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Nest choice in laying hens: Effects of nest partitions and social status

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ABSTRACT

Nest choice in loose-housed laying hens is influenced by nest characteristics, position and social factors. We examined the relative preference of laying hens for two group-nests differing in the presence or absence of a partition in the middle of the nest and whether this was influenced by social status. We hypothesized that hens would prefer the partitioned nest as it provides more enclosure, and that social status would affect nest choice.

Relative preference for the nests was assessed in a free choice preference test conducted in two consecutive trials each with eight groups of 20 hens from 18 to 31 weeks of age. The hens were individually marked and had access to two commercial group-nests (49 × 114 cm), one of which contained an internal wooden partition (30 × 10 cm) which divided the nest in two halves. At 28 weeks of age, the position of the nests was switched. The number of eggs laid was recorded daily. On one day each at 24 and 28 weeks of age (after the nest switch) video recordings were made of the first 5 h of daylight. From these videos we recorded the number of nest visits per egg per nest and the number of nest visits for individual hens. On one day each at 24 and 27 weeks of age we also recorded videos from within the nests to assess individual nest choice for egg-laying. In addition, we recorded aggressive interactions between individual hens during the first hour of light on one day each at 18, 24 and 27 weeks of age to establish social status.

We found a relative preference for the partition nest with a greater proportion of eggs laid in these nests as well as fewer nest visits per egg. The hens were also consistent in their egg-laying location over the two days of observation. After the nest switch, however, the hens did not switch egg laying location and the number of visits per egg no longer differed between nests suggesting that the preference for the partitioned nest was only important at the beginning of lay. In addition, although social rank had no impact on preference of nest type, lower ranking hens performed more nest visits and laid their eggs slightly later on the second observation day (week 27 of age) compared with higher ranking hens. Therefore, the use of partitions could improve the attractiveness of group-nests.

1. Introduction

Non-cage systems for laying hens utilize the motivation of hens to lay their eggs in an enclosed area in order to allow automatic egg collection. To ensure a working system, attractive nests must be provided to avoid floor eggs and to improve animal welfare by allowing hens to perform highly motivated pre-laying behaviour (Cooper and Appleby, 1995; Duncan and Kite, 1989; Kruschwitz et al., 2008a). The attractiveness of a nest is influenced by various factors including physical characteristics such as amount of enclosure and floor type (Duncan and Kite, 1989; Kruschwitz et al., 2008b; Stämpfli et al., 2011), position (Huber-Eicher, 2004; Lentfer et al., 2011; Riber and Nielsen, 2013) and presence of other hens (Riber, 2010, 2012). Individual hen factors such as hormonal status, age, and social rank are likely to play a role as well.

In response to the current industry trend of increasing the area of group-nests due to economic reasons, we compared two group-nests differing in size (0.43 m^2 vs. 0.86 m^2) in a previous study and found that hens laid more eggs and performed fewer nest visits per egg in the smaller nests (Ringgenberg et al., 2014a). When comparing the number of visits per egg per nest in a preference test, the nest with the fewest visits per egg is considered to be more attractive

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as more of its visits result in egg-laying. Although small group-nests are attractive to hens, in large aviaries such nests may be associated with an increased risk of overcrowding in preferred locations like the ends of nest rows (Clausen and Riber, 2012; Lentfer et al., 2013; Niebuhr, 2007; Riber and Nielsen, 2013). An alternative to smaller nests would be to partition larger nests internally into smaller areas, thereby increasing nest attractiveness without promoting overcrowding.

The use of partitions in nests has not been investigated before but Duncan (1978) reported that feral hens had their nest sites well concealed, mostly utilizing a vegetative cover. Knowing that hens are highly motivated to lay their eggs in an enclosed area (Appleby and McRae, 1986; Zupan et al., 2008), we hypothesized that a central partition in a large nest would increase nest attractiveness.

Pre-laying behaviour and nest site selection are also affected by social factors, including the presence of hens (Riber, 2012), the identity of those hens (Ringgenberg et al., 2014a), and their relative social status (Freire et al., 1998). There are however conflicting results on whether social status affects nest site choice; i.e. whether higher ranking hens have preferential access to the most attractive nesting locations (Freire et al., 1998; Rietveld-Piepers et al., 1985). Social status affects priority access to other resources such as feed (Banks et al., 1979; Collias and Collias, 1967) and space (Keeling and Duncan, 1989; Odén et al., 2004) and we hypothesized that if there was a preferred nest, social status would affect nest choice.

