

Preliminary study of breeding boars' welfare

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ABSTRACT

The behaviour and housing requirements of mature boars (*Sus scrofa*) are poorly understood although they may be an important aspect of improving welfare and productivity. Since a definition of relevant behaviours is essential to obtain quantitative information about the housing requirements of mature boars, the aim of this study was to establish the breeding boars' ethogram and to define the most relevant behaviours that can be used as welfare measurements. Breeding boars were observed in their enclosures three hours before semen collection. The boars exposed 13 functional behaviours (eating, drinking, defecating, urinating, rooting, scenting, grooming, grunting, social behaviour, elements of social behaviour, watching, stereotypes, motionlessness) and five body positions (lying on the belly, lying on the flank, standing, walking and sitting). The dominant behaviours were motionlessness and eating. The boars' vocalisations were different in sound and duration. The dominant positions were lying on the flank and belly. Lying was connected with motionlessness and not reacting to environmental changes. In this study, the behavioural repertoire and the presence of stereotypes were not a good approach to evaluate the boars' welfare. We concluded that it is necessary to have more subtle methods to evaluate how they cope with their environment and suggested that measurement of boars' welfare could be the frequency of their vigilance, since typically they will be motionless most of the time. Moreover, the duration of pig species-specific behaviours, such as rooting and scenting, could be an important measurement in approaching their welfare, because it is poorly exposed in a barren environment and environmental enrichment should stimulate those behaviours. The third possible measure of breeding boars' welfare could be vocalization.

Key words: boar, behaviour, welfare, housing

Introduction

Animal welfare can be described in terms of animal health and the needs that an animal should be able to fulfil from its environment (BROOM, 1991; DAWKINS, 2003).

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However, the housing requirements and welfare of mature breeding boars (*Sus scrofa*) are still poorly understood, especially in comparison with sows or growing pigs.

What we know about boars is their behaviour in the semi-natural environment (STOLBA and WOOD-GUSH, 1989). Furthermore, between countries there are significant differences in boar housing, but the majority of boars used for semen-processing are housed in single crates (SINGLETON, 2001; ROHRMANN and HOY, 2005). This kind of housing is considered legitimate since when boars are housed in groups there is the possibility of homosexual behaviour and aggression (CORDOBA-DOMINGUEZ et al., 1991). The lack of stimuli could impair behavioural development in young boars (HEMSWORTH et al., 1977a, and 1978), hence they should be housed near sexually receptive females after puberty (HEMSWORTH et al., 1977b).

We have studied boars on a standard commercial breeding farm. Since a definition of relevant behaviours is essential to obtain quantitative information about housing requirements of mature boars, the aim of this study was to establish the breeding boars' ethogram and to define the most relevant behaviours that can be used as welfare measurements. Our hypothesis was that certain behaviours will be distinguishable by their duration or frequency and therefore suitable indications of the good or bad welfare of the boars.

Materials and methods

Housing. The experiment was conducted on a commercial pig breeding farm. The boars were housed individually with the possibility of contact with neighbour boars in adjacent pens through bars and in the same facility with dry sows. Boars were in non-bedded pens with outdoor enclosures. Each pen measured 3.00 m × 1.90 m (L × W) and each outdoor enclosure measured 4.5 m × 1.9 m, respectively. Indoor enclosures were separated by walls and outdoor enclosures were separated by metal bars. The boars could go in and out through small doors. Each pen had a feeder and a waterer and there was a siphon below.

The average morning temperatures ranged from 17 °C to 24 °C (measured at 7 o'clock), while daily temperatures were up to 35 °C.

Animals. All 25 boars (*Sus scrofa*) were seghers, approximately 26 months old and at the time of experiment used for semen collecting.

Methods. The behaviour of boars was observed during July and August 3 hours before they were used for service (7.30 to 10.30 am). Each animal was observed for 5 days, that is, in total for 900 minutes.

The ethogram was defined, with a list of all behaviours displayed by the boars (Table 1) and the duration and frequencies of behavioural elements were measured.

