

BEHAVIOUR OF HENS DEPRIVED OF DUSTBATHING

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ABSTRACT

Aim of this study was to confirm the hypotheses that dustbathing behaviour of adult hens is influenced by previous manners of housing. We used 40 hens; first group was from enriched cages (EC) and second group from conventional cages (CC). The observations were performed in an experimental aviary equipped with dust bath of ash. There was a barrier – a ford with water – that prevented them from entrance into the ash bath. The observations were performed during 12 hours of light, in 5 consecutive days. During this time the ashbath was accessible with changing difficulty from 1 to 5 days. The duration of eating was higher in the EC group. The greatest difference was observed at difficulty level 3 (302 versus 207 min; $P < 0.001$). Locomotion and standing were longer in the CC group throughout all difficulties. Durations of perching were higher in the CC group ($P < 0.05$) and increased from difficulty 1 to difficulty 5. The length of vacuum dustbathing was shorter in the EC group than in the CC group (1.2 min vs. 4.2 min) per one hour of observation. The average length of normal dustbathing represented 6.6 min (EC) or 5.4 min per hour (CC). The results suggest that the manner of preliminary housing in enriched or conventional cages can have an influence on hen's behaviour.

Key words: hen; maintenance behaviour; dustbathing

INTRODUCTION

Conventional cages for laying hens are to be banned in the EC in 2012. Already minimum cage dimensions and floor slopes have been changed. It is proposed that hens must be provided with perches and a nesting area. There are a littered area for scratching and dustbathing. It is still unclear whether hens actually suffer from not being able to dustbathe and perform certain other activities in cages (Fraser and Broom, 1997; Cooper and Albentosa, 2003).

Dustbathing of birds is an important part of their behaviour. This activity called also grooming behavior, defined as combination of preening and scratching, is known to be critical for defense against ectoparasites (Clayton *et al.*, 2010). Hen hatched with dustbathing predisposition. The preferred time of dustbathing is the middle of the day and females of *Gallus gallus domesticus*, living under natural conditions, perform

dustbathing every second or third day (Wichman and Keeling, 2009). A basic goal of this behaviour is the removal of stale feather lipids, which attract parasites (Olsson *et al.*, 2002 b). However, the functions are still an open question. New housing systems for commercial egg production should improve the welfare of laying hens. Enriched cages include dust baths to provide birds with the opportunity to perform dustbathing behaviors (Mench and Duncan, 1998). Thus, these new housings are thought to satisfy the dustbathing motivation of hens more than in conventional cages, in which no litter area is present. However, there is no concrete evidence that non-cage systems, particularly aviaries, satisfy hens' motivation to dustbathe and thus improve welfare in terms of dustbathing behaviour (Van Niekert and Reuvekamp, 1999; Rodenburg *et al.*, 2005).

Hens in cages perform vacuum dustbathing on the wire-floor. Such behaviour is noticed in conventional cages and even in enriched cages which include a

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dustbath. The vacuum dustbathing pattern exhibited by birds that dustbathe without litter could be a sign of frustration; an indication that dustbathing without litter does not provide the required welfare (Widowski and Duncan, 2000; Wichman and Keeling, 2009). Vacuum dustbathing behaviour cannot be explained only by the absence of litter (Moesta *et al.*, 2008; Larsen *et al.*, 2000). It can be the result of social facilitation (Olsson and Keeling, 2002). If other hens observing a hen dustbathing in the dustbath become more motivated to dustbathe themselves, they may have to vacuum dustbathe on the floor. If the hens are prevented from dustbathing as chicks, or as pullets when first moved to the enriched laying cages, they may persist in vacuum dustbathing even if a dustbath is made available to them. Olsson *et al.* (2002 a) supposed an effect of habituation or early experience on sham dustbathing. The key element in layer housing is the material for dustbathing. Hens prefer litter of fine and loose structure, which penetrates easily into plumage. The preliminary results showed that the cheapest and most available material remains ash.

