SHORT COMMUNICATION

DICHOTOMY IN CHOICE OF NEST CHARACTERISTICS BY CAGED LAYING HENS

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Abstract *Animal Welfare 1994, 3:* 313-320

Soiling of nests in modified cages for laying hens might be reduced by using a wire mesh floor for the nest. However, use of such a material might be contrary to the preferences of the hens and compromise their welfare. Twenty-four laying hens were housed singly in modified cages which incorporated two nests. One nest had the standard perforated plastic floor whilst the other had one of two types of metal mesh floor. To determine whether hens preferred any one of the floor types for oviposition, the positions of the nest floors were swapped three times during 110 days. The hens showed a dichotomy in their behaviour after the nest floors were swapped: the majority (12 of those making a consistent choice) continued to lay in the same nest location (ie location conservative) whereas 6-9 hens changed the nest in which they laid (ie floor type conservative). Only one of the floor type conservative hens preferred to lay on metal mesh. These results show that although the majority of hens showed no apparent aversion to laying in nests with metal mesh floors, 57-68 per cent preferred plastic floors and changed location to lay on this substrate.

Keywords: *animal welfare, hens, laying behaviour, modified cages, nests*

Introduction

Laying hens are highly motivated to seek access to a suitable nest site in the hours before oviposition (Duncan & Kite 1987; Smith *et al* 1990). If a suitable site is not available, they often exhibit behaviours indicative of frustration such as increased pacing, reduced sitting, and displacement activities (Duncan & Wood-Gush 1972; Wood-Gush 1972; Meijsser & Hughes 1989). Several characteristics of nests (eg mouldability, depression) have been demonstrated as preferred by hens (see Appleby *et al* 1984b; Huber *et al* 1985; Kite 1985; Hughes *et al* 1989; Reed & Nicol 1992). These characteristics are not possessed by wire mesh and placing hens in conventional cages which offer only a wire mesh floor to lay on presumably causes frustration and suffering (Dawkins 1990). Modified cages which incorporate nests might overcome this problem. Investigations of such a system at the University of Bristol have revealed that hens repeatedly and consistently used pre-moulded, plastic nests with perforated plastic floors (Sherwin & Nicol 1992, 1993a,b). However, there was a tendency for faeces to be dropped in the nests during general activity and roosting. These accumulate causing a potential hygiene and welfare problem (see also Robertson *et al*

1989; Appleby 1990; Appleby & Smith 1991; Reed & Nicol 1992). Soiling may have been exacerbated by the small perforation size of the plastic nest floors and might therefore be reduced by replacing the floors with larger metal meshes allowing faeces to drop out of the nest. This solution would pose another welfare concern. If the wire mesh of a cage floor does not satisfy the needs of laying hens as discussed above, hens might also avoid laying in nests with a floor of similar material. The present study examined the preferences of hens for laying on plastic or metal mesh nest floors. Such studies on the preferences for laying substrates have been conducted previously, but not using hens in modified cages with incorporated nests. The results showed an unexpected but clear dichotomy in the choice behaviour of hens for location of nest, or its floor type.

Methods

Twenty-four, commercially cage-reared Hi-Sex layers at 14 weeks of age were placed singly (to avoid interference from cagemates) into modified cages. The cages were essentially a conventional design measuring 45x60x40cm (height x width x depth) incorporating two roll-away nest hollows at the rear (Figure 1). The hollows were rectangular (25x30cm), moulded plastic depressions sloping from 7cm depth at the front to 12cm at the rear. The hens entered the front of the nests which adjoined the rear of the cage. The ceiling of the nest area was 20cm high, and adjacent nests between and within cages were partitioned with plywood. Food troughs (containing standard layers' mash replenished daily) were located at the front of the cages and water was available from overhead nipples. The floor slope was five degrees. Twenty-four cages were constructed as two banks that were placed facing each other, each comprising three tiers of four cages.