Table 1. Breeding boars' ethogram

Behaviour	Description
Functional behaviours	
Eating	Boar is standing and taking food with its mouth from the feeder or floor
Drinking	Boar is standing or sitting and taking water with its mouth from the waterer
Defecating	Self explanatory
Urinating	Self explanatory
Rooting	Boar is standing and pushing substrates along the floor forward with its snout
Scenting	Boar is touching substrates with its snout, occasionally breathing can be heard
Grooming	Boar is scratching its flanks on the fence up and down or left-right, two or three times
Grunting	Boar is vocalising
Social behaviour	Boar is touching another boar with its head or some other body part
Elements of sexual behaviour	Boar mounts a fence, followed by hip movement and exposing the penis, finalised with the ejection of a small amount of sperm, simultaneously chewing
Watching	Boar has eyes open and passively observes the environment without taking any consequent activity
Stereotypes	Boar bites bars or walls repeatedly; boar scratches or jumps on walls with front legs repeatedly
Motionlessness	Boar lies on its belly or flank with eyes closed
Body positions and walking	
Lying on flank	Boar's legs are stretched parallel to floor, head and body are on a floor
Lying on belly	Boar's front legs are stretched in front of him, head is in upright position, body is on a floor
Sitting	Boar is in upright position, with stretched front legs and back legs are under his body, on the floor
Standing	Boar is in an upright position and all his 4 legs are stretched
Walking	Boar changes position in the pen

Statistical analysis. Descriptive statistics were created by Statistica (data analysis software system), version 7. Additionally, data were presented graphically and analysed in Microsoft Excel 2007.

Results

The boars in this study displayed 13 functional behaviours and they were observed in 5 different body positions. All observed behaviours differ greatly in their duration and frequency (Fig. 1, 2, 3 and 4).

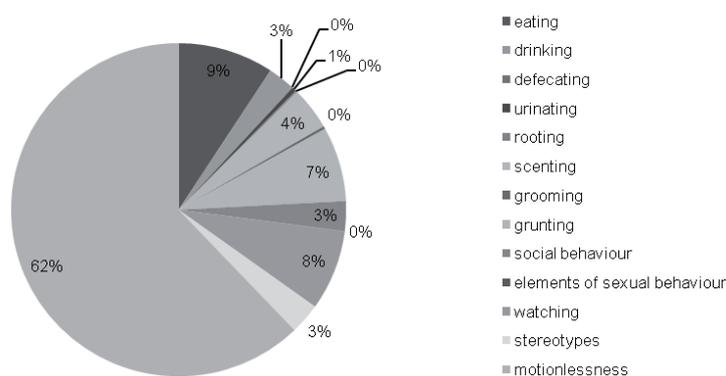


Fig. 1. Relative duration (percentage of minutes) of displayed functional behaviours by boars

