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Influence of the design of resting-boxes on laying behaviour of dairy cows in free-stall barns

Animal-related livestock housing conditions play an important role to assure welfare and also motivation of dairy cows. Thereby the laying area has a special relevance. When cows are kept in free-stalls, the evaluation of husbandry and management should not only base on constructional and technical aspects, but also on animal-based criteria in order to avoid negative effects on the cows behaviour. Within data collection, the husbandry- and management-based influencing factors on cows were analysed with regard to selected criteria of dairy cows behaviour. This article presents some results of a doctoral research study which concern influences of cubicle design on the cows laying behaviour. The investigation is part of the projekt „Cows and more“ which is realized by the Landwirtschaftskammer Nordrhein-Westfalen. Stated aim is to develop a weak-point analysis for free-stalls.

Keywords
Dairy cows, husbandry systems, management, cubicles, laying behaviour, weak-point analysis

Abstract
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In view of the economic framework, altered animal welfare aspects and changing consumer behaviour, milk production is subject to a high pressure to adapt that necessitates continuous optimising of housing conditions. [1]. To optimise production accordingly, not only feeding and dairy cattle breeding are of major importance, but above all the animal housing and keeping conditions. Free-stall barns with resting cubicles admittedly offer cattle sufficient opportunities to satisfy their basic ethological needs, but despite this – as a result of the strict division of the function areas and the controlling housing facilities – they can restrict the natural behaviour of the animals.

In order to mobilise unused reserves in these areas, housing and management should be oriented specifically to the natural needs of the cows [2].

For a holistic assessment of keeping conditions, relevant literature recommends a multifactorial observation method [3] comprising animal-related, technical and management-specific indicators [4; 5; 6]. This should draw as far as possible on complete, objective assessments that can easily be implemented in practice [7].

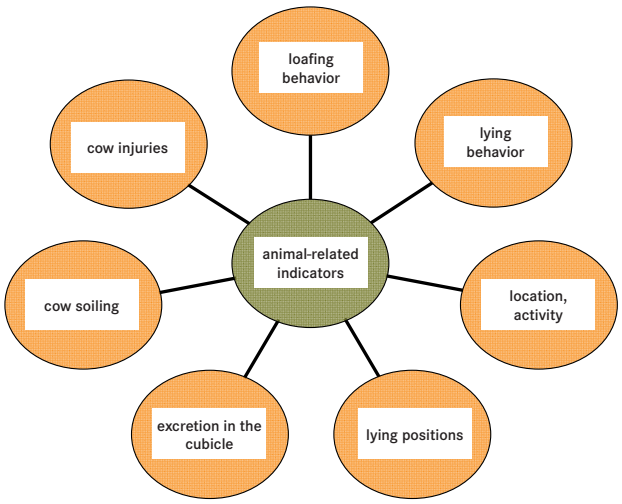
Material and methods

In a field survey, staff of the Landwirtschaftskammer Nordrhein-Westfalen (NRW) (Chamber of Agriculture NRW) gathered certain animal-related data on animal behaviour and habitus in 66 dairy farms in the state with an average herd size of 80 lactating dairy cows (**figure 1**) and on comprehensive structural aspects and function measures of the housing environment [8]. The data were collected exclusively during the barn-keeping period in order to avoid disturbances e.g. through pasture sessions. The persons conducting the survey were familiarised in advance with the systematics and the indicators. In order to ensure a uniform data basis for the behaviour attributes, surveys were conducted at specific times in relation to the feeding time [9].