In each cage, the moulded plastic floor of one nest was replaced with one of two welded wire mesh types. The standard plastic nest floor (P) was a lattice of 3mm plastic making 8mm squares. The first metal mesh type (R) was 1.90mm thick wire arranged as a rectangle 25x76mm; the cage floor also comprised the same mesh. The second metal mesh type (S) was 2.54mm thick wire arranged as a 26mm square. Both R and S floor types were allocated to cages accounting for differences in tier, position in the tier, position in the cage, and the bank of cages.

Lighting was by timed fluorescent lights, initially on between 0600h and 1800h increasing to 0600-2400h six weeks later. All routine husbandry was conducted after 1200h to avoid disturbing the hens during egg-laying.

To determine whether the hens showed a preference for nest floor type during oviposition, the nests (and thus the floor types) within each cage were swapped on three occasions, ie 45d, 85d and 99d after the last hen had laid her first egg. At 1700h each day, the location in which each egg had been laid was noted and the eggs collected. A 'consistent' choice of site prior to laying was defined post-experimentally as 'all five eggs prior to the nests being swapped were laid in one site', and 'consistent' subsequent to laying as 'seven or more of the 10 eggs after the swap were laid in one site'. These proportions were arbitrary; the different criteria were chosen as it was believed site choice subsequent to a swap was likely to be more variable. Differences between consistent preferences for plastic or metal meshed floors were tested by the *G* test (Sokal & Rohlf 1981).

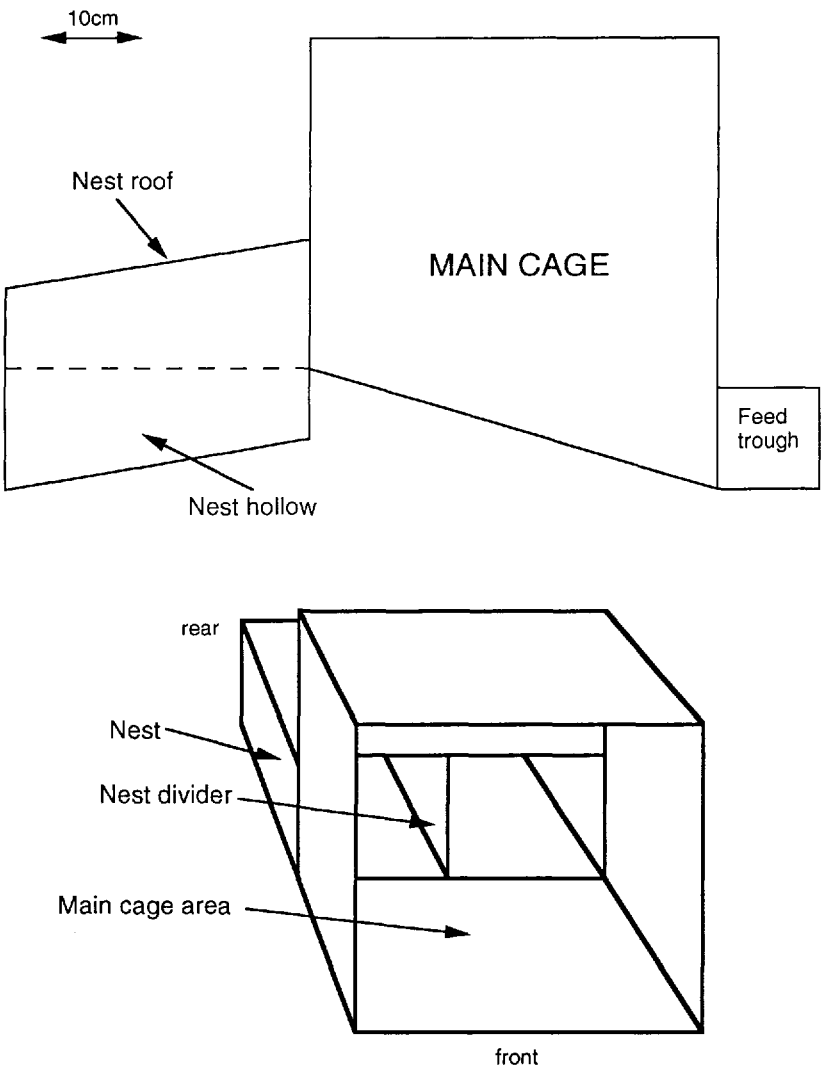

Figure 1 **Schematic representations of the modified cages which incorporate two nests at floor level. Top: side view (to scale); bottom: 3-D view (not to scale); see text for dimensions.**