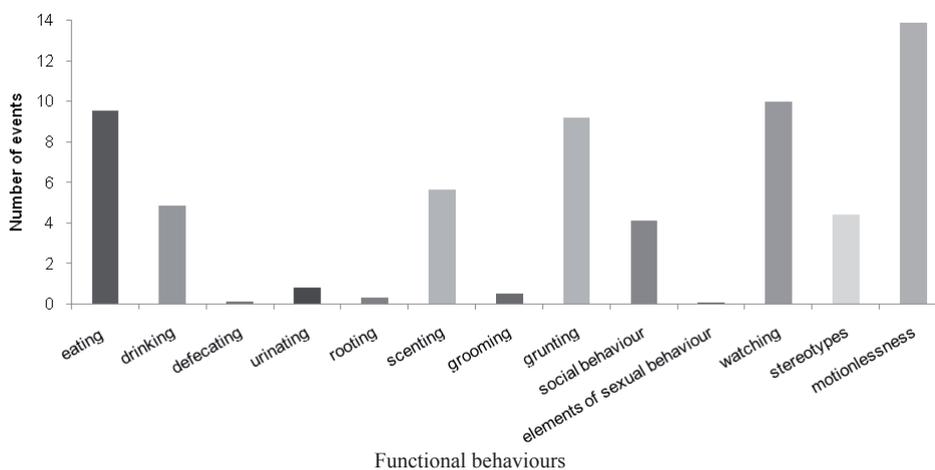


Fig. 2. Frequency of displayed functional behaviours by boars

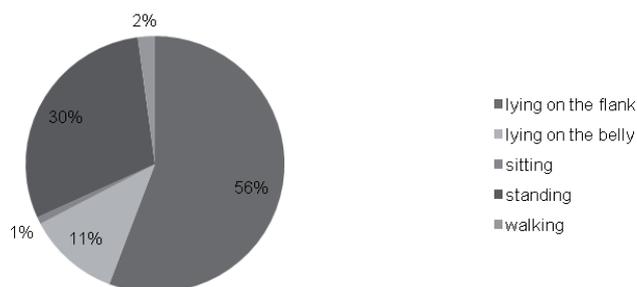


Fig. 3. Relative duration (percentage of minutes) of displayed body positions and movements by boar

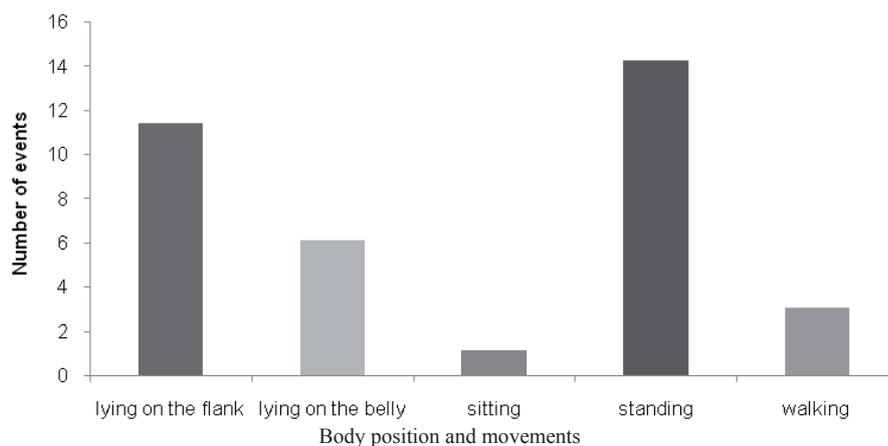


Fig. 4. Frequency of displayed body positions and movements by boars

Thirteen functional behaviours had different durations, where mean values ranged from 1 minute (for elements of sexual behaviour and defecation) to 587 minutes (for motionlessness). In the boars' ethogram, motionless behaviour was more frequent than all the other behaviours (587 ± 22.7 minutes, $\bar{x} \pm \text{SEM}$), that is, the shortest time that one boar spend motionless was 360 minutes (X_{\min}), and the maximum duration of motionlessness was 790 minutes (X_{\max}). Boars in this study spent a great deal of time eating (87 ± 8.2 min),

and this was the second longest behaviour in the ethogram (Fig. 1). Stereotypes (28 ± 5.0 min) were not largely represented in the boars' behavioural repertoire, some boars were never even observed to engage in stereotyped behaviour ($X_{\min} = 0$). Additionally, the boars displayed several other functional behaviours for a longer time than stereotyping, such as eating, grunting (68 ± 10.7 minutes), watching (74 ± 8.9 minutes) and motionlessness (Fig. 1). The boars displayed exploratory behaviours, such as rooting (2 ± 0.9 minutes) and scenting (39 ± 6.1 minutes), for a shorter time that they ate (Fig. 1). Some behaviours like sniffing and grunting were never displayed by some boars ($X_{\min} = 0$), but were more frequently displayed by others ($X_{\max} = 150$, $X_{\max} = 190$, respectively), showing a high variability in the behaviour of boars living in the same environment.

