PERCHING BEHAVIOUR AND PREFERENCES FOR DIFFERENT PERCH DESIGNS AMONG LAYING HENS

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Non-cage systems for housing laying hens often incorporate a framework of perches, allowing birds to move in three dimensions. Wood is predominantly used for perch construction, because it is relatively cheap and easy to work with. However, wooden perches are difficult to clean and disinfect, which could lead to disease and discomfort for the birds using them. The objectives of this study were to identify which characteristics of perch design are preferred by laying hens; and to test whether birds would use perches of alternative materials for a comparable amount of time as they use wooden perches. Six laying hens were housed individually in litter-floored pens and were offered a choice of three pairs of contrasting perch types (experiments 1-3): a rectangular, wooden perch ('control') versus two, thin, parallel, rectangular wooden perches; 'control' versus a similar perch covered with foam and fabric; and 'control' versus a round, wooden perch. Birds were given each pair of perches twice, controlling for perch position in the pen. Time spent on each perch in a 48h period was determined from video records. Preferences were then tested in consecutive trials (experiments 4-5) between perches of the following materials: wood versus plastic versus steel; and wood versus textured aluminium. There were no significant differences in time spent on different perches, suggesting that birds had no preferences between perch types. The implications of these results could be important for the design of alternative systems for laying hens. Birds may be content to perch on artificial materials which could be more hygienic than wood and easier to maintain in a commercial system.

Keywords: *animal welfare, behaviour, laying hens, perches*

Introduction

Alternatives to conventional battery cages for housing laying hens incorporate facilities such as nest boxes, dustbathing areas and perches, in an attempt to meet the perceived needs of the birds and improve bird welfare (McLean *et al* 1986). In certain countries, eg Switzerland and Sweden, such installations have to be included in all systems for laying hens and other countries are likely to implement similar regulations in the future. These facilities allow hens to carry out behavioural patterns which they could not fully perform in conventional cages. Perches enable birds to move at different levels and to perch for rest (Tauson *et al* 1992).

Wood is most commonly used for perches in alternative systems, because it is easy to work with and relatively inexpensive. However, one major problem with wooden perches is that they quickly wear and the surface becomes scratched, especially with soft woods. This leads to a build up of droppings in these areas and makes the perch uncomfortable for birds (Tauson *et al* 1992). An alternative material, which is less difficult to clean and disinfect, may be more suitable than wood for perch construction (Tauson & Abrahamsson 1994; Tauson & Abrahamsson 1996).

The amount of damage caused to the feet and breasts of hens by perching depends on the perch type. In general, perches with a rectangular cross-section cause less damage to the feet of birds than those with a circular cross-section (Duncan *et al* 1992). Nevertheless, birds housed with traditional, rectangular, wooden perches often suffer from poor foot condition (Siegwart 1991; Oester 1994; Tauson & Abrahamsson 1994). Round perches with flat upper and lower surfaces cause fewer bumble foot lesions and allow good grip (Tauson & Abrahamsson 1994). Conflicting effects on foot condition (good, bad and no effect) have been found by coating perches with rubber (Siegwart 1991; Oester 1994; Tauson and Abrahamsson 1996). Plastic perches, with either a mushroom-shaped profile (Engström & Schaller 1993; Oester 1994; Tauson & Abrahamsson 1994), or a circular cross-section with flat upper and lower surfaces (Tauson & Abrahamsson 1996), result in frequent bumble foot problems and bad foot condition. Few bumble foot lesions were observed in birds given perches with a channel down the centre or two thin, parallel perches close together, acting as a single perch (Oester 1994). Narrow bridges made from chicken wire, provided as perches, caused little or no foot damage (Siegwart 1991; Oester 1994).

Rectangular perches also cause less damage to the keel bones of birds than those with a circular cross-section (Tauson *et al* 1992). However, flat-surfaced, round, wooden perches reduce keel damage when compared with traditional, wide, rectangular wooden perches (Tauson and Abrahamsson 1994). Covering these flat-surfaced, round perches with a layer of rubber did not reduce the incidence of keel bone lesions in comparison with similar perches made of hardwood (Tauson and Abrahamsson 1996). Plastic, mushroom-shaped perches frequently result in keel bone deformation (Engström & Schaller 1993).

A perch design which birds will use frequently is necessary if the provision of perches is to be a welfare benefit (McLean *et al* 1986), and allow an increase in stocking density in a house. Appleby *et al* (1992) offered perches made of five different materials (hardwood, textured metal, smooth plastic, softwood and padded vinyl) to birds in cages. The birds spent most time on the softwood perch and least time on the plastic perch (Appleby *et al* 1992). Tauson and Abrahamsson (1994) found no differences in the proportions of time birds spent perching on four different perch designs: plastic, mushroom-shaped perches; rectangular, wooden perches, both wide and narrow; and circular perches with flat upper and lower surfaces. Overnight use of perches in cages did not differ between birds given rectangular, wooden perches and mushroom-shaped, plastic perches (van Niekerk & Reuvekamp 1995) and no consistent difference was found in the number of birds observed on a perch when broilers in pens were offered a choice of wooden perches, some of which were foam-cushioned with a plastic cover and some of plain wood (Hughes & Elson 1977).

