentages of parturition between different parities, litter sizes and lamb birth weights were determined by Chi-square test. Similarly, percentages of parturition within different parities, litter sizes and lamb birth weights were also determined Chi-square.

Average time taken to first attempt to stand, to successful stand and to successful suckling was recorded for each lamb. Data met the assumptions of parametric statistics (normality, linearity and homogeneity of variance). Differences between lambs of the two groups in these behaviours were tested using the independent-samples *t*-test (Petrie and Watson, 2006). Similarly, average rectal temperature was determined for lambs in each group and differences between them were tested using the independent-samples *t*-test. All statistical analyses were carried out using SPSS (version 16.0 for windows). The lambs' mortality rates were also recorded for each group of ewes and the differences in mortality rates between the groups in the first week, second week till weaning, and total mortality from birth till weaning were tested using Chi-square.

The minimum level of significance value taken was $P<0.05$. Data of time of parturition in ewes and rate of mortality in lambs are presented in percentages whereas, data of lamb behaviours (attempt to stand, successful stand and successful suckling) and rectal temperature are presented as estimated marginal means (EMM) ± SE.

RESULTS

1. Incidence of lambing:

The hourly distribution of parturition in ewes indicates that there was a nocturnal pattern in the number and incidence of spontaneous births (Figure 1). Night time parturition showed two peaks (6.04 % each) with the first peak occurring between 00:00 and 01:00 and the second between 02:00 and 03:00, and a lowest incidence (3.74 %) occurring between 18:00 and 19:00. On the other hand, day time parturition showed one peak (4.89 %) occurring between 14:00 and 15:00, and a lowest incidence (2.59 %) between 09:00 and 10:00. There was a significant effect to the period of the day on the incidence of lambing with higher incidence occurring at night time ($\chi 2 = 12.69$, d.f = 1, $P < 0.001$) relative to day light time (Figure 2).

Regarding the factors that may affect the incidence of the time of lambing, our results showed that there was an effect to the parity on the incidence of lambing with higher incidences of lambing occurring in multiparous ewes in both day light time ($\chi 2 = 46.41$, d.f = 1, $P < 0.01$) and night time ($\chi 2 = 69.58$, d.f = 1, $P < 0.01$) compared to primiparous ewes (Figure 3). Similarly, night time lambing showed higher incidences in multiparous ewes ($\chi 2 = 9.95$, d.f = 1, $P < 0.01$) compared to day light time lambing, whereas incidence of day light time and night time lambing did not differ within the primiparous ewes ($\chi2 = 2.37$, d.f = 1, NS) (Figure 4). On the other hand, neither day light time lambing ($\chi2 = 3.37$, d.f = 1, NS) nor night time lambing ($\chi2 = 1.61$, d.f = 1, NS) differed between litter sizes (single versus twins) (Figure 5). Similarly, neither day light lambing ($\chi2 = 0.03$, d.f = 1, NS) nor night time lambing ($\chi2 = 2.13$, d.f = 1, NS) differed within litter sizes (Figure 6). The effect of birth weight of lambs was similar to that of litter size in which there was no effect to the birth weight of lamb (high versus low) on either incidence of day light time lambing ($\chi2 = 3.58$, d.f = 1, NS) or night time lambing ($\chi2 = 2.70$, d.f = 1, NS) (Figure 7). Likewise, neither day light lambing ($\chi2 = 1.36$, d.f = 1, NS) nor night time lambing ($\chi2 = 1.03$, d.f = 1, NS) differed within birth weight of lambs (Figure 8).

2. Relationship between the time of lambing and behaviour and survival of the neonate lamb:

Regarding the behaviour of the neonate lambs, results showed that there was an effect to the time of lambing on the behaviour of the neonate lamb including latency (min) to successful stand ($t_{522} = -3.28$, $P < 0.05$) and to successful suck ($t_{522} = -3.40$, $P < 0.05$) with the lambs of the day light time group showing shorter latencies to stand and to successful suck compared to those of the night time lambing group. There was however no significant effect to the time of lambing on the latency of the lambs to attempt to stand (min) ($t_{522} = -0.52$, NS) (Figure 9).

Similarly, the time of lambing affected the rectal temperatures of the neonate lambs with the lambs of the day time lambing group demonstrating higher values of both presuckling (^{o}C) ($t_{522} = -6.17$, $P < 0.001$) and 24hr temperature ($t_{522} = -5.35$, $P < 0.01$), however the 72hr temperature did not change significantly ($t_{522} = -0.37$, NS) between neonate lambs of the two groups (Figure 10).