The frequencies of functional behaviours exposed by the boars were different (Fig. 2). The most frequent behaviours were motionlessness (14 ± 0.7 , $\bar{x} \pm \text{SEM}$) and eating (10 ± 0.8 , $\bar{x} \pm \text{SEM}$), but still the boars were motionless more frequently than starting to eat (Fig. 2). The behaviours with the lowest frequency were elements of sexual behaviour (0 ± 0.1), defecating (0 ± 0.1), rooting (0 ± 0.2), grooming (1 ± 0.1) and urinating (1 ± 0.2) (Fig. 2). Some boars were very vocal and were engaged in grunting 24 times (X_{\max}), while others never grunted at all ($X_{\min} = 0$).

We learned that boars spent different amounts of time in each body position and walking and they repeated these behaviours with different frequencies (Fig. 3, Fig. 4). Most of the time boars lay on their flanks (502 ± 28.1 minutes, $\bar{x} \pm \text{SEM}$) or belly (104 ± 16.6 minutes, $\bar{x} \pm \text{SEM}$), or stood (267 ± 20.4 minutes, $\bar{x} \pm \text{SEM}$) (Fig. 3). Boars sat (8 ± 3.1 minutes, $\bar{x} \pm \text{SEM}$) and walked (19 ± 4.3 minutes, $\bar{x} \pm \text{SEM}$) for less time than they lay on their flanks or belly or stood (Fig. 3).

According to the observed frequencies, standing was the most frequent behaviour since the boars stood 14 ± 0.9 ($\bar{x} \pm \text{SEM}$) times. When the mean values are evaluated, the least frequent behaviours were sitting (1 ± 0.3) and walking (3 ± 0.6) (Fig. 4). Additionally, in the observed group some boars never lay on their belly or sat ($X_{\min} = 0$).

Discussion

The behavioural repertoire of boars studied in this research consisted of 13 functional behaviours. The list of behaviours is comparable with pigs in a semi-natural environment (STOLBA and WOOD-GUSH, 1989) and leads to the conclusion that pigs retain their basic behavioural patterns even in a barren environment. These results are contrary to the findings of HIRT and WECHSLER (1993) that showed that a barren environment causes lower behavioural diversity and poor welfare in fattening pigs. Therefore, our results suggest that behavioural diversity alone may be an insufficient measurement of breeding boars' welfare. However, the durations and frequencies of the observed behaviours differ

greatly and could represent the basis for the division of behaviours into very useful or less useful for welfare assessment.

Although stereotypes were considered as an important welfare criteria and they may be a sign of reduced welfare (BROOM and FRASER, 2007), in this study they were too underrepresented to be taken as relevant measure. As a stereotypic behaviour we considered beating and licking the bars and when boars repeatedly jumped on the fence in a stereotypic manner. This is broader definition than that given for other pig categories in different housing systems. Still, the boars behaved in a stereotypic way for only about 3% of the time and some boars were never engaged in these kind of activities.

The predominant behaviour by duration and frequency was motionlessness, as similarly described for pigs in a farm environment as resting behaviour (ROHRMANN and HOY, 2005). The boars spent 63% of three-hour period before sperm collecting lying on their flanks or bellies, with their eyes shut, without reacting to anything that happened in the building. Such unresponsiveness could be considered as abnormal, apathetic behaviour (BROOM and FRASER, 2007). However, great caution is necessary since well fed pigs may lack a reason for activity, and therefore this behaviour could be adaptive in summer time. Nevertheless, in welfare assessment the lack of adequate environmental stimuli may possibly be seen in terms of the prevalence of motionlessness over all other behaviours.

The boars spent about 8% of the observation time displaying watching behaviour. Apart from motionlessness and eating, this behaviour accounted for a considerable amount of the time of three hours before semen collecting. However, that behaviour is passive: sudden sound (noise) caused them to open their eyes, to raise their heads, observe the immediate environment, and then fall asleep again. We assumed that when they saw that there was no possibility for action or direct threat, they returned to motionless resting. This lends further creditability to the definition of motionless behaviour as an important element in welfare assessment.