Most of the literature concerning perches of different designs and materials has described their effects on the condition and health of birds' feet and keel bones. Perch preference experiments in the literature generally consider perches in cages. Most previous studies have

not controlled for different variables of perch design, eg material, shape etc. For example, a rectangular, wooden perch was compared to a plastic, mushroom-shaped perch (eg Oester 1994; Tauson & Abrahamsson 1994). Therefore, it is not clear which perch features were determining the preference of the birds. The aims of this study were: first, to identify individual characteristics of perch design which hens prefer in a non-cage system, by offering a choice of perch types; and second, to test, using one perch type at a time with no alternative, whether hens would perch for a comparable amount of time on perches made of materials other than wood, which may be easier to maintain in a commercial system.

Materials and methods

Background

For at least a month before this study all birds had been housed in a small research perchery. One week before the onset of each experiment, six birds were transferred into individual litter-floored experimental pens (Figure 1) and, according to which pen they were in, numbered 1 to 6. In three of the five experiments (experiments 1-3) 12 birds were tested, in two groups of six. In these experiments, the second group of six birds were numbered 7 to 12, but were also housed in pens 1 to 6 – bird 7 in pen 1, bird 12 in pen 6 etc. Pens were separated by visual barriers, except in experiment 1. Each bird was given one, solid, rectangular, wooden perch during this week.

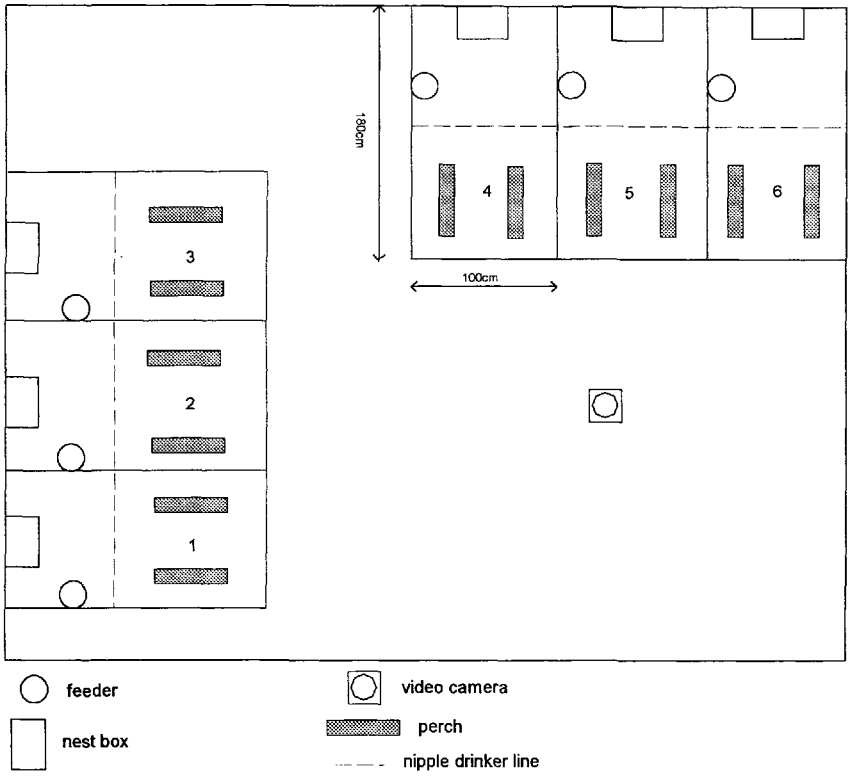

Figure 1 **Diagram of the experimental room.**

Experimental design

Six laying hens were kept individually in six pens with litter floors (100cm wide x 180cm long x 200cm high), each containing a nest box (35cm high x 30cm wide x 40cm deep) raised 10cm off the floor, food dish and nipple drinker line (45cm above the floor) as shown in Figure 1. The pens were separated by visual barriers, except in experiment 1. Food and water were available *ad libitum*. The lighting programme consisted of 16h continuous light and 8h darkness in every 24h.

In experiments 1, 2 and 3 each bird was presented with 2 different perches at a time, one on either side of the pen near the front (Figure 1). Each perch was supported with its top surface 30cm above the ground by rectangular wooden legs, stabilized by triangular plywood supports of the design shown in Figure 2. In experiments 4 and 5 only one perch was available, positioned in the centre of the pen at the front. Each perch arrangement was kept in a pen for 72h. On the first day birds were allowed to become accustomed to the perches, with video recording taking place over the following 48h, ie the observation period. The birds were recorded for 48h in each treatment, with a night light (10W) allowing them to be observed overnight. Three birds were recorded at a time (birds 1-3, 4-6, 7-9 or 10-12), on the same two days in successive weeks. Preliminary analyses of variance were performed on log-transformed data from the six birds (birds 1-6) and, if the results were approaching a significant difference, the experiment was repeated with another six birds (birds 7-12).

