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Elastic walking surfaces in dairy cattle loose housing

Hoof problems are among the most important diseases of dairy cows and are the third biggest reason for culling. An unarguable key role here is played by hard and often slippy flooring. To suit walking surfaces to the requirements of the cow it is possible to cover flooring with elastic rubber matting thus avoiding mechanical-traumatic hoof damage and behavioural limitations. Cows move spontaneously on elastic walking surface, fulfilling all desired movements with no fear, as on pasture. Because physiological loadings on the hooves are correct, they are healthier with optimum movement-related blood circulation.

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Increasingly more cattle are kept in loose housing and, especially in this system, cow mobility is essential. Lameness causes serious performance penalties and treatment costs. Additionally hoof treatment is time-intensive and this aspect is especially important, especially for larger farms where ever-decreasing time is apportioned to care of the individual animal. Alongside organisational and farm management requirements hoof care is also part of animal welfare responsibilities. All these aspects together justify a comprehensive analysis of hoof problem causes.

Causes of hoof damage

Observation of disease distribution on the separate hoof halves *(fig. 1)* indicates that damage mainly appears on the rear outer parts of the toes. Feeding and metabolic influences cannot be responsible for this but a sensible explanation can be found in the different mechanical load stresses of the hoof halves. In order to carry her weight, which is large in relation to the area of her hooves, the cow has several interacting shock absorbing mechanisms.

Cattle shock absorbing mechanisms

With regard to shock absorbance there are principle differences between the limbs. According to their role in supplying thrust for forward motion without too much loss of mechanical effort the angled rear limbs are attached relatively rigidly to the rump. The front limbs are attached via the shoulder blades which gives them an effective shock absorbance capability and means that the front limbs are basically less stressed.

The hoof itself contributes greatly to reducing mechanical loads (hoof mechanism). Thus the two-toe design of the hoof dampens shocks in that the gap between the toes widens, the hoof sole sinks and the hoof expands outwards in the load bearing area. On ground surfaces that give, the load is distributed evenly on both hoof halves.

The so-called hanging attachment system of the hoof also complements its shock absorbency effect because the cow stands not directly on the sole of her hooves but instead overhangs the horn shoe with elasticity and stability with the help of many layers of dermis. The load bearing areas of the hoof are represented in the first place by the supporting border with adjoining white line and the ball area *(fig. 2)*.

The architecture of the horn also follows the functional demands is different in the individual areas of the hoof. The wall horn is especially hard and on the sole forms the load-bearing border which carries the main loads. In that the cow first puts her weight on

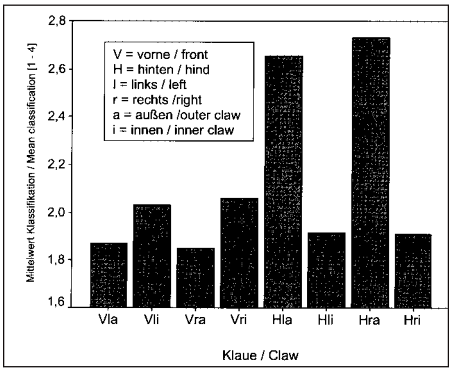

Fig. 1: Distribution of mean hoof health classification on traditional slatted floor (78 animals); 1= very good, 4= very bad

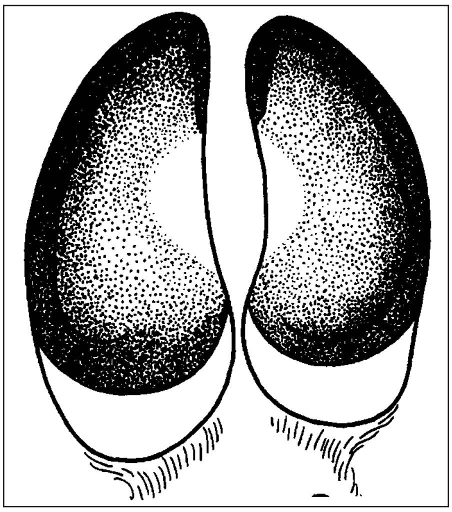

Fig. 2: Physiologically bearing areas of cattle hoof (BLOWEY 1998)

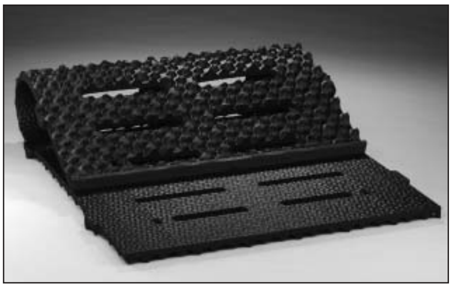

Fig. 3: Rubber matting with knob

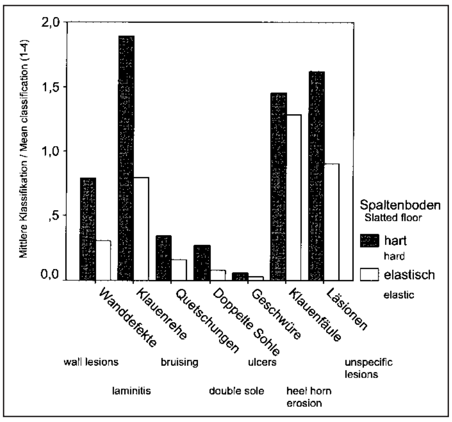

Fig. 4: Hoof diseases on hard and elastic floor; 1 = very slight, 5= very severe

the ball of the hoof the horn is comparatively soft-elastic in this segment. Additionally the hoof features gel-type fat cushions in the rear sole area.