MATERIALS AND METHODS

In the experiment 40 laying hens of ISABROWN hybrid at the age of 28 weeks from two different housings were used. Twenty layers were from enriched cages (EC) and twenty ones were from conventional cages (CC). Observations were performed in two aviaries (for groups EC and CC). Pens were placed in a climate-controlled room. The environmental temperature was 18 °C. All groups had access to three drinking cups and one square feeding trough placed along one of the walls of the pen. Feeding regimes were recommended by suppliers of commercial layers. Water and a commercial feed were provided *ad libitum*.

Times of feeding, drinking, walking, standing, sitting, perching, and the number of aggressive contacts were recorded. Dustbathing was determined as vacuum dustbathing (in the aviary) and normal dustbathing (in the ash bath). The water ford obstructed the access to ash bath and it helped to examine the motivation and will of layers to cross it and dust bath. The observations were performed during 12 hours of light-day (from 7 h to 19 h) in five consecutive days.

The method with changing difficulty to entry in bathing place was used (Kottferová *et al.*, 2008). Difficulty 1 (first day) - free entry; difficulty 2 (second day) - entry over water depth of 2 cm; difficulty 3 (third day) - entry over water depth of 7 cm; difficulty 4 (fourth day) - entry over water depth of 15 cm and difficulty 5 - entry over water depth of 18 cm (Table 1). Aggressive behaviour of hens was recorded in aviary and in the ash bath as number of aggressive contacts.

Table 1: Entry to ash bath during experiment

Day	Difficulty	Water depth (cm)
1	1	-
2	2	2
3	3	7
4	4	15
5	5	18

The observations were performed during 12 hours of light-day in five consecutive days. A method with 1 minute interval was used. The results were calculated by ANOVA using a statistical package STATISTIX, Version 8.0. We used 4 ANOVA factors with fixed effects and n=60 observations in i, j, k and l-th subclasses.

RESULTS

Sequence of maintenance activities changed with difficulties 1 and 5. Eating was the most recorded behaviour throughout all difficulty levels and the values were higher in the EC group. Times differed significantly among groups (Fig. 1). The greatest difference was obtained at difficulty level 3 (302 ± 98 min versus 207 ± 113 min; P<0.001). Locomotion and standing were behaviours with similar course; the times were higher in the CC group throughout all difficulties (Figures 2 and 3). We did not find significant differences in behaviours of sitting and drinking between groups. The second most often activity was perching, the time increased almost regularly from difficulty 1 to difficulty 5 (Fig. 4). Times of this behaviour were higher in the CC group, differences were found in the second and the fifth difficulty (72 ± 64 min versus 104 ± 88 min; 105 ± 80 min versus 156 ± 102 min; P<0.05).

We tested also the hypothesis whether limitation of access to dustbathing substrate influences aggressive behaviour of hens. From 2 factors variance analysis of aggressiveness in aviary and in the ash bath follows that highly significant differences exist between difficulty and time of observation. Two factor interaction - difficulty*observation time was also statistically highly significant. From the viewpoint of the time, we noticed the greatest occurrence of aggressive contacts in the ash bath at hour 18 and in the aviary area at hour 8.

The average length of vacuum dustbathing was lower in the EC group than in the CC group (1.2 min vs. 4.2 min) per one hour of observation. During hours 8 to 10 and 15 to 19 of the observation, no one layer performed dustbathing from the EC group. No one hen performed the dust bathing in the difficulty 5. In the CC group no layers dustbathed during 8, 16 and 19 hours of the observation. We did not notice dustbathing with

difficulties 4 and 5. No statistical differences were observed between groups.

The shortest time of normal dustbathing was 1.2

min with difficulty level 4, and the longest time 19.8 min with difficulty 1 per hour of observations in the EC group.