Results

Several hens tended to lay soft-shelled or brittle eggs on the cage floor, even if they had previously been using a nest consistently. Wood-Gush (1963) suggested that when laying such eggs, hens might be unaware of imminent oviposition. In the present study, this might have caused the hens to make an invalid choice of nest site, therefore soft-shelled and brittle eggs were excluded from the analysis.

During the five days prior to the first swap of the nests, 21 hens consistently laid in one nest, one laid on the floor, one stopped laying and another died. Of the hens which used one nest only, 13 laid in P nests and eight in metal-floored nests (G = 1.189; 1 df; P>0.05). After the swap, 18 of the 21 hens made a consistent choice of nest, two became inconsistent and one stopped laying. One hen continued to lay on the floor. Six hens changed the nest position in which they laid indicating conservativeness for nest floor type: 12 hens were conservative for location and laid in the same nest position despite the change in nest floor. Of the six hens conservative for floor type, five chose P nests and one the S nest (see Table 1).

Table 1 **The number of hens laying in nests with plastic or metal mesh floors before and after the floor types were swapped.**

	Number of hens					
	1st Swap		2nd Swap		3rd Swap	
Site laid in	Before	After	Before	After	Before	After
P nests	13	11	15	13	12	15
S nests	5	4	4	5	5	4
R nests	3	3	2	3	3	2
Cage floor	1	1	1	1	1	1
Consistent	22	19	22	22	21	22
Inconsistent	0	2	0	0	1	0
Nest floor type conservative	6		9		8	
Location conservative	12		12		12	
Cage floor conservative	1		1		1	

Prior and subsequent to the second swap, all laying hens (n = 22) made a consistent choice of site for oviposition. Nine hens were conservative for floor type; eight chose P nests and one chose a metal-floored (S) nest (G = 6.198; 1 df; P<0.05). Twelve hens were conservative for nest location (of which 11 were location conservative in the previous swap) and one hen, the same individual, continued laying on the floor.

Prior to the third swap, one hen laid three out of five eggs on the floor whereas the others (n = 21) were consistent in their choice. After the swap, all hens made a consistent choice of site. Eight hens were conservative for floor type; seven chose P nests and one (the same

hen as in the previous two swaps) chose a metal-floored (S) nest (G = 5.06; 1 df; P<0.05). Twelve hens were location conservative (all were location conservative in the previous swap), one changed from laying on the floor to laying in the P nest, and one hen, the same individual, continued laying on the floor.

Throughout the study, 20 hens laid at least one egg in the P nest showing that almost all the hens experienced using the plastic nest floor at some time.

Several hens were exclusive, or very nearly, in their choice of nest floor during 110 days of observation and throughout the three swaps of floor type. Two hens laid all their eggs on one nest floor type only (both P nests), and several others laid only one or two eggs on the least preferred type. One hen laid all her eggs on the floor and was never observed to use either nest for oviposition.

Six hens were conservative for floor type and 13 conservative for location over all three swaps. Two hens changed from being location conservative on the first swap to floor type conservative on the second and third swaps.

Discussion

The present study shows that considering the group as a whole, the hens were equivocal in their preference for laying on plastic or metal mesh nest floors in modified cages. An overall indifference to the substrate used for laying was also reported by Hughes (1993), who compared choices between wire mesh floors or a section of flat astroturf in conventional cages. The proportion of hens sufficiently motivated to change location to lay on plastic (5-8/23; present results) was slightly greater than that motivated to change location to lay on astroturf (2/12; Hughes 1993), though the statistical significance of this difference cannot be checked. Possibly, the use of moulded depressions, enclosure and isolation in the present experiment contributed to this greater proportion.

