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The impact of lambing stress on post-parturient behaviour of sheep with consequences on neonatal homeothermy and survival

R.A. Darwish[a,*], T.A.M. Ashmawy[b]

[a] Department of Animal Husbandry, Faculty of Vet. Medicine, Mansoura University, Mansoura, Egypt
[b] Animal Production Research Institute, Ministry of Agriculture, Egypt

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Abstract

During lambing the expression of an appropriate behavioural response from both the ewe and the lamb are extremely important to lamb survival. The aim of this study was to show the effect of length and difficulty of the birth process on the expression of maternal and neonatal behaviour with consequences on homeothermy and survival of the neonate lamb. Data were collected from 61 Finnish Landrace × Rahmani crossbred (second generation) primiparous ewes and their single born lambs. Based on the average length of parturition, the ewes were grouped into short birth (less than 32.5 min) and long birth (equal to or higher than 32.5 min) classes. The data recorded include maternal and neonatal behaviour, lamb body temperature over the first 3 days of life and survival rate of the neonate lamb during the first week after birth. Blood samples were also collected from the lamb, pre-suckling and at 24 and 72 h after birth. The obtained sera were assayed for thyroid hormones (T_3 and T_4) that are associated with heat production. Ewes that had prolonged and difficult births did not show competent maternal behaviour compared to mothers with short and un-complicated deliveries, as they were slower to begin grooming their lambs after birth, spent less time licking their lambs, made less low-pitched vocalizations and nosing, were more likely to show rejection behaviour (10.34 % vs 5.4 %, $P < 0.05$), and were more likely to move away when the lamb sought the udder in an attempt to suck (acceptance rate, 55.5 % vs 64.79 %, $P < 0.05$). Similarly, lambs from a prolonged and difficult birth were significantly less vigorous after birth, as they had taken more time to stand, reach the udder and to suck successfully. These lambs had lower serum concentrations of T_3 and T_4, and they also had a reduced ability to maintain body temperature after birth. This effect persisted over the first 3 days of life and was associated with higher neonatal mortality in the first week after birth (11.54 %), compared to lambs from short and non-stressful birth processes (2.86 %, $P < 0.01$). From the present study, it can be concluded that, prolonged deliveries with birthing difficulty were one of the main causes of death of large, single-born lambs, as these complications cause the expression of inappropriate behavioural responses from both the ewe and neonatal lamb. Thus, interventions designed to reduce the incidence of prolonged parturitions are likely to be associated with better welfare for the ewe and the lamb and consequently improved lamb homeothermy and survival.

Keywords: Ewe; Lamb; Behaviour; Thyroid hormones; Homeothermy; Survival

1. Introduction

Lamb mortality in both extensive and intensive systems is considered to be a major constraint to profitable sheep production [1,2]. A pre-weaning lamb mortality of 15–20% is common in farming systems worldwide [3,4]. Lamb deaths are primarily concentrated in the first week of life, reflecting the difficulty of the transition from an intra-uterine life to an extra-uterine one [5,6]. Most lamb deaths result from a failure in bonding between the ewe and the lamb [7], thus studies in ewe and lamb behaviour could help to improve lamb survival.

* Corresponding author. Tel.: 0108820462; fax: 0502379952.
E-mail address: ragab_darwish69@yahoo.ca (R.A. Darwish).

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Two main factors; dystocia and starvation-mismothering-exposure have been most often implicated with lamb losses [8,9]. Dystocia can be a consequence of lamb birth weight, sire breed, dam pelvic conformation [10], malpresentation, maternal overfeeding, or prolonged parturition [11,12]. Ewe maternal behaviour is known to be affected by a difficult delivery [13]. In addition, lambs born from difficult births have difficulty in maintaining their body temperature and have retarded behaviours in teat searching and suckling [14]. Such lambs have increased chances of death when subjected to cold stress or malnutrition.