Interaction between animal behaviour and hoof health

Alongside the movement-associated blood circulation and nutrition supply of the hoof it is especially the aspect of the hoof which indicates interaction between movement behaviour and hoof health. Hard concrete surfaces are often slippy and the cow takes precautions by walking carefully. In such cases the animals reduce their stride length to avoid slipping. This results in differing load relationships in that the hoof placing motion from the ball over the sole functions in association with stride length.

On hard surfaces, independently of these being slippy or abrasive (as with poured asphalt surfaces), no outstanding load-carrying border to protect the sole from overloads can form between hoof care sessions. On the contrary the wall horn can be worn down under the level of the sole.

Elastic rubber matting fitted on slatted flooring

As prevention against mechanical-traumatic hoof damage and to design the production system „loose housing“ according to the requirements of the animal, cow movement areas on two farms were laid with rubber matting as part of a research project. The material used was much more giving than normal rubber in that it featured a knobbly undersurface *(fig. 3)*. To fit the slatted flooring the matting was precisely perforated by the manufacturers so that a self-cleaning effect was retained.

Within the framework of regular hoof care, reports on condition differentiated according to type, localisation and degree of seriousness could be recorded. Mechanical-traumatic damage was reduced in frequency as well as in seriousness *(fig. 4)*. The hoof changed back into the functional hoof form of the natural pasturing cow with the lightly overhanging, load-carrying rim protecting the sole from overloads *(fig. 5)*.

This positive development in hoof health was caused partly by reduced mechanical stress. But changed animal behaviour also played an important role. On giving surfaces the hoof sinks in. The resultant grip enables the cow to walk normally in which she, as on pasture, treads with the rear hoof in the print of the front hoof. Then she treads on the rear sole and ball area and therefore on the soft-elastic horn that was conceived by Nature for this task.

Movement according to requirements on elastic surfaces

The measurement of step length and walking speed on hard and on elastic surfaces confirmed clear differences *(fig. 6 and fig. 7)*. Animals are more active on elastic flooring. Where they take an average 84 steps per hour on hard surfaces the figure is 115 on elastic ones. Extrapolated, this means a cow is walking up to 1000 metres more per day on the rubber flooring which, through the blood circulation related oxygen and nutrition supply for the horn-forming epidermis, is advantageous for the hoof. Additionally, it can be assumed that every movement of the cow serves her requirements, be this related to feed or water consumption, oestrus behaviour or for comforting actions. Thus on the rubber flooring, oestrus behaviour such as riding could be performed more often and thus observed more clearly. Also, the cow doesn’t need to be tethered at such times, as is often the practice, to avoid accidents on the hard flooring. Comfort actions such as licking the hide tailwards appeared more often on the elastic slatted flooring with the animals licking each other spontaneously and thoroughly over long periods. Especially between udder and thigh this cow-grooming behaviour offered comfort and also served for improved hygiene.

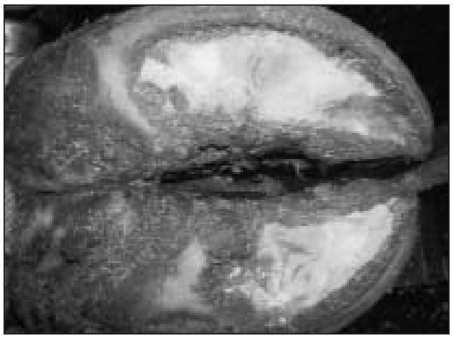

Fig. 5: Cattle hoof from below

Summary

With fitted elastic rubber matting the loose housing is suited to the real requirements of the cow. Mechanical-traumatic hoof damage can be avoided. Hoof problems from feed and metabolic disorders appear less serious. On non-skid flooring cows can express behaviour according to their requirements.

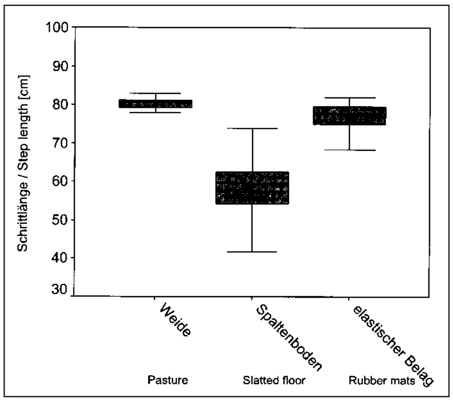

Fig. 6: Step lengths on different floor types

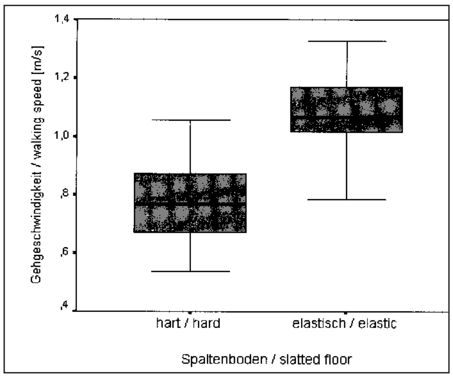

Fig. 7: Walking speed on different floor types