The shortest dustbathing was at hour 8, and the longest at

Figure 1: Average times spent eating according to difficulty levels

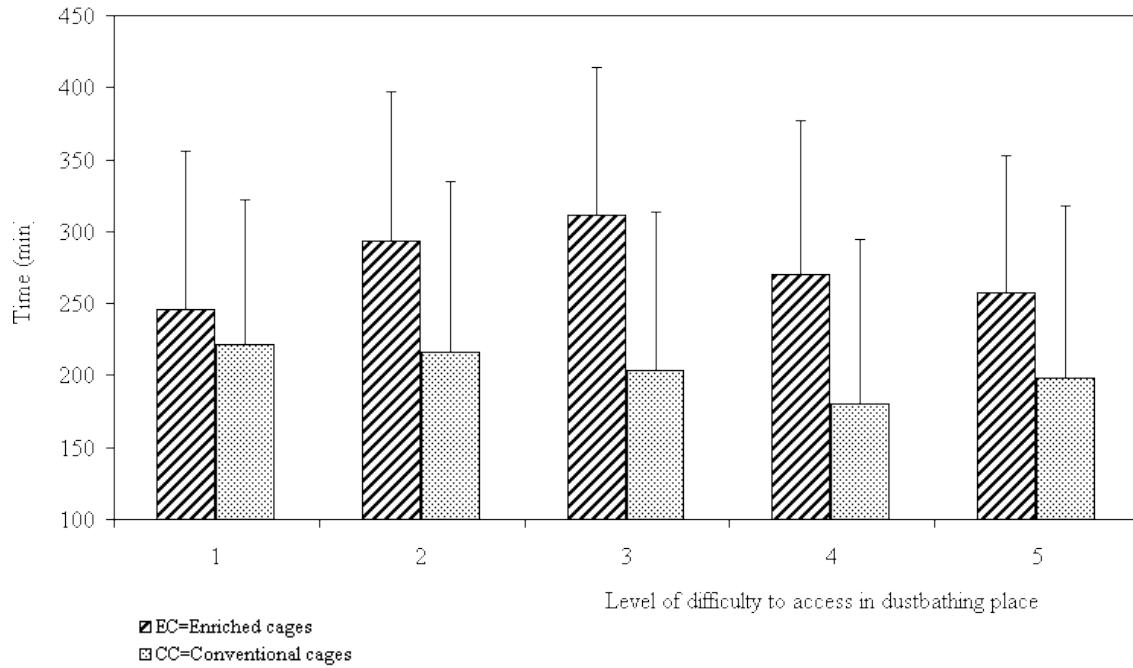


