

Effects of milking stall dimensions on behavior of dairy cows during milking in different milking parlor types

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Summary

In recent decades, dairy cows have increased in size due to breeding selection for higher milk yield. Despite this, the dimensions of milking-parlour stalls have never been adjusted, and are still based on past practical experience of milking-machine manufacturers and advisory institutions. Milking stalls that are too small could lead to impaired behaviour of the cows during milking, owing to a lack of comfort.

The aim of this study was to examine the current space allowance of milking stalls on dairy farms and to assess the effect of space allowance on cow behaviour (rumination, latency in entering the milking stall, elimination and restlessness) during milking.

Zusammenfassung

Einflüsse der Melkstand-Abmessungen auf das Verhalten von Milchkühen während des Melkens in verschiedenen Melkstandtypen

In den vergangenen Jahrzehnten nahm die Körpergrösse von Milchkühen aufgrund der Zucht auf höhere Milchträge ständig zu. Die Abmessungen der Melkstände wurden jedoch nie angepasst und beruhen auf der praktischen Erfahrung von Melkmaschinen-Herstellern und Beratungseinrichtungen. Einschränkende Melkstandabmessungen könnten jedoch aufgrund mangelnden Komforts zu einem beeinträchtigten Verhalten während des Melkens führen.

Das Ziel dieser Studie war es, das gängige Raumangebot von Melkständen in Milchviehbetrieben und den Einfluss der Abmessungen auf das Verhalten der Kühe während des Melkens (Wiederkäuen, Zögern vor dem Betreten des Melkstands, Eliminierung und Ruhelosigkeit) zu prüfen.

Résumé

Effets des dimensions des postes de traite sur le comportement des vaches laitières durant la traite dans différents types de salles de traite

Ces dernières décennies, la taille des vaches laitières a augmenté suite aux améliorations génétiques visant à augmenter le rendement laitier. Toutefois, les dimensions des postes de traite dans les salles de traite n'ont jamais été ajustées et restent basées sur l'expérience pratique des fabricants de machines à traire et des organismes de conseil. Les dimensions imitées des postes de traite peuvent affecter le comportement des vaches durant la traite suite à un manque de confort.

La présente étude avait pour but d'examiner la place actuellement disponible dans les postes de traite des exploitations laitières et de déterminer l'effet de l'espace disponible sur le comportement des vaches (rumination, période de latence avant d'entrer dans le poste de traite, élimination et agitation) pendant la traite.

Introduction

Breeding selection for high milk yield has caused body dimensions of dairy cows to increase in the past decades. Between 1967 and 1987, diagonal body length of Holstein dairy cows increased by 13.9 cm according to analyses of breeding history (Grothe, 2007; Brade and Brade, 2013). Similar results were observed by Rudolphi *et al.* (2008) for Holstein cows between 1988 and 2005, with an increase in weight of 20 % and in height of 8 % (+11 cm).

In Switzerland, minimum requirements and recommendations exist that dimensions of feeding and lying areas should be adapted to the size or weight or both of the animals (TSchV, 2008). Concerning milking, there are no studies dealing with effects of milking stall dimensions on

cow behavior, but small space allowance in waiting areas was found to increase heart rate and agonistic behavior, and these effects were still detectable during the milking (Irrgang *et al.*, 2015). To our knowledge, there are no research based recommendations for milking stall dimensions. In the milking parlor, the main focus is on milk yield and efficiency of milking. The recommendations for the construction of milking parlors are usually based on the practical experience of milking machine manufacturers and advisory institutions. However, not only milking stall dimensions but also the parlor type might affect behavior during milking, as found by Savary *et al.* (2014). With reference to the lack of scientific background information for milking stall dimensions, these facts highlight the importance of investigating space allowances of milking stalls in different milking parlors for the well-being of cows (Gomez *et al.*, in press).

Material and Methods

The study was conducted in March 2015 on 15 Swiss dairy farms (5 per milking parlor type: Side-by-Side, Herringbone and Tandem parlor, for details see Gomez *et al.*, in press). In total, 444 cows of two main breeds (Brown Swiss, Red and Black Holstein) were measured in size. Behavioral data were collected during one evening milking of 10 focus cows per farm.