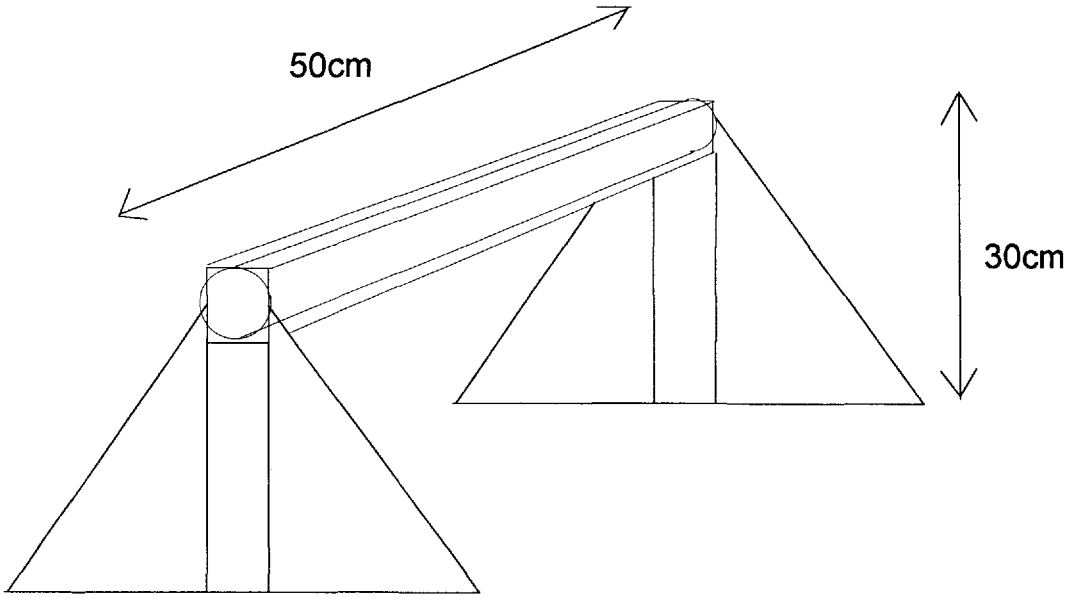

Figure 2 Perch construction.

Different birds were used in each experiment, except experiments 2 and 3. In experiment 1, six Lohmann Brown hens, approximately 60 weeks-old, were used. In experiments 2 and 3, birds 1-6 were Lohmann Brown hens, approximately 60 weeks-old, and birds 7-12 were

ISABrown hens at point-of-lay. In experiment 4, 12 ISABrown hens, approximately 25 weeks-old, were tested, and in experiment 5, six different ISABrown hens, approximately 32 weeks-old, were tested.

Experiment 1: Single vs double wooden perches

Two perches were offered per pen: a rectangular, wooden perch (4.5cm wide x 7cm deep x 50cm long; 'single'), which was the 'control' perch; and two, parallel, rectangular perches (1.5cm wide x 7cm deep x 50cm long), 1.5cm apart, such that they had the same overall external dimensions as the control - and the feet of a perching bird spanned the two beams at the same time ('double'), see Figure 3. The experimental treatments were:

Treatment A: left perch = single, right perch = double

Treatment B: left perch = double, right perch = single

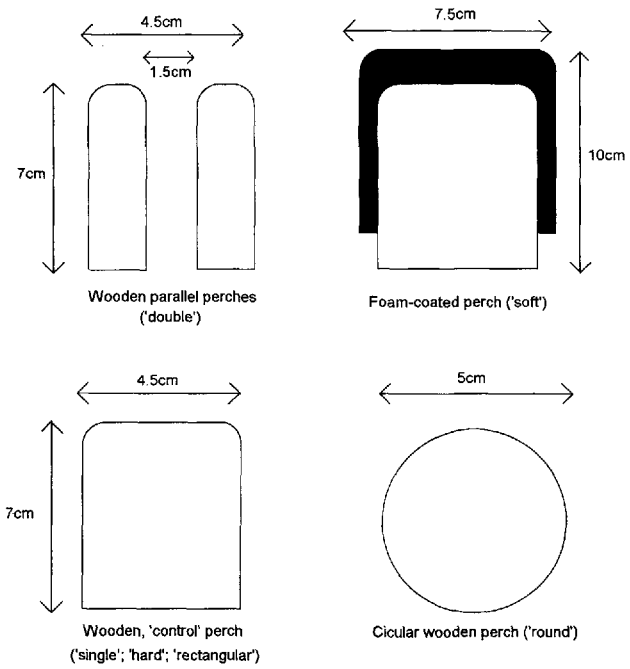

Figure 3 Perch profiles for experiments 1 to 3.

