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Housing conditions and management practices associated with neonatal lamb mortality in sheep flocks in Norway

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ABSTRACT

A study was conducted in order to obtain information about sheep farms in Norway and to identify housing and management characteristics that were risk factors for neonatal mortality of lambs 0–5 days of age. A questionnaire was submitted to sheep farmers, who provided demographic data and information on sheep housing conditions and feeding and management practices. Our description of farms is based on the questionnaire responses received from 2260 farmers. Data on lamb mortality during the preceding lambing season were available for those flocks that were enrolled in the Norwegian Sheep Recording System. Some flocks where the number of lambing ewes was less than 20 or greater than 400 were excluded. The total number of flocks included in the analysis of neonatal mortality was 1125. An increase in the mean number of live-born lambs per ewe per flock was associated with increasing neonatal mortality. Factors independently associated with increased neonatal survival were continuous monitoring of the ewes during the lambing season, active support to ensure sufficient colostrum intake of the lambs, feeding a combination of grass silage and hay compared with grass silage alone, and supplying roughage at least twice per day versus only once. Increased survival was also observed in flocks where the farmer had at least 15 years of experience in sheep farming. Flocks in which the Spæl breed predominated had lower odds for neonatal deaths compared to flocks in which the Norwegian White breed predominated. In conclusion, measures in sheep flocks targeted at feeding practices during the indoor feeding period and management practice during lambing season would be expected to reduce neonatal lamb mortality.

1. Introduction

Neonatal mortality is the cause of considerable economic loss and reduced animal welfare in sheep production (Mellor and Stafford, 2004; Østerås et al., 2007). Some flocks experience severe losses, which may reduce the farmers' motivation for keeping sheep. Based on studies involving a varying number of flocks, neonatal mortality rates ranging from 6 to 13% have been reported from different countries (Wiener et al., 1983; Scales et al., 1986; Jordan and Le Feuvre, 1989; Binns et al., 2002). Exact comparisons of figures from the various studies are difficult because rates reported correspond to observation periods of different durations. However, most neonatal deaths occur during the first five to seven days after birth (Wiener et al., 1983; Nash et al., 1996; Binns et al., 2002; Animalia, 2007) and extending the observation period somewhat beyond the first week of life will likely cause only a small increase in observed mortality rates.

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Factors affecting the risk for neonatal deaths have been evaluated in several studies. In flocks in which mortality rates are relatively high, exposure to adverse weather conditions and starvation due to mismothering and insufficient colostrum intake are commonly identified as main risk factors (Sawyer et al., 1977; Starr, 1981; Ahmad et al., 2000; Dwyer, 2008). Birth difficulties, which may lead to injuries or weak lambs, are also an important risk factor (Cloete et al., 1993). Feeding and breeding strategies directed towards increased litter size have resulted in increased number of triplet and higher order litters, which are associated with decreased lamb survival (Gama et al., 1991; Christley et al., 2003). Infections caused by various pathogens can be an important cause of neonatal deaths in some flocks but are generally not of major importance (Rhyan and Dubey, 1984; Haughey, 1991; Rowland et al., 1992). Congenital defects or functional disorders are not frequent findings (Green and Morgan, 1993; Cloete et al., 1993).

In Norway, ewes are lambing in spring, mainly in April–May. Around one third of all sheep flocks are enrolled in the Norwegian Sheep Recording System (NSRS). Stillbirths and all neonatal deaths are recorded in these flocks. According to annual reports from NSRS, neonatal mortality rates for recent years (2007–2010) are just above 3% (Animalia, 2009, 2010, 2011). Although this is much lower than figures reported from other countries, there has been an increase over the past decades. Reasons for the relatively small average loss in Norway compared with figures reported from other countries may include differences in flock size, housing conditions and management practices in the periparturient period. Average number of ewes in flocks in the NSRS is approximately 80. The relatively small flocks and the fact that lambing takes place indoors, usually in individual pens, allow for close supervision of ewes and their newborn lambs. On the other hand, a gradual increase in mean litter size in NSRS flocks, reaching 2.11 in 2010 (Animalia, 2011), has likely increased the risk of neonatal deaths.

Neonatal lamb mortality differs considerably among flocks (Rowland et al., 1992; Animalia, 2010). Previous studies and NSRS data show that flock mortality rates one year are strongly correlated with those recorded the subsequent year (Binns et al., 2002; Waage and Holmøy, unpublished data), clearly suggesting that flock level risk factors are important.

To obtain information about sheep farms, and housing, nutrition and management of the flocks, a questionnaire-based survey was carried out. The objective was to characterize sheep farms in Norway based on a reasonably representative sample of farms. For those flocks in the survey that were enrolled in the NSRS we cross-matched mortality records and other data from this register and data collected from the farms. Based on these data, a separate objective of our study was to identify flock characteristics that were associated with the rate of neonatal lamb mortality.

2. Materials and methods

2.1. Selection of farms

In March 2008, a questionnaire was sent to 4829 of the 16,909 sheep farmers registered in the Norwegian Livestock Register, i.e., to all farmers who had an e-mail address. Those who did not respond within 3 weeks received a reminder. A second reminder was submitted to non-responders 8 weeks later. Responses were received from 2260 farmers, i.e., 46.8% of those contacted, comprising 13.4% of sheep farmers in Norway. The characterization of sheep farming in Norway is based on this sample. Information about geographic locations of the farms was available in the Norwegian Livestock Register.

2.2. Questionnaire design

The questionnaire was submitted to the farmers using the online program QuestBack (Oslo, Norway). The participants were informed that the aims of the survey were to get information on sheep farming in Norway and farmers' attitudes to animal welfare. Before submission the questionnaire was pre-tested on one farmer and thereafter modified to improve clarity of questions. Responses were stored in a database on a webserver and subsequently exported to statistical software, where primary processing and quality check were undertaken. Answers regarding attitudes to animal welfare, which comprised approximately one third of the questionnaire, were not included in this study. Questions asked included demographic data, sheep housing conditions, feeding and management, and disease preventive practices. Closed questions were used, and response categories were those shown in Tables 1–5. If necessary, more than one answer could be given for a question. Information on age of farmer, amount of experience in sheep farming and year of construction of the sheep barn was collected in open questions (Table 6).

2.3. Study sample on neonatal mortality

Additional data were needed for the study of neonatal lamb mortality. Of the 2260 farms, such data were available for 1201 farms that were enrolled in the NSRS. We excluded 74 flocks with less than 20 ewes and two flocks with more than 400 ewes lambing in 2007 from the analysis. Data from the remaining 1125 flocks were used for the study of associations between flock characteristics and neonatal mortality. In the NSRS, each animal has a unique identification consisting of numbers for county, municipality within county, flock within municipality and animal within flock. Compulsory recording of several variables is required. One file containing variables recorded for each ewe at lambing includes the numbers of stillborn lambs and lambs that die shortly after birth (before they are given an identity number). In another file, containing animals which have received an identification number, the breed and dates of birth and death of the animals and the identity number of the mother were available. Initial screening and a thorough quality check of the extracted data were undertaken. Identical double records were found for 23 of the flocks; a