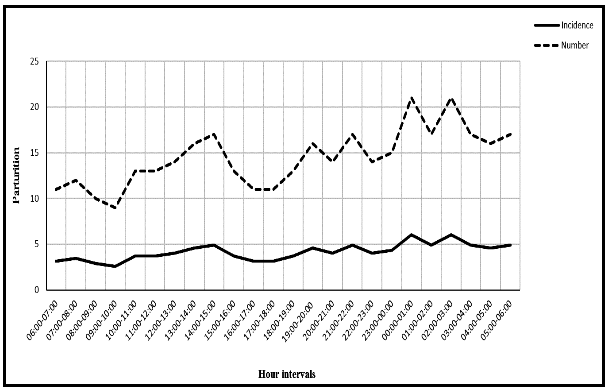

Figure 1: Number and incidence of parturition in day light time and night time ewes.

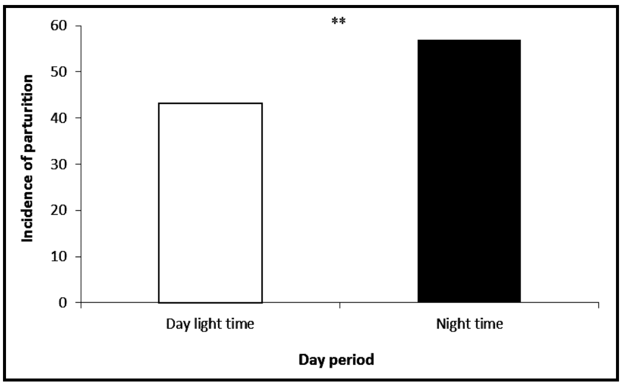

Figure 2: Incidence of parturition in the two 12-hr periods of the day in Sheep. ** P< 0.01

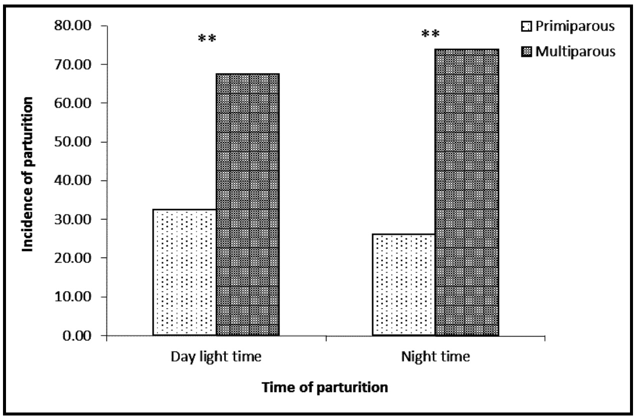

Figure 3: Incidence of parturition between different parities. ** P< 0.01

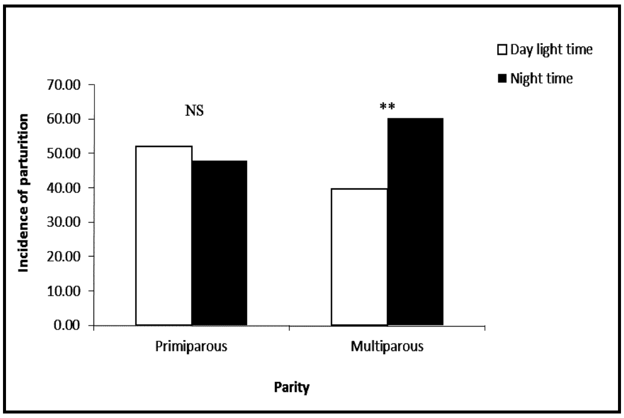

Figure 4: Incidence of parturition within different parities. ** P< 0.01 NS non-significant.

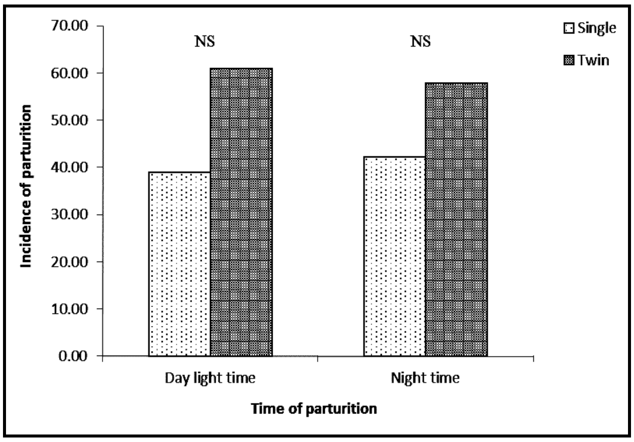

Figure 5: Incidence of parturition between different litter sizes. NS non-significant.