Each bird underwent both treatments, in random order. To avoid social interactions between birds in neighbouring pens, which might cause position preferences, visual barriers were placed between pens in subsequent experiments.

Experiment 2: Soft vs hard rectangular perches

The 'hard' perches used were the control perches. The 'soft' perches were wooden perches of the same dimensions as the control perches, but with a 3cm layer of soft, foam rubber attached to the top surface and 1.5cm of thick foam rubber attached to either side (Figure 3), making the overall dimensions 7.5cm wide by 10cm deep. The foam was then covered with a layer of fabric, of a similar colour to the wooden perches, to prevent the birds

pecking it. Twelve birds underwent treatments A and B in a randomized design, using both perch types, alternating the side of the pen on which each perch was positioned.

Experiment 3: Round vs rectangular wooden perches

The 'rectangular' perches were the control perches. The 'round' perches were made of wood with a 5cm diameter circular cross-section (Figure 3) and were 50cm long. Treatments A and B used both perch types, alternating the side of the pen on which each perch was positioned.

Twelve birds underwent both treatments according to a randomized design. Birds 1 to 3, and 7 to 9, underwent experiment 2, then experiment 3; while birds 4 to 6, and 10 to 12, underwent experiment 3 and then experiment 2. Birds 1-6 underwent both experiments before they were replaced by birds 7-12.

Experiment 4: Metal vs plastic vs wooden perches

The 'metal' perches were black, smooth, steel tubes (0.3cm thick) with a rectangular cross-section and rounded corners (5cm wide x 3cm deep overall), attached to the top of a wooden beam (5cm wide x 4cm deep). The 'plastic' perches were made from smooth, white plastic (0.2cm thick) glued, with an all-purpose, water-based adhesive, onto the surface of a 'control' perch, making the overall perch 5cm wide x 5.5cm deep (Figure 4). Both the metal and plastic perches were 50cm long, supported by wooden legs, with their top surfaces 30cm above the ground.

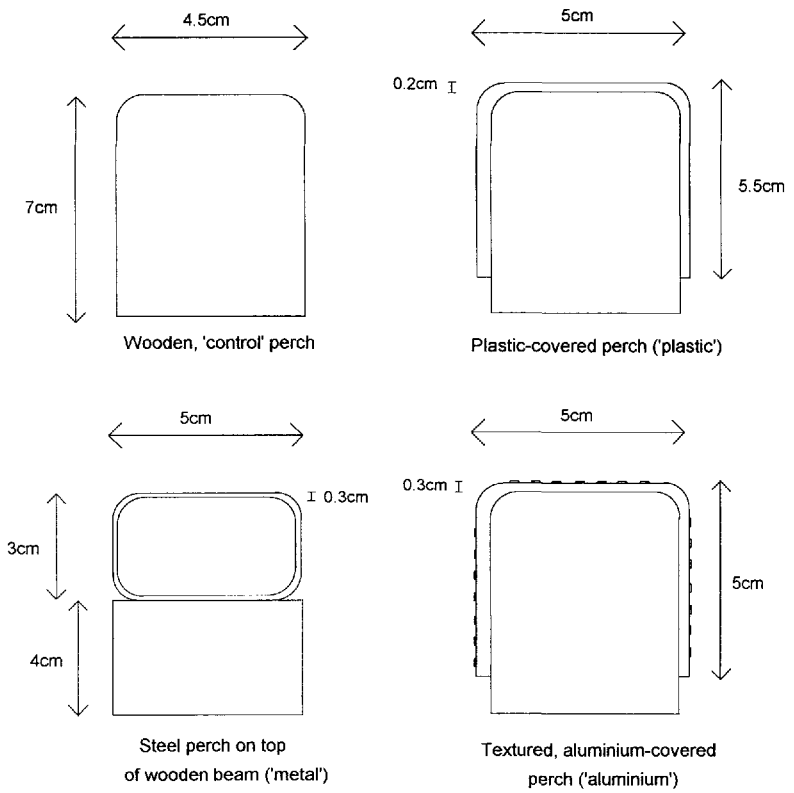

Figure 4 **Perch profiles for experiments 4 and 5.**

Each bird was given each of the three perch types, 'metal', 'plastic' and 'control', one perch at a time, in consecutive weeks according to a randomized design.

Experiment 5: Textured aluminium v wooden perches

The 'aluminium' perches were made from a layer of treaded aluminium (0.3cm thick), with a repeated pattern of 5 raised lines at different angles, as used in the construction industry for non-slip platforms. This material was shaped and glued, with an all-purpose, water-based adhesive, to the surface of a 'control' perch, making the overall perch dimensions 5cm wide x 5cm deep x 50cm long (Figure 4). Each bird was tested with both an aluminium and a control perch, one perch at a time, according to a randomized design.