Selected results and discussion

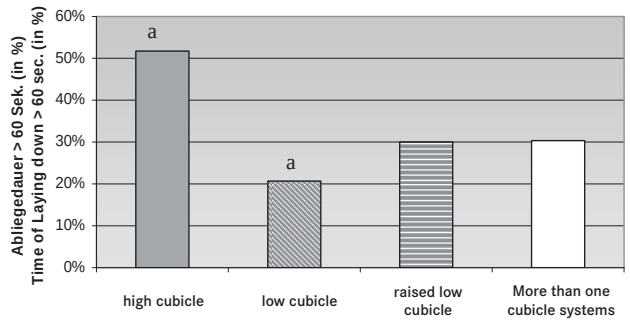
When resting in cubicles with sub-optimal design, the movement processes can be affected. Deficits in resting area quality are frequently reflected in extended resting periods [10]. To avoid pain, damage and suffering, the animals should therefore have soft and deformable bedding at their disposal. In this respect a significant influence of the cubicle type ($p < 0.01$) on the duration of resting was ascertained in the farms surveyed. Animals kept in high cubicles frequently required longer times before lying down than their companions in low cubicles (**figure 2**). This is possibly attributable to the fact that organic mattresses show a higher deformability than the high box floor coverings encountered in the survey that were on average nine years old and had thus already lost a good share of their softness.

Fig. 1



Animal-based criteria for detection of influencing factors from husbandry and management

Fig. 2



Means of frequency of laying down time > 60 seconds in several types of cubicle; a = significant difference in Post-hoc test (p < 0,01)

However, the type of litter in the low cubicles also influenced the duration of resting ($p < 0.05$). Fewer animals with a long-resting period were observed on mattresses made up of straw and recycled manure solids, and saw-dust litter. By comparison, straw lime mattresses and resting areas with chopped straw litter came off worse. One reason for this could be the very firm consistency or the lack of mattress formation.

The cubicle design influences not only the resting operations, but also the resting position [10]. Different cubicle dimensions have different effects on the chest position, which is termed the initial resting and stand-by position. Using the general linear model, it was determined that in the 42 farms in which a front limit was installed, the height of the neck rail ($p < 0.05$) and its distance from the dung step ($p < 0.01$)influence the frequency of the chest position. This emphasises the significance of the neck rail in conjunction with the front limit as major control elements in the resting cubicle, as regards positioning during resting too. Furthermore, the effective resting area length and the frequency of the chest resting position ($p < 0.05$) and on the front leg stretching ($p < 0.05$) were also ascertained. For instance the proportion of front leg stretching increased with longer resting areas.

Hind leg stretching like front leg stretching can be used to relax the joints. The cubicle type was determined as an factor influencing the frequency of this resting position in the above farms too ($p < 0.01$), which in turn allows conclusions to be drawn regarding the resting area quality. As **figure 3** shows, in high cubicle systems on average 24% hind leg stretching was observed. By contrast the proportion in low cubicles at 14% is substantially lower. This observation could on the one hand be due to the fact that high cubicles offer a level surface, while stretching in low cubicles is often made more difficult due to trough formation. On the other hand, however, a steeper gradient or a smooth floor covering in the high cubicles caused by dampness and insufficient litter can lead to the hind legs slipping away more easily during resting.

Conclusions

To secure cow wellbeing and performance motivation, the keeping and management areas should be aligned more with the natural needs of the animals. When assessing keeping conditions, animal-related indicators can provide valuable information about existing weaknesses.

The results of a part of the survey presented in this paper show that the resting area exerts a distinct influence on the behaviour of the animals on the basis of the various function dimensions and resting area quality. The significance of the neck rail as an essential cubicle control element was determined. The results of the statistical evaluation are used within the framework of a comprehensive weak point analysis as regards keeping and management in order to ascertain restrictions for the animals in conjunction with defined target, standard and boundary values and secured comparison data and to derive recommendations for action for optimising the housing conditions.

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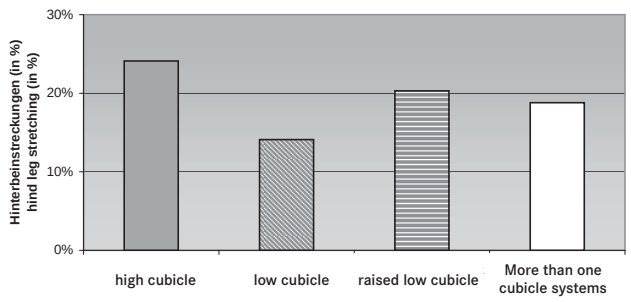
Fig. 3



Means of frequency of hind leg stretching in several types of cubicle ($p < 0,01$)

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