# THE EFFECT OF A 'FREEDOM FOOD' ENRICHMENT ON THE BEHAVIOUR OF BROILERS ON COMMERCIAL FARMS

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**Abstract** *Animal Welfare 2001, **10:*** 347-356

*The effect of an environmental enrichment — straw bales — on the behaviour of growing broiler chicks was investigated by comparing the behaviour of broilers kept in matched pairs of houses on commercial farms with and without bales. The birds provided with bales perched on them and clustered around them. The most striking result, however, was that, even away from the bales, birds in the enriched houses were more active (showing more walking and running and less sitting) than birds in unenriched houses. The study provides support for the 'Freedom Food' recommendation that activity in commercially kept indoor chickens can be increased by providing environmental enrichment in the form of straw bales.*

**Keywords:** *animal welfare, broilers, chickens, environmental enrichment, poultry*

## Introduction

Although the effects of environmental enrichment, such as pecking devices or novel objects, on laying hens (eg Nørgaard-Nielsen 1989; Bell & Adams 1998; Jones & Carmichael 1998, 1999) and on turkeys (Sherwin *et al* 1999) have been studied, relatively little attention has been paid to possible enrichment for growing broiler chickens (Newberry 1999). There are, as yet, no studies of the effects of such enrichments when applied on a commercial scale (European Commission Report on the Welfare of Chickens 2000) despite the fact that, in the UK, a number of producers are now operating to the 'Freedom Foods' standards set by the RSPCA (the Royal Society for the Prevention of Cruelty to Animals), which include specific requirements for environmental enrichment (RSPCA 1997). The RSPCA's suggested methods include the provision of straw bales, the scattering of whole grain on the floor and the provision of brassicas. However, there is no systematic information concerning the effects of these enrichments on the birds themselves.

We report a study on the effect of one particular enrichment — straw bales — on the behaviour of growing broiler chicks on commercial farms. By observing the behaviour of birds kept in matched pairs of houses, some with and some without straw bales, we aimed to evaluate the difference that the bales made to the behaviour of broiler chickens and thus to evaluate the RSPCA's proposal that this enrichment affects the activity of indoor chickens.

There are at least two issues involved in the study of environmental enrichment. The first of these is whether additions to the environment do have any effect on the animals — for example, whether the animals under study show increased activity levels (Shepherdson *et al* 1998). The second issue is whether any observed changes can be construed as an improvement in the animal's welfare. This is a complex issue, as a change in behaviour may indicate either a reduction or an improvement in welfare (Broom 1988; Duncan 1993; Dawkins 1998), and the way in which people perceive an 'enrichment' may or may not be the way in which it is perceived by the animals themselves. In the case of commercially kept broilers, neither issue has been adequately addressed (European Commission Report 2000). The present study is a contribution to the first, and is a necessary precursor to the longer-term evaluation of enrichment programmes for broilers.

## Methods

### *Subjects and housing*

A total of over 116,000 Ross/Cobb birds were used for the experiment, which was carried out on two farms belonging to Premier Poultry Ltd. Because these birds were part of the company's commercial enterprise, it was not possible, for logistical reasons, to make each of the replicates completely identical; therefore, a matched-pairs design was adopted so that comparison between treatments was entirely robust. On each farm, a pair of houses (one designated to have bales and the other not) was matched exactly for floor area, date when chicks were placed, date when chickens were moved out, and as closely as possible for numbers of chicks placed and strain of bird.

All birds used in this study were females from P/WART, COMM, HAT.A, A.SUS or C.SUS parent stock. Feed and environmental conditions between the houses were kept as constant as possible with a FLOCKMAN computer monitoring system. Temperature and ventilation regimes were identical, and feeding regimes and feed source and blends were the same both between and within farms. All houses were on a light regime of 24 h of light on day one, which was gradually reduced to 14 h at day six and then kept at 14 h until clearance. Dawn and dusk dimmer switches were used on all houses. One house of each pair was designated as the 'enriched' house, and straw bales (0.75 x 0.30 x 0.35 m) were distributed as regularly as possible throughout the house at an average density of one bale per 17 $m^2$. The other house of each pair was identical except that it had no bales and was therefore referred to as 'unenriched'. The sheds on one farm were 18 m wide x 100.58 m in length and the enriched house had 118 bales; the sheds on the other farm were 18 m wide x 79.9 m in length and the enriched house contained 81 bales. As part of the company's normal practice, litter in both types of house was regularly inspected and a scattering of fresh litter applied whenever litter quality fell below that which the farm manager regarded as optimum.

### *Data collection*

Behavioural observations of the birds were carried out at weekly intervals when the birds were two, three, four and five weeks old. For the purposes of observation, a map of each house was divided up into equal-sized sections marked out by the positions of the roof supports, each section being 4.5 x 2.96 m. These sections were then sub-divided into two categories — 'edge' and 'centre'. Sections were classed as 'edge' if at least one of their edges was formed by the wall of the shed. Each section was numbered so that it could be selected randomly for observation (see below). However, in order to eliminate 'edge' effects, observations were always carried out in pairs, one in an edge section and one in a centre section.