Statistical analysis

The time (seconds) spent on each perch during each 48h observation period was determined from video records. Duration was recorded each time a bird stood or sat on a perch, and the percentage of each 48h observation period spent on each perch was calculated for each bird. In experiments 1-3 (where each perch type was observed in two observation periods for each bird) the mean percentage of these two periods were calculated. Analyses of variance (ANOVAs) were performed on log-transformed data for each experiment to compare perch types, with respect to perching duration.

Results

Experiments 1, 2 and 3

As Table 1 shows, there was no significant difference between perching times on single, wooden perches or double, parallel, wooden perches ($P=0.744$); on padded/soft perches, or hard, wooden perches ($P=0.678$); nor between perching time on perches with circular cross-sections or rectangular cross-sections ($P=0.177$).

Experiments 4 and 5

Table 1 also shows that there was no significant difference between perching duration on wooden, plastic and metal perches ($P=0.164$), nor when comparing time on wooden and aluminium perches ($P=0.263$).

Total perching time

Patterns of perching were similar between experiments. In over half the observation periods from each experiment (7/12, 16/24, 17/24, 26/36 and 17/12 periods in experiments 1-5 respectively) birds spent less than 20 per cent of the time on the perches. No bird spent over 70 per cent of the 48h observation period on the perches.

Perching behaviour was compared during light and dark periods. For each experiment, the mean time spent perching was less than 20 per cent of the light period (Table 1) and no individual bird spent over 50 per cent of the light period on the perches. During the dark period in each experiment, there was greater variation in the amount of time spent perching (Table 1). Less than 10 per cent of the dark period was spent on the perches in 50 per cent or more of the observation periods for each experiment (8/12, 16/24, 17/24, 24/36 and 7/12 periods in experiments 1-5 respectively). In the remaining observation periods in which birds perched for more than 10 per cent of the dark period, they spent over 90 per cent of this time on the perches.

Table 1 **Mean percentage of the light and dark periods spent perching, proportions of perching time on each available perch type and results of ANOVAs comparing time spent on different perch types.**

Experiment	Perch type	Mean per cent of light and dark periods spent perching (and standard deviation)		Proportion of perching time on each perch type	*P* value (and degrees of freedom for each ANOVA test)
		Light period	Dark period		
1	single	10.30 (9.05)	18.07 (38.11)	0.52	0.744 (1,10)
	double	7.70 (9.58)	17.93 (38.27)	0.48	
2	soft	2.80 (5.83)	13.04 (31.28)	0.34	0.678 (1,22)
	hard	8.95 (12.13)	17.31 (35.45)	0.66	
3	round	1.32 (2.82)	4.84 (18.12)	0.31	0.177 (1,22)
	rectangular	4.76 (7.21)	18.21 (33.92)	0.69	
4	wood	10.00 (13.89)	27.73 (43.89)		0.164 (2,22)
	plastic	6.12 (9.94)	36.48 (47.23)		
	metal	8.29 (8.93)	14.25 (30.34)		
5	wood	15.25 (16.90)	33.55 (51.27)		0.263 (1,5)
	aluminium	15.14 (17.24)	37.14 (49.34)		

There was much variation between birds in the percentage of time spent perching, in each of the five experiments. Figures 5a-c show the mean percentage of time spent on each type by each bird, taken from the two observation periods when each perch was available. Figures 5d-e show the percentages from the single observation period in which individual birds experienced each perch type.

Discussion

No significant differences emerged when comparing time spent perching on single versus double wooden perches, soft versus hard perches, or round versus rectangular perches, using ANOVAs. In experiment 1 there were no visual barriers between pens, leading to social interactions between neighbouring hens (eg pecking, observation of other individuals). As a result, preferences may have developed for a certain side of the pen, confounding preferences for different perch types. This effect was noted subjectively, but not tested statistically. Figures 5b and 5c and the proportions presented in Table 1 suggest that there may have been a trend towards birds spending a greater amount of perching time on the hard perch rather than the soft one, and on the rectangular than the round perch, although these results were not significant when subjected to an ANOVA. Perching durations on wooden versus plastic versus metal perches, when no choice of perch type was offered, were not significantly different (in ANOVAs) nor were durations on wooden versus aluminium perches. These results suggest that birds did not discriminate between single and double, soft and hard, or round and rectangular perches. When only one perch type was available, the