Pigs' sense of smell is very keen and rooting is their preferred exploratory behaviour (STUDNITZ et al., 2003). The studied boars rarely rooted, which can be explained by the lack of adequate substrate in the crates with a concrete floor, where they could only root food or their faeces on the floor. The boars were scenting for about 4% of the observation time. Having in mind the importance of olfactory information that pigs can obtain from their environment (BROOM and FRASER, 2007), maybe this behaviour could be a useful measure for determining their welfare.

Social behaviour, elements of sexual behaviour and grunting were rarely seen in the boars. Although every boar had the possibility of contact with boars in two neighbouring pens, they contacted very rarely and there was no aggression between them. Boars in nature live separately (WODZICKA-TOMASZEWSKA et al., 1981), and this kind of behaviour

could be expected. Nevertheless, this is inconsistent with the findings of CORDOBA-DOMINGUEZ et al. (1991) that observed aggression in group housed boars. The boars were grunting for about 7% of the observation time, however their vocalizations differed in sound and duration, and in once case was more like squealing. As concluded in previous research papers, high-frequency vocalization could be connected with stressful situations (HILLMANN et al., 2004), and it may provide a behavioural method for the assessment of animal welfare (WEARY and FRASER, 1993 and 1995).

In our experimental design, the pigs were fed at about 7 am and this could be the reason why the eating behaviour represented 9% of the observation time. During the day boars in the semi-natural environment spend 27% of their time grazing (STOLBA and WOOD-GUSH, 1989), but when they were fed with concentrated meal they ate for only 9.66% of the observation time (DINUSSON, 1965). Since this study was undertaken during the hot summer days, we assumed that that was their major meal, because the feed intake of adult pigs may be reduced by increased air temperatures above 24 °C (BROWN-BRANDL et al., 1998). However, in this research the timing of the main meal, as well as environmental conditions, blur the real significance of the feeding pattern for the breeding boars' welfare.

The other maintenance behaviours, that is drinking, urinating and defecating, were not recognised as important for welfare assessment in singly housed boars. The boars did not spend much time drinking. Usually they came to the waterer, swallowed some water, and started some other functional behaviour. Similar results were observed by DINUSSON (1965). After eating they usually drank. Furthermore, the research was carried out during the summer, and the boars sometimes sprayed themselves with water, which may be considered important for thermoregulation (BROOM and FRASER, 2007). Other grooming behaviour was head- or flank-scratching on the wall, but this was very rare, comparable to pigs in a semi-natural environment that spend only 1% of their behaviour in grooming activities (STOLBA and WOOD-GUSH, 1989).

Urinating and defecating were rarely observed. Interestingly, urination by one boar sometimes elicited other boar to urinate, so it may be debated if urination is a kind of display that has some meaning in social context.

We observed boars in five typical body positions described previously for sows, which are lying on the belly, lying on the flank, standing, walking and sitting (HÖTZEL et al., 2003; STOLBA and WOOD-GUSH, 1989). These body positions may be connected to certain functional behaviours and therefore may represent an easier approach to boars' welfare through a body language research approach (WEMELSFELDER et al., 2001).

The dominant position was lying on the flank (55% of observation time) and belly (12% of observation time). In this research, lying was connected with motionlessness and not reacting to environmental changes. However, as emphasized by STREET and GONYOU

(2008), two lying postures may reflect different motivational states in pigs, i.e. they are followed by more active or more passive behaviours. Additionally, lying on cold surfaces may be how pigs cool themselves in a hot environment. Therefore, in our research this can be considered as a sign of reduced welfare since boars suffering from heat should have a more reliable cooling method. Although in our observation it was not possible to determine the motivation for lying, the ratio of these two body positions should be important in welfare assessments.