Observations were carried out every half-hour between 0930h and 1300h and between 1400h and 1800h. Before the observer entered a house, a section to be observed was chosen using the assigned numbers for each area from a random number table. After entering the house and locating the section, a settling period of 5 min was left to elapse before observations began. A scan sample was performed for 5 min, followed by a focal sample for 10 min and then another 5 min scan sample. The observer used a clear perspex grid measuring 30 x 30 cm bearing numbered 5 $cm^2$ squares in order to decide which small area of the chosen section was to be observed. By standing a few paces back from the edge of a section and holding the grid at arm's length so that the section was viewed through it, most of the section area fell within the edges of the grid and each square covered approximately 0.37 $m^2$ of floor area. A pre-selected random number indicated the square that was to be observed, with the constraint that, in the enriched houses, squares were chosen so that they did not contain a bale; the comparisons between enriched and non-enriched houses are thus between activity not directly associated with the bales themselves. The behaviour of all birds in a chosen square was recorded by speaking into a hand-held dictaphone. This was repeated with a different randomly chosen square in the same section every 60 s for 5 min.

The behavioural categories used were: resting (sitting on the floor with head on breast), sitting, standing, locomotion (walking or running), feeding, and preening. The data for each 5 min scan sample were subsequently pooled to give an average number of birds performing each behaviour for each data set. This figure was then converted to a percentage, as there were inevitably unequal numbers of birds within each area scanned. The data were then averaged across each day of observation to give a between-treatments comparison.

***Focal samples***

The behaviour of one bird was recorded continuously over a 10 min period. Focal birds were chosen from the designated area by placing a dot at a randomly chosen position on the perspex grid described above, holding up the grid so that it covered the chosen section and following the bird closest to the dot. As with scan samples, birds that were interacting with the bales (either on the ground surrounding them or on top of them) were not chosen. The same behaviour as was recorded for the scan samples was recorded for the focal samples. Both feeding and drinking were recorded as a continuous bout from the moment the bird lowered her head into the food hopper or drinker until she raised it again.

The first hour of observations was carried out according to the above protocol in one house out of the matched pair, with half an hour of observations in an edge section and half an hour in a centre section. The next hour of observations was carried out in the other house of the matched pair. Whether the enriched or the unenriched house was visited first was alternated between days, as was whether the first half-hour of observations was carried out in an edge or a centre section. Eight hours of observations were performed each day. Each pair of houses was visited one day a week over five weeks. The birds were killed at 46 days old.

***Statistical analysis***

Multivariate analysis of variance (MANOVA) was used to ascertain whether any of four identifiable variables (enriched/unenriched, farm, age, time of day) or any combination of variables had any effect on the total time allocated to each behaviour (Hair *et al* 1998). 'Age' and 'time of day' were considered to be repeated measures as, although the random selection of birds made it unlikely that the same individual birds were chosen at different times during one day or in different weeks, the birds selected came from the same houses and so could not

be considered entirely independent. 'Farm' and 'environment' were considered to be independent.

The non-parametric Kruskal-Wallis test was used for the analysis of bout lengths as these data were not normally distributed; they had very heterogenous variances and so did not fulfil the requirements for a parametric analysis.

### *Counts*

Counts were taken of numbers of birds clustered around roof supports in both enriched and unenriched houses and also of numbers of birds around or on top of the bales in the enriched houses. 'Clustered' birds were defined as those that were huddled together, touching one another. There was usually a distinct boundary between these birds and the others, even when the birds were nearly maximum size. The counts were taken at the start of the third, fifth, thirteenth and fifteenth observation periods each day from a high vantage point — either the raised platform at one end of the shed or from a standing position on top of a bale. A roof support pole and a bale were chosen at random, and the numbers of birds clustered around the pole, clustered around the bale and standing on top of the bale were noted. Even from the vantage point, however, it was impossible for the observer to see the birds on the opposite side of a bale. Therefore, in order to estimate the total number of birds surrounding a bale, a count was made of those birds seen clustered within a 180° angle along the length and breadth of the bale — this number was then doubled. A total of 15 counts (birds on or around 15 bales and poles) constituted one sample.

### *Production data*

The company's records on mortality and culls throughout the production periods were used.

## Results

### *Focal samples*

The MANOVA indicated that the only variable that explained a significant amount of variation in any behaviour was environment (enriched or unenriched). Environment had a significant effect on the amount of time allocated by individual birds to resting, sitting, locomotion and drinking, although it had no effect on feeding (Table 1). Neither the age of the birds, the farm from which they came nor the time of day at which they were observed had any significant effect on any behaviour, nor were there any interactions between independent variables. Figure 1, therefore, shows the effect of the environment only.