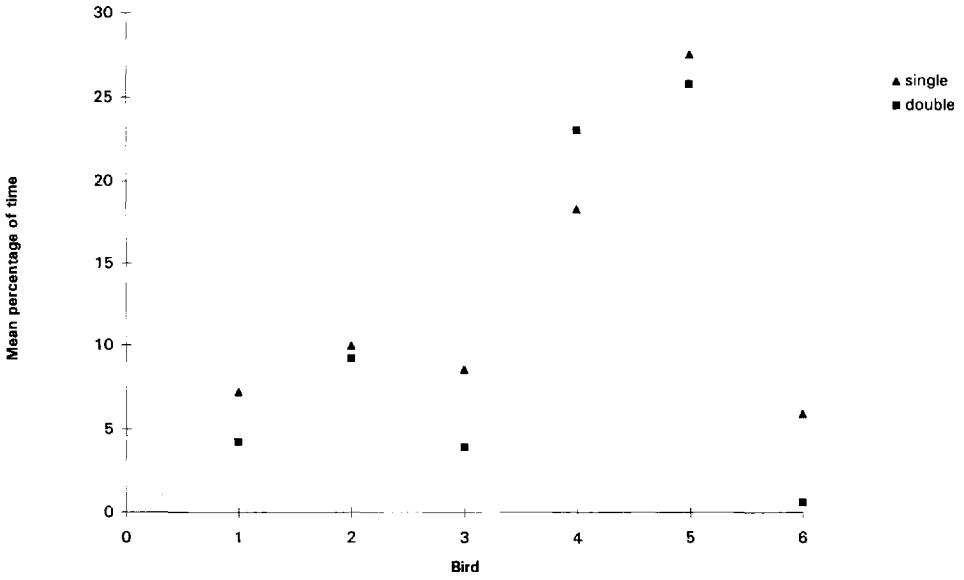

Figure 5a **Mean percentage of the observation period spent on the single and double perches by each individual.**

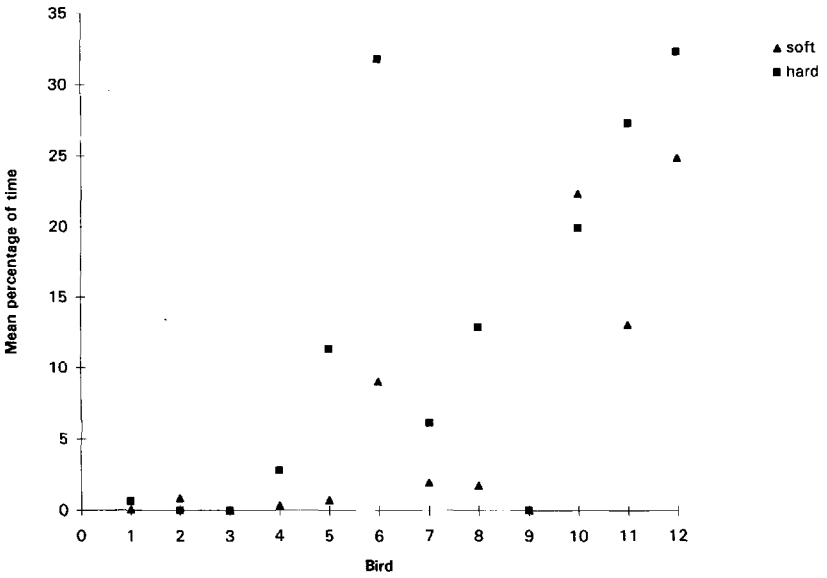

Figure 5b **Mean percentage of the observation period spent on the soft and hard perches by each individual.**

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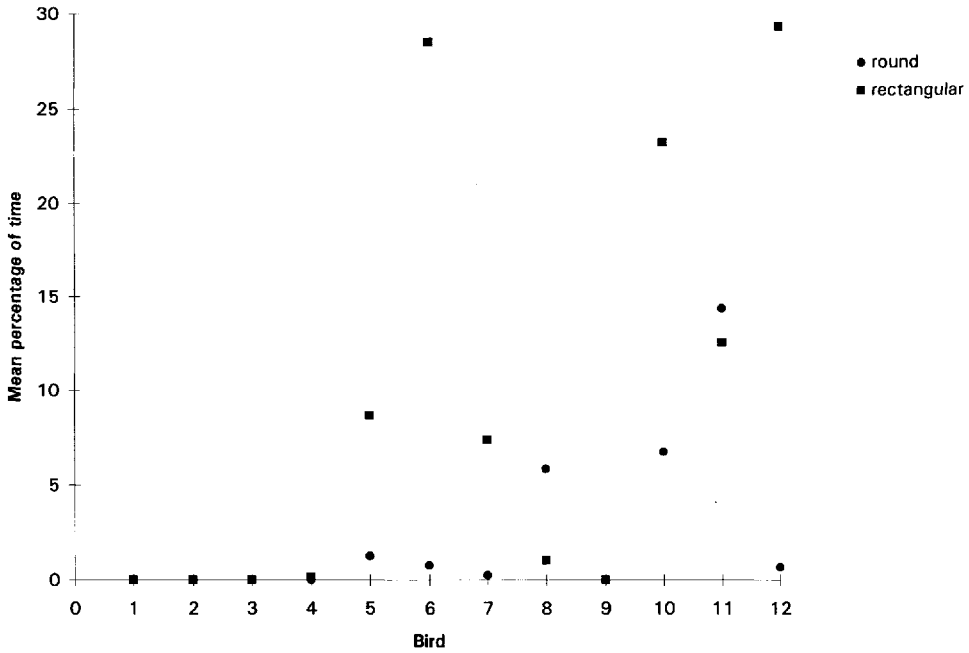