Standing was the most frequently used body position by boars, although they did not stand for long (30% of observational time). This is the most active position, because it is usually connected with observing the environment, grunting and eating. The boars walked for only 2% of the observation time. Since it is known that locomotive behaviour is significantly influenced by pen space (MORRISON et al., 2003) and each enclosure was small (14.25 m²), such results could be expected. In a semi-natural environment, boars spend 10% of the daytime walking (STOLBA and WOOD-GUSH, 1989). Therefore, more space and substrate for rooting could motivate boars to move and could be a way to reduce the boars' weight and increase leg soundness, as a possible problem of some boars in intensive production (LEVIS, 1997), and consequently a way to improve productive efficiency and welfare.

Sitting could be transition position between lying and standing as described by SCHMID and HIRT (1993) for sows. In our experiment, boars sat for 1% of the observation time. One animal drank water in this position. Furthermore, some boars were never observed sitting. Still, this position has not been described in pigs in a semi-natural environment (STOLBA and WOOD-GUSH, 1989) and may be considered as a sign of reduced welfare.

Conclusions

In this study, behavioural diversity and the presence of stereotypes were not a good approach to evaluate boars' welfare. Since domesticated animals are adapted to a man-made environment, we concluded that it is necessary to have more subtle methods to evaluate how they cope with their environment. From the perspective of this study, suggested measurement of boars' welfare could be the duration and frequency of their vigilance, since typically they will be motionless most of the time. The duration of pig species-specific behaviours, like rooting and scenting, could be an important measurement in approaching their welfare, because it is poorly exposed in a barren environment, and environmental enrichment should stimulate those behaviours. The third measure, already studied for other pig categories (HILLMANN et al., 2004) and other farm animals (MANTEUFFEL et al., 2004), is the diversity of the boars' vocalization, but this needs further research.

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SAŽETAK

Potrebe nerasta (*Sus scrofa*) u odnosu na smještaj i izražavanje normalnoga vladanja, nisu dostatno istraživane kada se uzme u obzir važnost istih u poboljšanju dobrobiti i proizvodnosti. Budući da je definiranje vladanja pojedinačnoga nerasta ključno za dobivanje kvantitativne informacije o njihovim smještajnim potrebama, cilj ovog istraživanja bio je odrediti etogram rasplodnih nerasta i definirati najvažnija ponašanja koja mogu biti mjere dobrobiti. Rasplodni nerasti bili su promatrani u boksovima tri sata prije korištenja za pripust. Nerasti su pokazali 13 funkcionalnih ponašanja (jedenje, pijenje, defeciranje, mokrenje, rovanje, njušenje, timarenje, roktanje, društveno ponašanje, elemente spolnoga ponašanja, promatranje okoline, stereotipije, mirovanje) i pet položaja tijela (ležanje na trbuhu, ležanje na boku, stajanje, hodanje i sjedenje). Dominirala su ponašanja mirovanja i jedenja. Glasanje nerasta razlikovalo se po zvučnosti i trajanju. Dominantni položaji tijela bili su ležanje na boku i trbuhu. Ležanje je bilo povezano s mirovanjem i nereagiranjem na promjene

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u okolišu. U ovome istraživanju, repertoar prikazanih ponašanja i stereotipije nisu bili dobri pokazatelji za procjenu dobrobiti nerasta. Stoga smo zaključili da je prijeko potrebno imati osjetljivije metode za procjenu odnosa nerasta s njihovim neposrednim okolišem, pa budući da nerasti uglavnom miruju, predlažemo da se za mjerenje dobrobiti rabi učestalost njihove aktivnosti. Nadalje, trajanje ponašanja koja su tipična za svinje, kao što su rovanje i njušenje, mogla bi biti ključna za procjenu njihove dobrobiti zbog toga što su rijetko pokazana u osiromašenom okolišu, a obogaćeni okoliš treba ih potaknuti. Treća moguća mjera dobrobiti rasplodnih nerasta moglo bi biti njihovo glasanje.

Ključne riječi: nerast, ponašanje, dobrobit, smještaj