Figure 2: Average times spent by movement according to difficulty levels

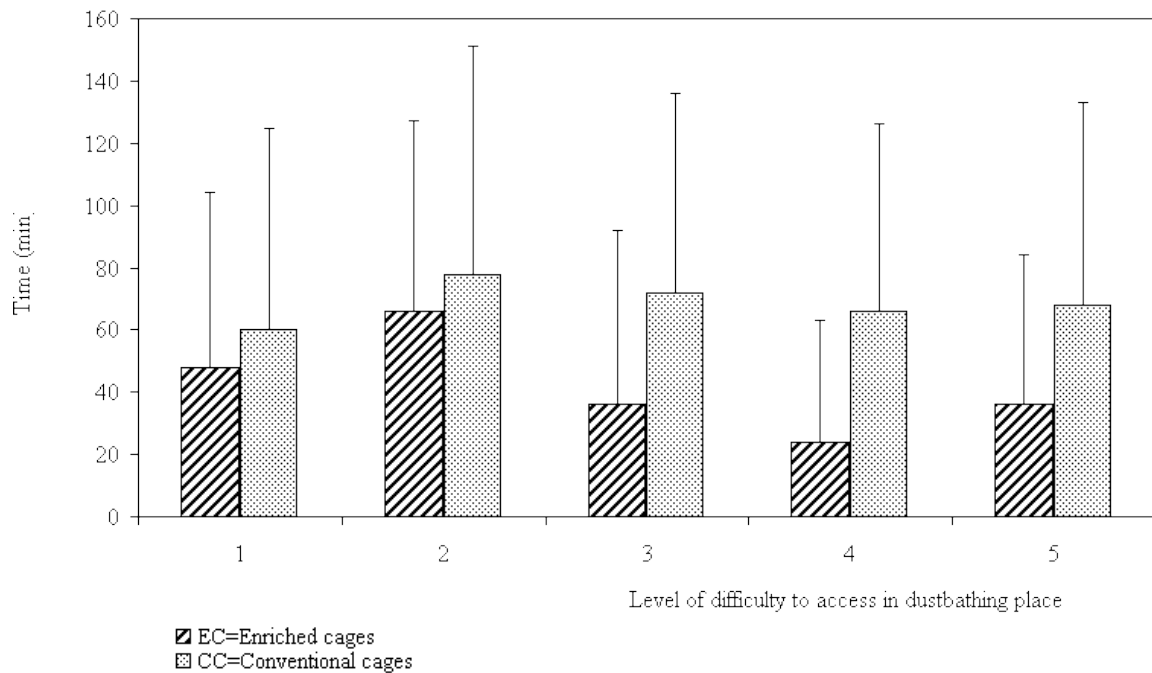
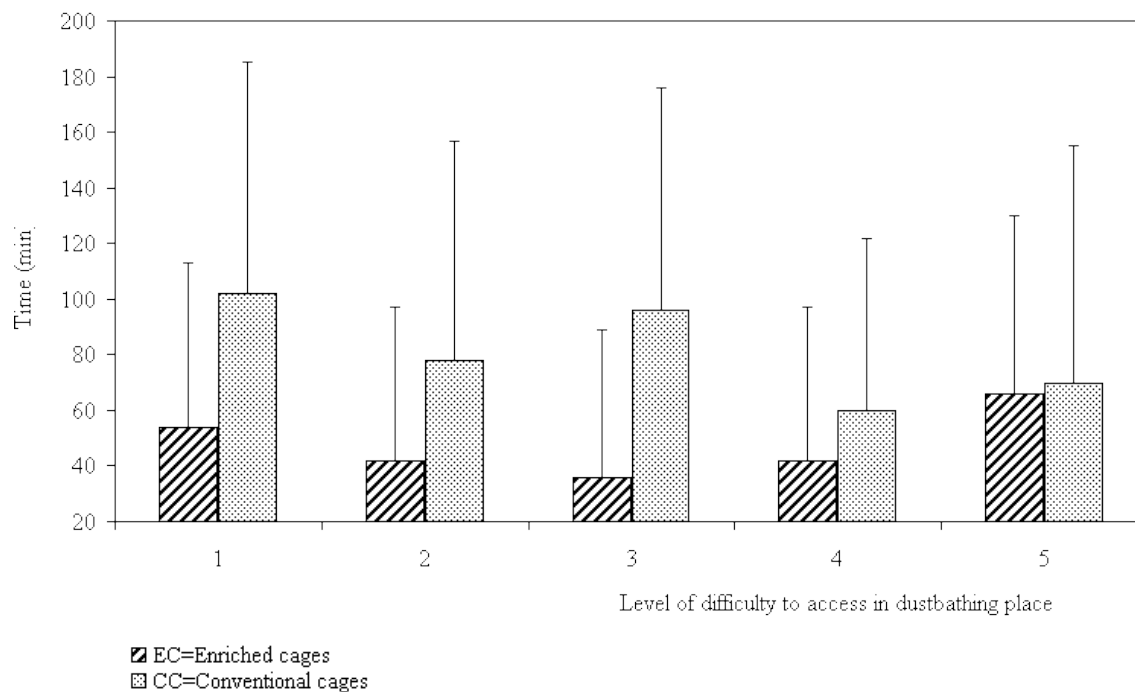
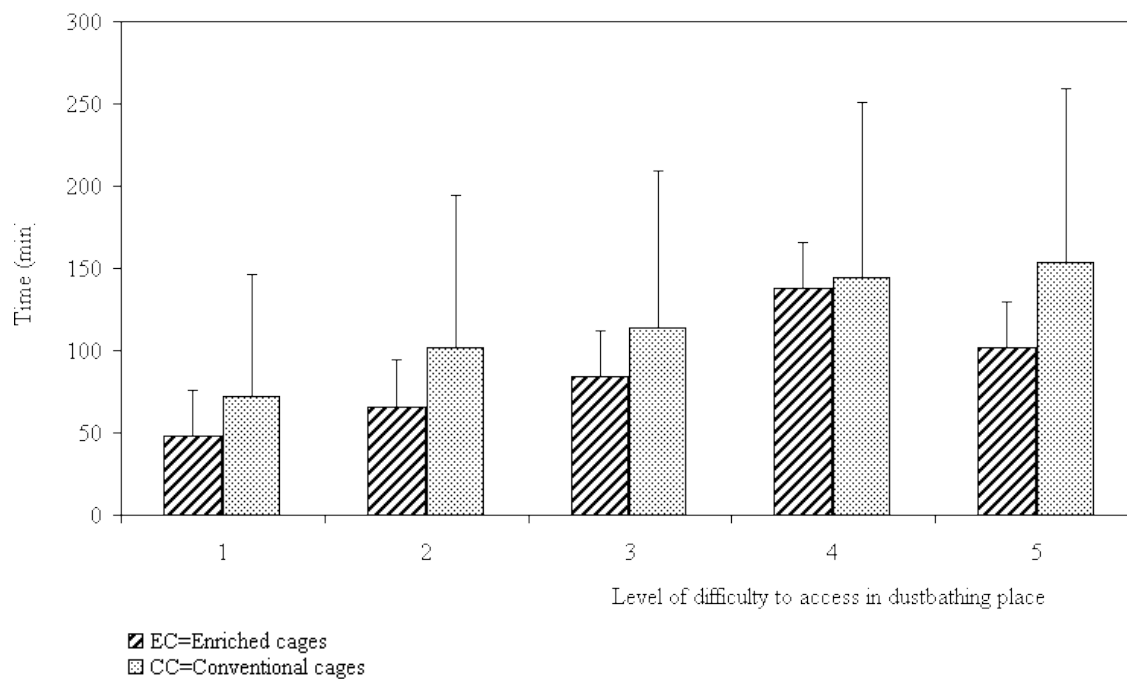


