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Always restless?
Effect of different housing systems on time budgets and restlessness in beef bulls

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Summary

Scientific evidence of beef bull behaviour in different housing systems is rare. This MSc thesis aimed to expand our knowledge of bulls' daily time budgets housed in barren to semi-natural housing systems. Furthermore, based on evidence from human psychology that restless behaviour occurs more often in barren environments and might indicate boredom, we were also interested in studying restlessness in bulls.

To this end we observed bulls between May and September 2022 housed in 3 different housing systems: 1) pens with a fully slatted floor (FS; n = 4 farms), 2) structured with a concrete floor area and a straw bedded lying area (SB; n = 4) and 3) housing on organic pastures (OP; n = 3). Each farm was visited twice. For the indoor housing systems (FS, SB), animals from the 3 pens with the oldest animals were observed. For OP only 1 group of bulls was observed. We observed bulls from 6 a.m. to 10 p.m. using focal animal sampling (n = 1857 observations) to describe restlessness, which was operationally defined as the number of transitions between consecutive individual behaviours within the 8-minute observation period. Moreover, every 10 min the basic activities of all animals in a group were recorded for calculating daily time budgets using scan sampling (n = 4992). The basic activities covered *Standing/Walking*, *Lying*, *Ruminating while walking/standing*, *Ruminating while lying*, *Eating feed/Grazing* and *Drinking*.

For data analysis, data of FS and SB was analysed using generalised linear mixed models. Regarding the daily time budget, the model took the housing system (2 levels: FS & SB) as fixed effects and day (2 levels) nested in farm visit (2 levels) nested in farm (4 levels) nested in housing system (2 levels) as random effects into account. For restlessness, housing system (2 levels: FS & SB) was used as the fixed effect and pen no. (3 levels) nested in day (2 levels) nested in farm visit (2 levels) nested in farms (4 levels) nested in housing system (2 levels) were the random effects. Data of OP were only analysed descriptively due to high variation of housing conditions within the OP farms.

Housing system affected most basic activities. *Walking/Standing* ($p = 0.01$; $\chi^2_1 = 6.30$) and *Lying* ($p = 0.007$; $\chi^2_1 = 7.22$) was observed more often in SB than in FS. For *Drinking* ($p = 0.004$; $\chi^2_1 = 8.09$) and *Ruminating while lying* ($p = 0.02$; $\chi^2_1 = 5.70$) the opposite was found. There was no effect on *Eating feed/Grazing* ($p = 0.84$; $\chi^2_1 = 7.98$) as well as on *Ruminating while walking/*standing ($p = 1.00$; $\chi^2_1 = < 0.001$). Basic activities deviated more when OP was compared with one of the indoor housing systems than when FS and SB were compared to each other. Moreover, basic activities were described in the course of the day, which was split into blocks of 2 hours. The courses through the day showed a more similar pattern within the indoor housing systems compared to OP. Regarding restlessness, no effect of the housing system was found comparing FS and SB ($p = 0.62$; $\chi^2_1 = 0.24$), but bulls of OP showed a much lower number of transitions (mean per 8 min = 18.7) compared to FS (35.1) and SB (36.5).

The deviations of the daily time budgets as well as the number of transitions of bulls housed indoors compared to those on pasture raise concerns about bulls' welfare in the indoor housing systems. In order to get a deeper insight into bulls' welfare, behavioural observations should be carried out on a 24 h basis. Moreover, there is a need to study groups of bulls and their normal behaviour in a (semi-)natural environment to understand to what extend confinement restricts bulls.

This study was based on the hypothesis that restlessness, at least in humans, is a reaction on to the discrepancy between understimulation as a consequence of barren conditions and high arousal motivation. We thus assumed that the most restless bulls would be found in the most barren housing system, which is FS. However, the level of restlessness was comparable in both indoor housing systems. This may be explained by the monotony of the housing systems (e.g. bulls are shielded from environmental influences when housed indoors; daily routines are the same) and the feeding intensity (e.g. energy- and protein dense feed may lead to a permanent subacute rumen acidosis, which was found to lead to behavioural alterations) found in both indoor housing systems compared to OP. To understand the mechanisms of restlessness in cattle, barrenness, monotony and feeding intensity need to be further investigated.