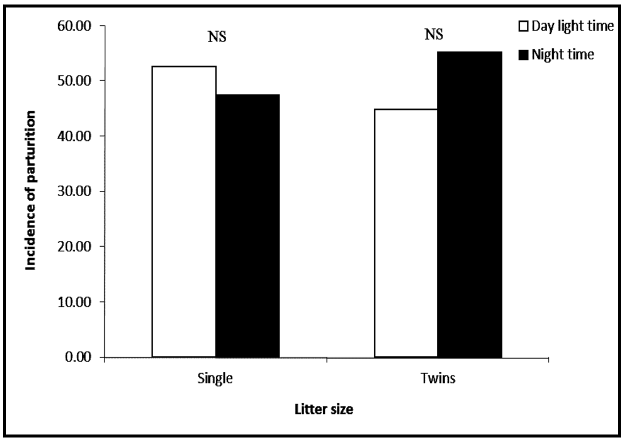

Figure 6: Incidence of parturition within different litter sizes. NS non-significant.

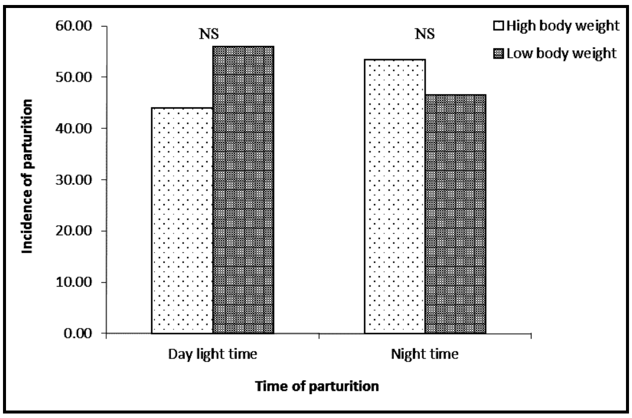

Figure 7: Incidence of parturition between different lamb birth weights. NS non-significant.

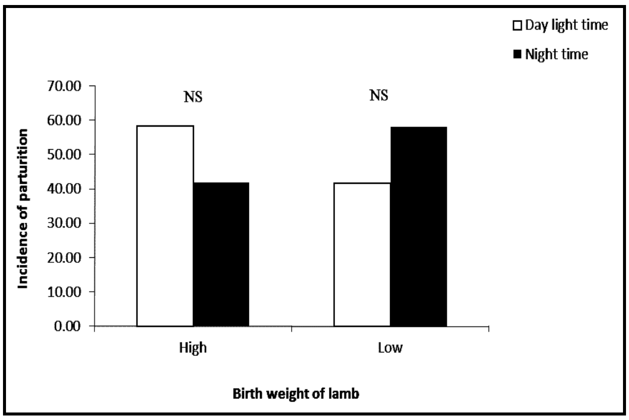

Figure 8: Incidence of parturition within different lamb birth weights. NS non-significant.

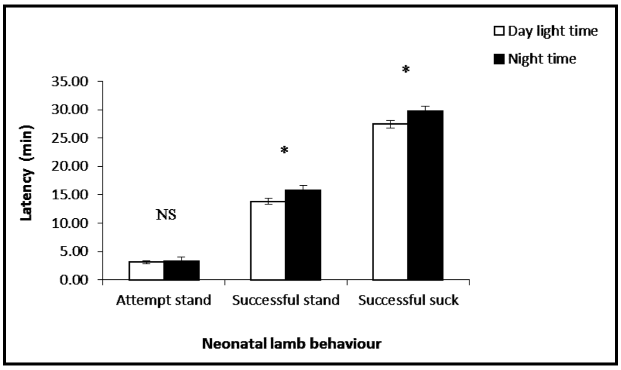

Figure 9: Estimated marginal means ± SE 'latency to attempt stand, successful stand and successful suck' by the lambs in the two groups. NS non-significant * P< 0.05