Figure 5c **Mean percentage of the observation period spent on the round and rectangular perches by each individual.**

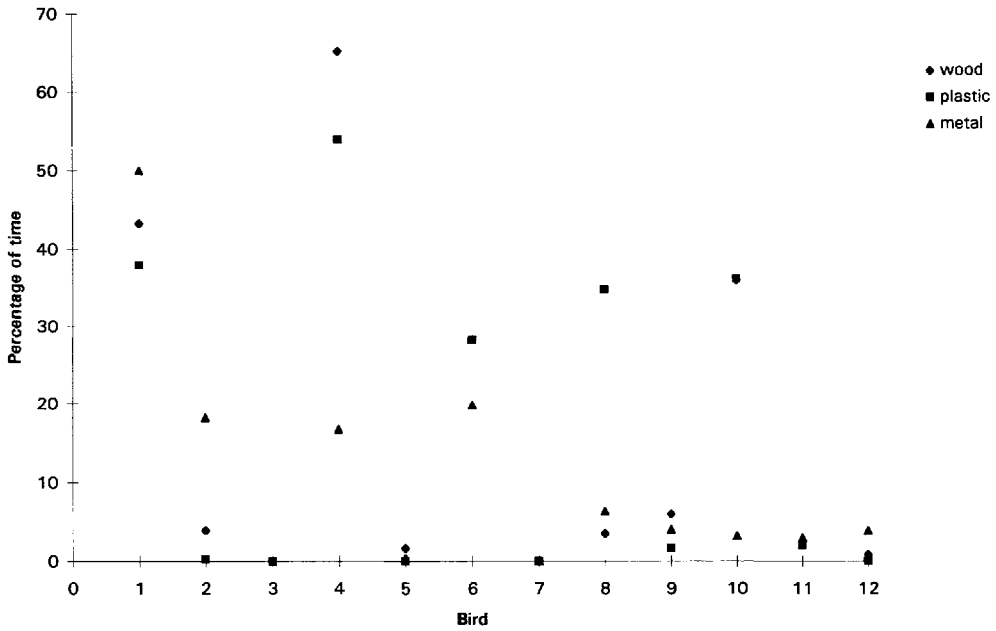

Figure 5d **Percentage of the observation period spent on the wood, plastic or metal perch by each individual.**

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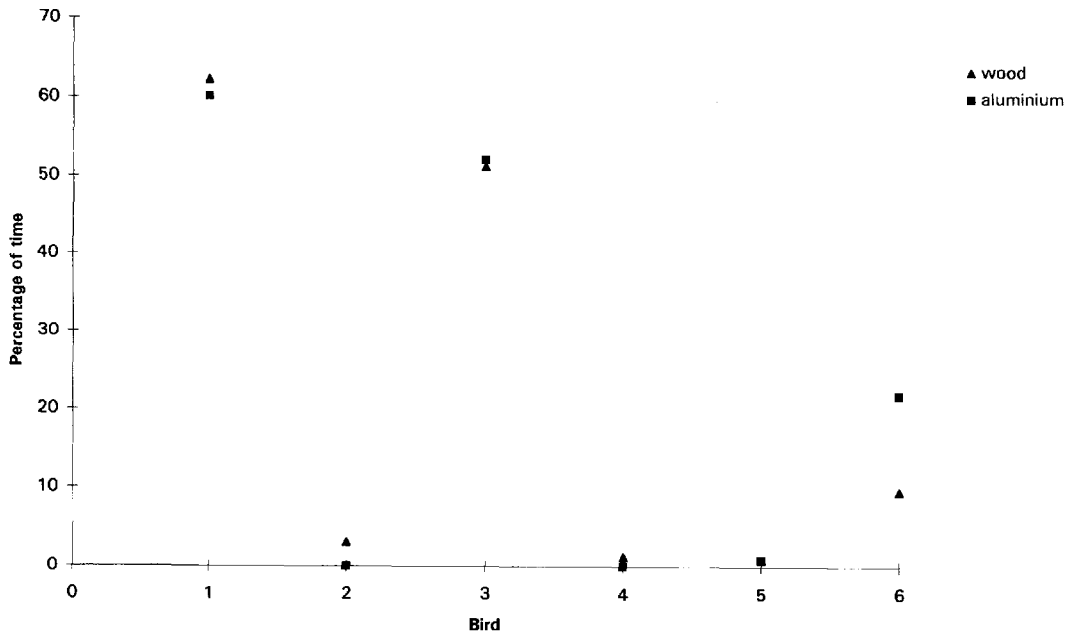

Figure 5e **Percentage of the observation period spent on the wood or aluminium perch by each individual.**

surface material of the perch did not influence the amount of time spent perching. This implies that if a bird is motivated to perch it will do so, regardless of perch type.