Figure 3: Average times spent standing according to difficulty levels**Figure 4: Average times spent on the perch according to difficulty levels**

hour 10 of the observation.

The average length of dustbathing with all layers in the given type of housing represented 6.6 min per hour. In the CC group we found the lowest value of dustbathing

(1.2 min) with difficulty 5 and the highest value (10.8 min) with difficulty 3. The average length of dustbathing was 5.4 min per hour of observation. During hour 8, no layers were dustbathing. The hens spent by dustbathing

13.8 min at hour 18. We recorded significant differences between groups in the difficulty 1 only ($P < 0.05$).

DISCUSSION

In the present study, females of domestic fowl were reared since hatching with or without access to dust bathing material. Their responses to the dust bath were influenced by previous experience. There were no differences in drinking and sitting times between rearing groups, however, dust bath-reared hens from enriched cages showed more food eating than second group. Times of movement, standing and perching were higher in hens kept in conventional cages. It would be influenced by former housing (Vestergaard *et al.*, 1990). We found out that restriction of normal dustbathing changes sequence of other activities. Feeding and partially drinking were activities, which kept their position during the whole course of the experiment. Other studied activities changed their order by one or two positions at the most. However, no activity rose markedly, therefore we think that normal dustbathing is of low importance for hens. As many factors influence the variability of behaviour, it is difficult to determine, which importance we can give to the factor studied in our experiment.

Analysis of variances found significant differences among technologies and significant differences between levels of difficulty and hours. However, it is necessary to say that factor interactions were also statistically highly significant. In such case, it is difficult to judge about the influence of main factors.