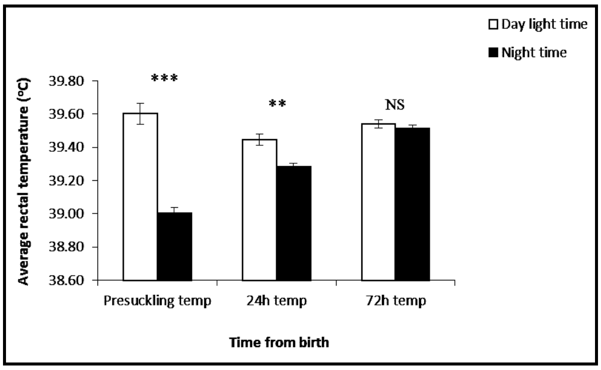

Figure 10: Estimated marginal means ± SE 'Presuckling temperature, 24h temperature and 72h temperature' of the lambs in the two groups. NS non-significant ** P< 0.01 *** P< 0.001

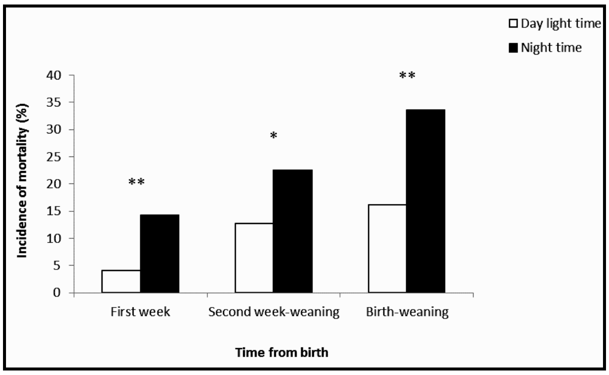

Figure 11: Incidence of mortality in first week, second week-weaning and birth-weaning of the lambs in the two groups. * P< 0.05 ** P< 0.01

There was also an effect of the lambing time on the rate of neonate lamb survival with the lambs in the night time lambing group showing higher incidences of mortality in the first week of age ($\chi 2 = 15.35$, d.f = 1, $P < 0.01$), from second week till weaning age ($\chi 2 = 9.47$, d.f = 1, $P < 0.05$), and from birth till weaning age ($\chi 2 = 20.32$, d.f = 1, $P < 0.01$) compared to those in the day time lambing group (Figure 11).

DISCUSSION

1. Incidence of lambing:

This study demonstrated a significant effect to the period of the day on the time of parturition. Low incidence of lambing occurred in the day light hours than during the night period. The interaction of various exogenous and endogenous factors could determine the time of birth, and could therefore affect the parturition process and trigger its onset. It is possible that physical and metabolic activity of the ewes could be factors influencing the onset of labour. Lindahl, (1964) demonstrated that, in sheep, lambing occurred with a lowest rate during the period of concentrate feeding, whereas the peak of the lambing incidence was after the twice-daily periods of feeding. Feeding pattern has also been found to change the concentrations of fetal plasma cortisol which has an important role in controlling parturition (Simonetta et al., 1991). Thorburn and Challis, (1979) stated that increments in cortisol levels could influence the onset of labour through its effect on the synthesis of placental steroids stimulating the synthesis of placental estrogen. In addition to any feeding effects, time of birth may have been influenced by shepherding activities, separation from flockmates that had already lambed, and by being moved to new paddocks, since labour can be disrupted by stressful experiences (Bontekoe et al., 1977). In contrast with this, the initial mechanism triggering the onset of birth has been shown to be encoded in the genes of the fetus, moreover these genes have been shown to link to certain developmental events in the fetus (Jenkin and Young, 2004).

Results of studies concerning the effect of day period on the time of lambing were conflicting. In general, the delivery of lambs has been shown to evenly spread throughout the 24 h period, although various investigators have stated that lambing may be concentrated at certain time of the day. For instance, Lindahl, (1964) and Younis and El-Gaboory, (1978) have reported a higher incidence of lambing during day light hours among domestic sheep but Hersher et al. (1963) and Arnold and Morgan, (1975) found a random distribution of lambing. Peak of parturition occurred in sheep in the periods between 09.00 and 12.00 and between 03.00 and 06.00 h (Lindahl, 1964). George, (1969) found that significantly more Merino ewes lambed at night whereas, more Dorset Horn ewes lambed during the day. In Barki sheep, Sharafeldin et al. (1971) observed a diurnal trend in the incidence of lambing with large proportion occurring at daytime. Moreover, Hudgens et al. (1986) stated that, irrespective of feeding time or diet, ewes exhibited peaks in the incidence of lambing between 03.00 and 07.00 h and between 15.00 and 19.00 h. Approximately 44.6 % of the ewes gave birth during these two 4-h periods which represent only 33 % of a 24-h day. Furthermore, Aleksiev, (2007) showed that more ewes (56.7%) lambed between 06:00 and 1800 h and less (43.3%) during the night time between 18:00 and 06:00 h.

