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Influences of various factors on cows' entrance order into the milking parlour

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ABSTRACT

This study investigates the stability of the milking order of cows entering into the milking parlour of a commercial dairy herd, and changes to this order consequent to a change in health status and a change in the membership of the group of cows being milked. In large herds it is difficult for stockmen to monitor all cows closely. If changes in the milking order are indicative of health or other problems, the monitoring of any changes in the order could alert stockmen to such problems. This could therefore be a tool to add to the parameters collected routinely in precision livestock farming (PLF). The milking process of 692 cows, in seven different feeding groups, over a period of six months, was monitored. The milking order was found to be stable within days, and across days, but was more variable within milking sessions. Cows with mastitis ($P < 0.001$) entered the parlour later than when they were healthy. Cows with metritis entered into the milking parlour earlier than usually ($P < 0.05$). When new cows entered a group they fitted into a stable position within the parlour entrance order within two days. There were no effects found of parity, age, days in milk, milk production or milking duration on the milking order. It is concluded that the regular monitoring of milking order, and flagging of changes in this order could be a useful tool in the early identification of the presence of disease in cows.

1. Introduction

Most dairy production in Europe is intensively farmed. Many of these farms provide loose housing for the cows in cubicle barns, and mean herd size has increased steadily over recent years in combination with a reduction in the number of farms (EFSA Journal, 2009). However, loose housing systems do not always guarantee good welfare (Rousing et al., 2004). With an increase in the number of cows in a herd the possibilities to notice and identify individual animal welfare and health problems decrease. Intensive farming systems have lead to a strong demand for more efficient husbandry methods, which increasingly include the use of precision livestock farming (PLF) management. PLF comprises the monitoring, collection and evaluation data from on-going processes (Berckmans, 2008). PLF is considered to have great potential in developing technology for the continuous automatic monitoring and improvement of animal health, animal welfare and quality assurance at farm level (Wathes et al., 2008). In commercial farming practice, economizing is often achieved at the expense of animal welfare, which inevitably can reduce individual productivity (Hemsworth and Coleman, 2011). Farm animals' voluntary movements

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have been studied in different situations, and one of these is entry into the milking parlour. Consistent entrance order to the milking parlour is a prominent feature of the social system of dairy cattle (Rathore, 1982; Grasso et al., 2007; Berry & McCarthy, 2012). Similar results have been found with buffaloes (Polikarpus et al., 2014), sheep (Wasilewski, 1999; Villagrá et al., 2007) and goats (Margentínová et al., 2003; Górecki & Wójtowski, 2004). Possible applications of a detailed understanding of the milking order in farming practice could comprise several aspects, for example, some cows may be fearful of the milking parlour because of the risk of injury during access to the parlour or during the milking process itself, and may therefore be reluctant to walk in that direction (Flower et al., 2006). In this regard, an uncharacteristically late entry into the parlour can often be related to health problems (Reinhardt, 1973) and can therefore be used as an indicator for PLF. Deluyker et al. (1991) suggest that systems for automated milk yield recording might be used for the early detection of sick cows if these milk production changes can be detected prior to, or at the same time as, usual clinical disease diagnosis. Early detection of health problems is good for animal welfare – cows suffer less and need less medication, and also saves money for the farmers and helps to avoid production losses. The objective of this study was to analyze milking order stability and changes, in a large loose housing cowshed, and estimate the value of the automatic monitoring of milking parlour entry order as a tool for the early detection of health problems.

2. Material and methods

2.1. General management

A commercial loose housing cowshed was used. Lactating cows in-milk were managed in seven feeding groups according to lactation stage (of 60–80 cows each) and milked in a 2 × 12 parallel milking parlour, equipped with ALPRO® system (DeLaval, Sweden), three times per day. Cows were milked in the morning (from 5:00 to 9:00) in the afternoon (from 12:00 to 17:00) and in the evening (from 19:00 to 23:00). The walking distance from the housing to the milking parlour varied from 50 to 300 m, depending on the cows' group location within the cowshed. Prior to milking the whole group entered into a waiting area (of a size of 171.5 m^2) which was situated next to the milking parlour; this was equipped with a moving crowd gate to drive the cows gently towards the parlour. All cows were zero-grazed and fed a grass silage-based total mix ratio and housed in the same cubicle loose-housing cowshed with a size of 2960 m^2, average stocking density was 4.1 m^2/cow. The milking parlour and waiting area are shown diagrammatically in Fig. 1.

At the entrance to the milking parlour each cow was identified automatically on passing an identification gate (DeLaval Multi Reader). Cows' identification numbers, with entrance time, milking duration and individual milk yields were recorded and transferred to the computer of the cowshed management information system (MIS ALPRO). Health problems of cows were also registered: the cows' health data for the MIS were identified and entered manually by a veterinarian. Identified cows were treated with a proprietary medicine but were not separated from herd.

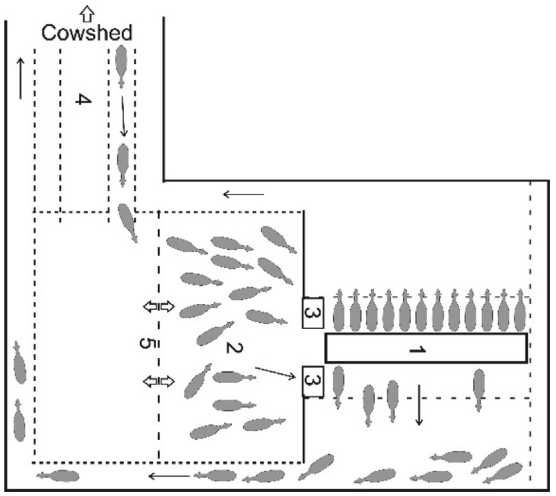

Fig. 1. Milking parlour with waiting area and cows' traffic: 1–milking parlour, 2–waiting area, 3–identification gates, 4–walking alleys, 5–crowd gate.

2.2. Statistical analysis

The dataset was collected from January to June with a total of 237,434 milkings from 692 dairy cows (385 Estonian Holstein and 307 Estonian Red cows). On average the cows were in the study for 117 days and had 343 milkings (due to errors in automatic data recording only 93% of days per cow had data from three milking sessions). For each milking session and feeding group, cow milking order within the group was determined based on automatically registered entrance times, and for each cow the position in milking order was selected as the study variable. A milking session is each of the three daily milking events, and the milking session order is the order of entrance into the parlour in each of these sessions. The daily milking order is the mean of these three events from each day.

To investigate the stability of milking order single cow's 1st to 10th order autocorrelations were calculated for each milking session and then meaned over all cows. Within-day mean position data per cow from combined milking sessions were also calculated and analysed in the same way. For comparison the same analysis was also performed with automatically recorded milk yield and milking duration data.

To study the stability among three milking sessions within day, Spearman rank correlation coefficients between cows' positions at three milking sessions were calculated. Analyses were initially performed based on single milkings, and subsequently on the cows' mean values (evaluated as three mean milking order positions for each cow corresponding to three different milking sessions).

In addition, the differences in milking order subsequent to the days following the introduction of a new cow were analysed. In order to be included in the analysis a threshold