The length of vacuum dustbathing was shorter in the EC group than in the CC group. The average lengths of normal dustbathing were similar (6.6 min vs. 5.4 min per hour). These results indicate that the missing experience with a dusty substrate may contribute to the initiation of vacuum dustbathing. It can imply that vacuum dustbathing may be sometime normal dustbathing (Liere van, 1991; Duncan and Fraser, 1998).

The absolute time spent normal dustbathing per day was unaffected by the rearing or previous housing. Surprising is the fact that total length of dustbathing was the longest in the aviary. This finding confirms that dustbathing to a great deal is controlled by internal mechanisms. Some layers in spite of having access to bathing substrate without obstructions were satisfied with vacuum dustbathing.

As far as external factors are concerned, visual, light and thermal stimulation influence the performance of dustbathing. Surprisingly, total time of dustbathing was the longest, or belonged among the longest, right with difficulty 1 in aviary. With the same difficulty reached dustbathing maximum values also in comfortable ash place. The finding of Duncan (1998; 2004) that

dustbathing is controlled by internal mechanisms to a high extent confirms this finding. Some hens got along with vacuum dustbathing although they had access to dustbathing substrate without obstruction. Our results also showed that dustbathing is conditioned not only by accessibility of dustbathing substrate but also by a complex of other factors, e.g. individual variability of

If hens were raised and kept without litter material (for example the CC group) they could perform alternative vacuum dustbathing (Lindberg and Nicol, 1997). If birds gain access to litter over a longer time, they change their preference and begin to use the more functional dustbathing (Vestergaard and Hogan, 1992s). This implies that vacuum dustbathing is not satisfying as normal dustbathing.

Tendency to dustbathing changes according to the part of the day; it occurs more often in the middle of day. This information was confirmed also in our experiment, with the maximum value of dustbathing from 10 to 16 o'clock. If the birds are deprived of opportunity to dustbathe, the tendency to dustbathe increases with the time of deprivation; crossing the wet ford decreased with increasing difficultness but total length of dustbathing in ash place was not the shortest.

Our results can indicate that hens' motivation to dustbathing was more satisfied in aviaries than in former housing in enriched and conventional cages. Thus, laying aviaries improve hens' welfare in term of dustbathing behaviour compared with conventional cages. It is generally accepted that alternative housing systems should provide opportunities for both dustbathing (de Jong *et al.*, 2007)

The restricted access to dustbathing substrate can cause aggressive behaviour in hens. With aggressiveness is involved not only the introduction and stabilization of relations among individuals in the stable group but also the permanent pursuit and suppression of weaker individuals in the flock. Therefore it occurs also in social stable group and it is necessary to pay greater attention to each factor, which could make the situation even worse (Olsson *et al.*, 2002 a). In the present study significant differences between difficultness and time of observation, but not between groups have been determined.

We can notice that enriched cages have been developed in response to the demand for improved hen welfare. However, vacuum dustbathing behaviour on the cage floor is recorded in conventional and also in enriched cages despite the presence of a dustbath with litter. Moreover, enriched cages seldom have enough space in the dustbath for more than one hen, and this could lead to frustration and detrimental behaviour from the other hens (Oden *et al.*, 2002). This implies that if birds are seen to perform sham dustbathing on the floor, the quality of the litter in the dustbath place is not optimal or it is not sufficiently accessible. The fact that hens performing

dustbathing without litter may indicate that these birds are frustrated due to lack of feedback from missed material (Sanotra *et al.*, 1995; Shields *et al.*, 2004). This would imply that dustbathing without litter is not able to replace functional dustbathing. From an animal welfare point of view this study further supports the view that dustbathing in a suitable substrate is a behavioural need in laying hens.

CONCLUSION

The results of the present study suggest that the manner of preliminary housing in enriched or conventional cages had influence on hen's behaviour. However, the deprivation of the possibility to normal dustbathing was not a sufficient cause for suffering in layers. It would be important to examine further the relationship between bedding type, dustbathing, and leg condition. We can conclude that motivation of hens to dustbathing was more satisfied in aviary than in ashbath after obstruction overcome.

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