Regarding the factors that may affect the incidence of lambing, our results revealed that neither litter size nor birth weight of lambs had detectable effects on the distribution of birth in sheep as reported previously by Younis and El-Gaboory, (1978) and Aleksiev, (2007). Likewise, in goat, there was no effect to the number of the newborn on the distribution of birth process (Romano and Piaggio, 1999). However, the authors found a significant effect to the parous category on the distribution of birth. The differences in the actual delivery time between primiparous and multiparous ewes is probably due to differences in the duration of labour rather than in its onset, since primiparous ewes exhibited longer and more variable labour compared to multiparous ewes that tended to give less warning of the approach of parturition than the younger animals. In consistent with this result, Romano and Piaggio, (1999) denoted non-significant differences in kidding distribution in different parities of goats.

2. Relationship between lambing time and behaviour and survival of the neonate lamb:

The newborn lamb has limited energy reserves in its body in the form of stored fat and carbohydrates (Eales and Small, 1995). Exposure to cold causes an increase in heat production rates, which is associated with a rapid depletion of the body energy reserves (Starr, 1981; McCutcheon et al., 1983; Bird et al., 1984; Silva, 1995). The exhaustion of energy reserves and the subsequent hypoglycemia were marked characteristics of lambs which become hypothermic within 12 hours of birth (Eales et al., 1982; Alexander, 1984; Mellor and Cockburn, 1986; Plush, 2013). This shortage of energy is more likely to reduce lamb viability and to depress suckling drive (Slee, 1981; Thompson, 1983; Nowak and Poindron, 2006; Dwyer, 2008). Lambs of low vigour may be unable to suck sufficient milk and therefore may become hungry; this can ultimately result in an inability to generate sufficient heat and consequently to hypothermia. In addition, lambs that are unable to maintain their body temperature may also fail to effectively seek the udder and may therefore complicate hypothermia with starvation. Thus, behavioural capabilities and body temperature appear to be linked; lambs with normal rectal temperatures were more likely to stand and reach the udder earlier than those with low temperatures as reported here in lambs born during the day light hours than those born during the night time and this has also been demonstrated previously by Slee and Springbett, (1986) and Dwyer and Morgan, (2006).

There are various factors through which the newborn lamb could lose more heat at birth such as, considerable skin through which the heat is lost, poor insulation value of the birth coat and being born wet (Joyce et al., 1966; Bird et al., 1984; Eales and Small, 1995; Stephenson et al., 2001). All these factors cooperate to make the newborn lamb highly susceptible to hypothermia due to exposure in the first few hours of life. To maintain body temperature, the newborn lamb has to produce much heat to compensate for the heat it loses. The environment become potentially lethal for the lamb when the heat loss from the lamb body exceeds heat production (Starr, 1981). Lambs must therefore increase their heat production by up to 15 times the prenatal level to compensate for the heat loss (Alexander, 1962; McCutcheon et al., 1981). In other study, Graham et al. (1976) showed that the rate of metabolism required for homeothermy is five times that required for maintenance. For that, the rate of metabolic heat production in homeothermic animals such as lambs should increase in response to an increase in heat loss to the environment and represent an attempt to stabilize body temperature. This can be achieved through the body energy reserves and successful suckling (Eales et al., 1983; Alexander, 1988; Bird et al., 2001; Aleksiev et al., 2007).

Before colostrum ingestion, the newborn lamb depends solely on its body energy reserves to maintain body temperature. Exposure to cold causes a rapid depletion of these reserves. This may explain the differences stated in the current study during the pre-suckling period between lambs born during the day light time and those exposed to cold during the night time hours. Moreover, day light time born lambs were more active at birth, taking less time to stand and to suck successfully, and since colostrum is the main source of fuel production (Bird et al., 2001; Dwyer and Morgan, 2006; Hamadeh et al., 2000), an increase in body temperatures were reported in these lambs during the first 24 hours of birth compared to those born during night time. This effect continued for 72 h of birth but without significant differences. This may probably be due to an improvement in suckling drive of lambs born during night time as a trial to improve their temperatures.