We used a free choice preference test to assess relative preference among two group-nests, differing only in the presence or absence of a partition, and to examine the pre-laying behaviour of hens kept in small groups. Furthermore, we explored the social status of the hens, using David's score (David, 1987), in terms of nest choice and timing of egg-laying. We expected hens to show a relative preference for nests offering a greater degree of enclosure and some structural complexity, i.e., the partitioned nest. We also expected that hens with a higher social rank would lay more eggs in the preferred nests and would perform fewer nest visits than subordinate hens.

2. Materials and methods

2.1. Animals, housing and treatments

The Cantonal Veterinary Office approved this experiment (Bern, Switzerland, Approval BE27/13) and we followed the ethical guidelines of the International Society of Applied Ethology. The experiment was conducted over two consecutive trials, the first conducted from May to August 2013 and the second from September to December 2013. For each trial, 160 LSL non beak-trimmed laying hens were reared in one group with ad libitum access to water, feed, perches and sawdust bedding from 0 to 17 weeks of age. At 18 weeks of age, the birds were moved into the experimental barn and randomly assigned to eight pens in groups of 20 animals. The hens were individually marked with numbered PVC plates (8 × 6 cm) mounted on the back of the hens with two straps that went under the wings (as in Harlander Matauschek et al., 2010). Daigle et al. (2012) studied the behaviour of hens outfitted with similarly mounted sensors and found that aggressive interactions were not affected and that the hens habituated to the tags within two weeks in terms of resource use.

The pens were arranged in rows (two rows of three pens and one row of two pens) and were identical in size (3 m × 3 m) with sawdust bedding, three perches and ad libitum access to feed and water. To prevent seasonal effects of daylight, only artificial light was provided. At 18 weeks of age, the hens had 10 h of light from 6:30 to 16:30 h with a 15 min twilight phase at the beginning and end of the day. Light exposure was then gradually increased by 30 min each week until 15 h of light was reached at week 28 of age (1:30 to 16:30 h); the photoperiod then remained constant for the remainder of the study (until week 33 of age). The mean temperature was 21.3 ± 4.5 °C in the first trial and 16.1 ± 1.9 °C in the second trial. After the experiment, the hens were sold to local farmers.

The hens had unrestricted access to two commercial group-nests (0.56 m^2) positioned across from each other on either side of the pen door (Fig. 1). The nest positions (left or right of the door) were balanced across pen and trial. The nests were identical with the exception that the partition nest contained a wooden partition 10 cm high and 1 cm wide in the middle of the nest (Fig. 1). The partition was only 10 cm high in order for the hens to be able to move over the partition. The nests were of a rollaway type with a green Astroturf® covered floor sloping towards the front, allowing for manual egg collection underneath the nest entry platform. The nests were closed at the front with a plastic red curtain with two openings (width = 24 cm, height = 30 cm). The outer appearance of the nests was identical. The small width of the partition only marginally affected the actual surface area and volume of the two nest types (0.54% less surface area and 0.1% less volume in the partition nest compared to the control).

During week 28 of age, after the hens had been in full lay for four weeks, we switched the position of the nests in order to determine if hens would follow their preferred nest for egg-laying. In order to control for the effect of the nest vs. the partition, we swapped only the partition in half of the pens and the entire nest in the other half of the pens.

2.2. Data collection

The number of eggs per nest was recorded daily for the entirety of the experiment. A digital video camera (Samsung SCO-2080R) was located above each pen to provide a complete view of the nest exterior and surrounding floor; two infra-red video cameras (Conrad, BP258IR) were mounted in each nest.

Videos inside of the nests were taken on one day during week 24 of age and on one day during week 27 of age. Using continuous recording and focal animal sampling, we determined the timing of egg-laying of individual hens before possible disturbances associated with the nest switch.

Videos of the pen surroundings were taken on one day during week 24 of age and on one day during week 28 of age (after the nest switch). Using continuous recording and focal animal sampling, the number of nest visits of individual hens was assessed during the first 5 h of daylight (Table 1). Based on these observations, we further calculated the number of nest visits per egg for each nest (total number of visits per day/number of eggs per day) and the mean number of nest visits per hen per day.

To assess the relative social status of individual hens, we used continuous recording and focal animal sampling for the first hour

Table 1
Ethogram of behaviours recorded for individual hens (adapted from Cordiner and Savory, 2001; Lentfer et al., 2011; O'Connor et al., 2011; Struelens et al., 2005).

Behaviour	Definition
Enter nest	Hen enters the nest, whereby the head and at least one foot are inside the nest
Exit nest	Hen moves out of the nest, whereby the head and at least one foot are outside of the nest
Aggressive interaction[a]	Rapid peck(s) between two hens, the retreating hen was defined as the loser of the interaction

[a] If there was no clear winner, the interaction was recorded but not used to calculate the David's score.