As with laying hens kept in cages with perches (Hughes & Elson 1977; Appleby *et al* 1992), there was a great deal of individual variation between birds in pens in the amount of time spent perching. Some individuals did not use the perches at all, yet others perched for up to 65 per cent of the observation period. These same birds tended to roost, or spend large amounts of the day, on the perches, regardless of treatment. This variation in perching behaviour between birds may have outweighed any differences due to perch type. In experiments 2, 3 and 4 the results from the first six birds tested (birds 1-6) were nearing significance when preliminary analyses were performed to compare perching duration on different perch types. For this reason the experiments were repeated with another six birds, but in each case the final results were not significant. Greatly increasing the number of replicates in the five experiments might have identified preferences between perch types. A longer period of study would also have been preferred. However, this was not possible as resources were limited.

In cages where perches are present, time spent perching by birds ranges from 25 per cent to 50 per cent of the light period (Appleby *et al* 1992; Duncan *et al* 1992). These figures increase to around 85 per cent of the dark period when birds roost on the perches (Appleby *et al* 1992; Duncan *et al* 1992). The mean times spent on the perches in the present series of experiments, using birds in pens, were low in comparison in the majority of observation

periods – both during the light and dark intervals. Birds in pens have access to a litter floor and a nest box, whereas caged birds are kept on a wire floor, which may be a less appealing or less comfortable alternative to a perch. Food and water could not be reached from the perches in the present experiments, so birds would have to move off the perches to eat or drink. It is usual to house several birds together in cage systems and large groups of birds together in commercial percheries, but in our experiments there was only one bird per pen. Therefore, perching was not a means of avoiding aggressive behaviour nor was it due to competition for space. Hens often perch close together, especially at night, to roost (Lill 1968), which may be a social or heat-conserving behaviour that was not possible in these experiments. Therefore, the lack of companions in the experimental pens could be one reason for the low amount of time spent on the perches. When groups of broilers were housed in pens with perches it was suggested that the birds did not use the perches until floor space was in short supply due to stocking density (Hughes & Elson 1977). The use of perches may differ between different breeds, or age groups of birds (Tauson and Abrahamsson 1996) and it would have been beneficial if less limited time and resources had allowed for using the same strain and age of birds throughout this study, in order to reduce this variation.

Birds tended to use the perches for either less than 10 per cent or greater than 90 per cent of the dark period, because they roosted in one place for most of the time. Many of the birds roosted on the floor or in the nest box, with a few perching on the drinker line or on top of the nest box. Both of these installations were higher than the perches, which may be preferable for roosting. Hens often use high perches in preference to low perches, when offered a choice (Blokhuis 1984). If a bird wanted to relocate from the perch to another area of the pen, there were no other perches at different heights or positions elsewhere in the pen, which may help to explain why the birds moved off the perches, and the low perching times. However, in this experiment only preferences between different perch surfaces were investigated, not between different perch heights. During the light period there was much more movement on and off the perches. Birds were often observed preening on the perches during the day. As the dark period approached, birds frequently became very active – jumping on and off the perches, the roof of the nest box and the drinker line and moving quickly around the pen floor. Even without a period of artificial sunset, birds are able to predict the onset of the dark period under conditions of artificial lighting (Savory 1976) and this behaviour may have represented a 'decision making' period as birds searched for a suitable roosting site.

The implications of these preference experiments are of importance in the design of an alternative system to cages for laying hens. Perch preferences may affect the use of facilities in, for example, aviaries or percheries, leading to avoidance of floor-laying, even distribution of birds on perches throughout the house, etc. If, as suggested, birds will perch on different materials as frequently as on wood then an alternative to wood could be used for perch construction within a non-cage system. Artificial materials, such as metal and plastic, would be easier to clean and disinfect (Tauson and Abrahamsson 1996), as they are non-porous and do not contain the cracks and crevices common in wood (although 'cleanliness' was not measured in this study). A treaded, non-slip surface could be formed on an artificial perch surface which would also provide grip for birds' feet. Accidents often occur as birds attempt to negotiate their way between perches and other facilities within a

perchery and, as a result, there is a high incidence of old breaks in the bones of end-of-lay hens from these systems (Gregory *et al* 1990). Perches which are easier for the birds to grip and move between may reduce the risk of such bone breakage. Similar perch preference studies, on a larger scale, coupled with an investigation of the effect of the different perch types on foot and keel bone condition, may allow practical recommendations on perch material and design for use in a commercial non-cage system for laying hens to be made.

Animal welfare implications

Wood is a difficult material to clean and disinfect thoroughly and can become a biological risk in a poultry system if colonized by micro-organisms, ectoparasites (eg mites) etc. It is difficult to remove faecal material effectively from the surface of wood, making it unhygienic and uncomfortable for birds to perch on. By replacing wooden perches with those of a material which is easier to clean the potential for better hygiene and bird welfare within a perchery system would be increased.

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