In order to maintain profitability in sheep production systems, it is vital to minimize lamb mortality and to maximize lamb growth rate. A major factor in mortality is hypothermia due to delayed suckling and exhaustion of brown fat reserves (Huston and Maddox, 1974; Slee, 1981; Stott and Slee, 1985; Barlow et al., 1987; Rook et al., 1990; Haughey, 1991; Hancock et al., 1996). Lambs that are vigorous at birth with a short latency of standing and suckling may therefore be more likely to survive during the perinatal period (Owens et al., 1985; Cloete, 1993; Nowak et al., 1997; Nowak et al., 2000; Dwyer et al., 2001; Darwish et al., 2010; Darwish and Ashmawy, 2011). The importance of early postnatal nutrition for the survival of young lambs in a cold environment is self-evident, since cold depletes the energy reserves by inducing an elevated metabolic rate which may exceed five times the resting level (Slee, 1981). In the present study, lambs born during the day light hours exhibited improvement in body temperatures and neonatal behavioural progress compared to those born during the night time and probably suffering from cold stress. Consequently, low mortality rates were recorded in these lambs from birth to weaning specifically during the first week of life. On the other hand, death may occur as a result of direct exposure to cold because of lethal hypothermia which happen soon after birth as most lambs die without standing or sucking (Alexander et al., 1980; Slee, 1981). Similarly, Henderson, (1991) revealed that of the millions of the lambs which die each year in the UK, almost half are severely chilled or hypothermic. Thus, cold stress could be a significant source of discomfort to neonatal lambs and could therefore be a critical factor in lamb survival.

CONCLUSION & RECOMMENDATIONS

This study demonstrated that the incidence of lambing in Finnish Landrace – Rahmani crossbred ewes was significantly higher during the night time compared to day light period. Opposite to litter size and birth weight, ewe parity had a significant effect on distribution of lambing. On the other hand, neonatal behavioural retardation, low ability to maintain body temperature and high mortality rates were characteristics of lambs born in night time and exposed to cold.

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الملخص العربي

التوزيع النهاري للولادة في الأغنام وعلاقته بسلوك ومعدل نفوق الحملان حديثة الولادة

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أجريت هذه الدراسة على ثلاثمائة وثمانية واربعين نعجة هجين من الاغنام الرحماني مع الفنلندي لدراسة التوزيع النهاري للولادات وعلاقتها بسلوك ومعدل نفوق الحملان حديثة الولادة. تم توزيع النعاج اما الي مجموعة نهارية شملت النعاج التي ولدت خلال ساعات النهار (من ٦ صباحا الي ٦ مساءا) او مجموعة ليلية شملت النعاج التي ولدت خلال ساعات الليل (من ٦ مساءا الي ٦ صباحا) وذلك على أساس توزيع الولادات على فترات طولها اثني عشر ساعة. شملت البيانات التي تم تسجيلها ميعاد الولادة، سلوكيات المولود، درجة حرارة المولود للثلاثة أيام الاولي من العمر ومعدل نفوق الحملان من الولادة حتى الفطام.

أظهرت النتائج ان الولادة تمت في عدد كبير من النعاج خلال فترة الليل. لم يوجد تأثير لعدد الحملان المولودة من كل نعجة او لوزن الولادة للحملان على ميعاد الولادة في النعاج. أظهرت حملان مجموعة الولادة الليلية نشاطا اقل ودرجات حرارة اقل خلال الثلاثة ايام الاولي من العمر ومعدل نفوق اعلي في الفترة من الولادة حتى الفطام وخصوصا خلال الأسبوع الأول بعد الولادة بالمقارنة بحملان مجموعة الولادة النهارية.

ولذلك فإنه يمكن التوصية بالآتي: حدثت أكثر الولادات اثناء فترة الليل بالمقارنة بفترة النهار. لم يظهر تأثير لعدد الحملان المولودة لكل نعجة او لوزن المولود على ميعاد الولادة في النعاج. كان هناك فروق معنوية في ميعاد الولادة في النعاج بالنسبة لتأثير عدد مرات الولادة. بالإضافة الي ذلك فان التعرض للبرد غير في الأنماط السلوكية للحملان حديثة الولادة وقلل من قدرتها في الحفاظ على درجة حرارة الجسم وزاد من معدلات نفوقها.