On each farm, stall dimensions in the parlor were measured. Only clear widths and lengths were measured because these are relevant for the space that is available to cows. For stall width and length, the mean was calculated per farm. In the Tandem parlors feed dispensers were used that reduced the space for cows. Therefore, the length of

the feed dispenser (\varnothing 30 cm) was subtracted from the length of the stall to make space allowance for cows comparable across parlor types.

To measure cow body dimensions, we used a camera system with a digital single lens reflex camera (Figure 1a, [label 1]; Nikon D7000 with the prime lens Nikon AF NIKKOR 24 mm f/2.8 D), attached to a mobile tall tripod (Figure 1a; [label 2]) connected to a laptop (Figure 1a; [label 3]) to trigger pictures using the software Lightroom 5 (Adobe Systems Incorporated, San Jose, California, USA). This method allowed fast collection of data without the need to handle and to touch the cows. Pictures were taken from top view perspective with a red reference plate (15 x 15 cm) at backbone height (Figure 1a; [label 4]) during one feeding in the mornings. The images were analyzed using the software ImageJ 1.48v. With the reference plate, the measurement tool was calibrated and the body lengths and belly widths of cows were measured (Figure 1b). Body length was defined from the head of the humerus (Caput humeri), defined as the cranial boundary for shoulders, to the caudal ischial tuberosity at the pin bones (Os ischii). Belly width was defined as the largest width found at the belly from top view.

To get a comparable unit for spatial conditions of individual cows, a so-called space ratio (SR) was calculated, separately for length (SR_{length}) and width (SR_{width}), using the formula milking stall dimension divided by cow dimension (Eqs. [1] and [2]):

$$SR_{width} = \frac{\text{clear width of milking stall (cm)}}{\text{belly width of cow (cm)}} \quad (1)$$

$$SR_{length} = \frac{\text{clear length of milking stall (cm)}}{\text{body length of cow (cm)}} \quad (2)$$

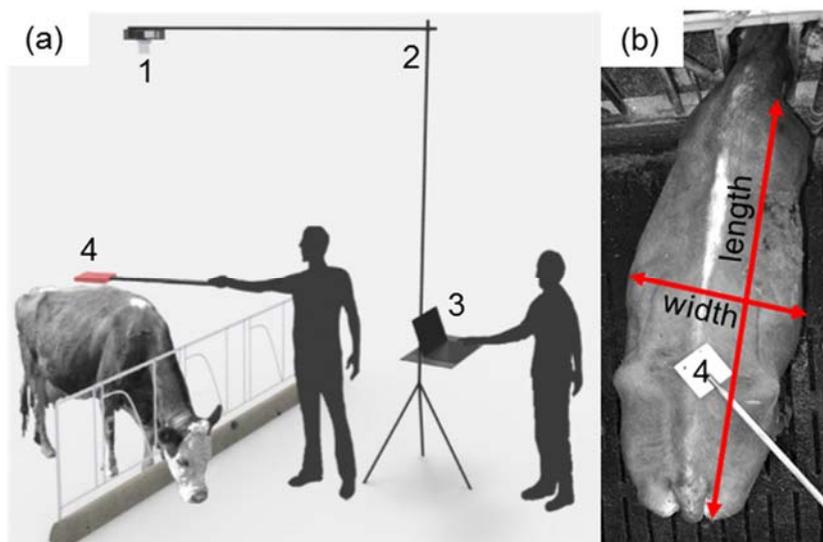


Figure 1: Camera system installation to measure cows from top view perspective without the need for direct handling (a). The camera (1; Nikon D7000, prime lens NIKKOR 24mm f/2.88 D) was fixed on a mobile tall tripod (2) and connected to a laptop (3) to trigger pictures when the reference plate (4; size 15 x 15 cm) was at backbone height of the cow. Based on the area and length of the reference plate, the pixel scale was calibrated in the software ImageJ to measure body length and belly width of cows (b).

For statistical analysis, SRs were calculated individually for all cows based on the averaged milking stall dimension found on their particular farm. $SR_{length} > 1$ reflects the length of the milking stall to be larger than the length of the cow, whereas $SRs < 1$ indicates a too short or too narrow milking stall for this particular cow, respectively.

On each farm, ten healthy cows were chosen for behavioral observation during one evening milking. We recorded rumination, elimination and the latency to enter the milking stall by direct observations. Hind leg activity was recorded using acceleration loggers. Data were analyzed using generalized linear mixed-effects models with farm as random effect.

Results

The results will be presented at the conference.

Literature

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