In sheep, vocalisations represent an important element of mother-young interactions [15,16]. Sheep utilise auditory and olfactory cues to establish a rapid bond between a ewe and her newborn lambs [17,18]. In addition, vocalisations are used as a long-distance recognition signals particularly between mother and young, although they appear to act as a secondary signal to visual information [19]. In addition, a lamb bleat may be regarded as an essential adaptive method for attracting maternal attention [20,21].

Newborn lambs are highly susceptible to hypothermia from exposure due to a large area of skin through which the lamb loses heat; a birth coat of poor insulation value, and being born wet [22]. Thus, the newborn lamb must produce as much heat as it loses to maintain its body temperature. This could be partly supplied by the oxidation of fat from brown adipose tissue (BAT) by a process under the control of triiodothyronine (T_3), which is produced from thyroxin (T_4) in BAT by the enzyme 5-monodeiodinase [23,24]. Body temperature is maintained mainly through early colostrum ingestion, which is extremely important. In addition to containing immunoglobulin, colostrum provides the lamb with fuel to maintain body temperature [25,26]. Therefore, an essential priority for homeothermy and survival of the neonate is early access to the udder [27]. This study aimed to investigate the effect of birth length and difficulty on the expression of maternal and neonatal behaviour and its relationship with homeothermy and survival of the neonate lamb.

2. Materials and methods

2.1. Animals

This study was carried out at Sakha Animal Production Research Station, Animal Production Research Institute, Ministry of Agriculture, Kafr El-Sheikh Governorate, Egypt, during the period between 2007 and 2008. Sixty-one Finnish Landrace × Rahmani cross-bred (second generation) primiparous ewes and their single born lambs were used in this study. Oestrus was not synchronised, and the ewes were naturally mated. The ewes had an average body weight of 38.59 ± 0.35 kg at mating and 42.18 ± 0.32 kg at parturition with 1.72 ± 0.023 years as an average age. Pregnancy diagnosis was confirmed by transabdominal ultrasonic scanning at day 70 of pregnancy. Based on the average length of parturition, which was recorded in the present study at 32.5 ± 3.18 min, the ewes were grouped into short birth (less than 32.5 min) and long birth (equal to or higher than 32.5 min) classes. Thirty-five of the ewes fell into the short birth class, with an average lamb birth weight of 3.34 ± 0.08 kg, and twenty-six ewes fell into the long or protracted birth class, with an average lamb birth weight of 4.29 ± 0.09 kg.

2.2. Management

Ewes were given free access to green fodder (*Trifolium Alexandrium*) during the green season, hay in the dry season and fresh drinking water. A concentrate mixture (cotton seed cake, Soya bean meal, yellow corn, limestone and mineral mixture) containing 16.6% crude protein, 12.7% crude fibre and 73.4% TDN was provided during pregnancy at a rate of 400 gm daily/ewe. This amount was increased gradually until 1000 gm/ewe was reached at the late stage of pregnancy (last 4–6 weeks). Ewes were vaccinated with 2 ml clostridial vaccine (Covexin, Schering-Plough Company) subcutaneously at the 17th week of pregnancy. Ewes were housed in semi-covered large pens (6 m × 20 m), in groups of 30 ewes/pen.

Two weeks prior to the expected lambing time, ewes were transported into well straw-bedded pens (6 m × 9 m) in groups of approximately 10–11 ewes/pen for lambing. Ewes due for lambing were kept under 24 h observation for 2 wk to determine the exact time of lambing. At lambing, ewes were allowed to give birth without assistance. However, if the ewe was observed straining for a long period of time without further progress of the lamb, assistance was provided. Lambing assistance was provided 1 h after breakage of the water bag without appearance of any part of the lamb (n = 3) or 2 h after parts of the lamb were seen at the vulva with no further progress being made (n = 4) [28,29]. The assistance given involved correcting the lamb presentation and then manually delivering the lamb. Because assistance was based on time intervals, the interval prior to the assistance was accepted as an indication of the true length of parturition [30].