The apparent indifference to floor type reported here was confounded by the high proportion of hens that were conservative for nest location. For those hens with a floor type preference, this was clearly for plastic: only one hen changed location to lay on a metal mesh floor. Nonetheless, the metal mesh floors were not overly aversive to many hens; prior to the first swap of floor types, the number of hens choosing the metal or plastic nest floors was not significantly different indicating ambivalence of the group as a whole. Similarly, location conservative hens laid on metal mesh when this was swapped to their preferred location indicating no overwhelming aversion. This was also reported by Hughes (1993).

The hens used the pre-moulded nests consistently and repeatedly for laying, as reported previously for this housing system (Sherwin & Nicol 1992, 1993a,b). Only one hen consistently used the floor for laying, though several others used the floor occasionally – usually after a brief period of non-laying or when the eggs were brittle or soft.

Floor-laying in modified cages has been reported often (Bareham 1976; Robertson *et al* 1989; Appleby 1990; Appleby & Smith 1991; Sherwin & Nicol 1992, 1993b), and rearing experience, age at transfer and social factors have all been identified as having some influence (Sherwin & Nicol 1993b). In the present study, conditions were controlled to eliminate or reduce these effects, but floor-laying still occurred at a low rate (6.3%). Possibly,

the pre-moulded nests and/or the design of the cages were less suitable than repeated oviposition in the nests suggests, or alternatively, floor-laying in modified cages might be impossible to prevent other than in exceptional circumstances (see Reed & Nicol 1992).

There was a clear dichotomy in the hens' behaviour with respect to conservativeness. Although 6-9 hens patently preferred to lay on the same nest floor type, 12 hens consistently laid in the same location regardless of the floor type. Conservativeness for location of laying has been recorded in modified cages (Sherwin & Nicol 1992, 1993b), conventional cages (Wood-Gush & Gilbert 1969; Hughes 1993) and floor pens (Rietveld- Piepers *et al* 1985). In the present study, eight hens preferred to lay in the left nest (as viewed from the front) and four hens in the right. (Coincidentally, Hughes [1993] also reports that hens prefer to lay on the left.) There were no obvious factors eg light, noise, doorways, to account for any location preference. Eggs which did not roll from the nest were often found in exactly the same position in the nest, even after swapping the nest floors. Possibly, the location conservative hens differed from the floor type conservative hens in that they gained little information on the characteristics of the nests, did not integrate this information in the same manner, or considered both metal and plastic floors as equally unsuitable and laid in the same location because nowhere else was more preferable. It has been suggested that feral or free-ranging hens regularly change nest site between clutches as an anti-predator, antiparasite and hygiene strategy, and that choice of nest site may have an 'avoidance of previously used nests' component (Duncan *et al* 1978). It would be informative to determine whether location conservativeness was reduced if cage floors were swapped on pause days, rather than in the middle of the laying sequence.

Although the wire mesh of the R nests was the same as the cage floor, only one hen repeatedly laid on the floor indicating that the nests had other qualities which the hens found attractive. All the nests offered some degree of enclosure, isolation and depression which were absent on the cage floor; these qualities are reported as attractive to (some) laying hens (Appleby *et al* 1984a; Appleby & McRae 1986; Reed & Nicol 1992). Although some characteristics of the pre-moulded nests in the present study were possibly sub-optimal (as indicated by occasional floor-laying), their regular use and the pre-laying behaviour of hens with P nests (Sherwin & Nicol 1993a) shows that in general, the nests fulfilled some needs of the hens.

Animal welfare implications

The behaviour of laying hens reported here and elsewhere strongly suggests that welfare is improved when hens are housed in modified cages which incorporate nests, rather than in conventional cages. However, the present study shows that a clear dichotomy existed in laying behaviour: some hens were nest location conservative whilst others were nest floor type conservative. Such individual and group differences in preferences must be considered in future designs if the welfare of *all* animals is to be catered for. The preference for plastic nest floors expressed by the floor type conservative hens is relative. Since the hens seemingly paid little or no biological cost in changing location to lay on plastic, there was little indication of the strength of preference in absolute terms. This requires further examination to determine if hens would suffer if offered only wire mesh as a nest floor substrate.

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