However, although this analysis examines the time (out of a possible total of 10 min) allocated by each bird to a particular behaviour, it does not take into account whether the behaviour was divided into bouts, or the duration of these. Average bout duration was calculated for each bird within each environment for each day of observation. The first and last behaviour in each focal sample was omitted from the analysis as it was of unknown duration. The analysis was carried out separately for each farm, each age and each time of day (Table 2). The environment (presence or absence of bales) had a significant effect on bouts of resting, standing, locomotion and drinking, but not on feeding. Bouts of sitting were the only behaviour that showed a change with time of day. The effect of presence or absence of bales on bouts of behaviour is shown in Table 3. In the absence of bales, bouts of resting were longer than when bales were present but bouts of locomotion, standing and drinking were shorter.

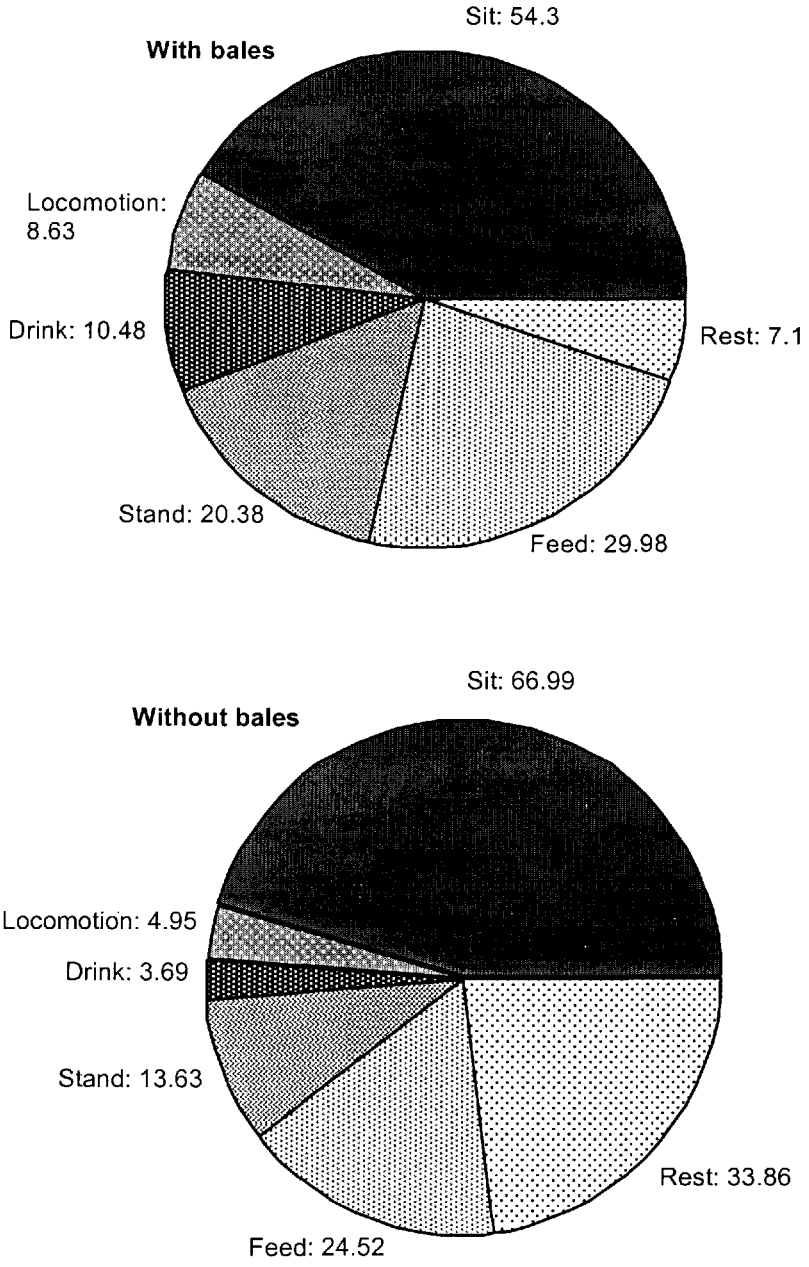


**Figure 1** **Amount of time spent performing behaviour in houses with and without bales.** The figures indicate the mean percentage of time spent performing each behaviour by birds of all ages in all houses.



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**Table 1** **MANOVA of four identified possible variables and their effect on time spent performing each of six behaviours scored in the focal observations.** n = 64. The figures shown are *P* values: $*P < 0.05$; $**P < 0.01$.

| Behaviour | Farm | Age | Time of Day | Environment |
|---|---|---|---|---|
| *Rest* | 0.44 | 0.78 | 0.96 | 0.0003** |
| *Sit* | 0.77 | 0.85 | 0.62 | 0.04* |
| *Stand* | 0.68 | 0.71 | 0.34 | 0.000004** |
| *Locomotion* | 0.73 | 0.37 | 0.62 | 0.000004** |
| *Feed* | 0.39 | 0.94 | 0.61 | 0.255 |
| *Drink* | 0.97 | 0.83 | 0.16 | 0.011* |

**Table 2** **Kruskal-Wallis non-parametric analysis of possible variables affecting bout duration.** The figures shown are the *H* statistic values. $*P < 0.05$; $**P < 0.01$.

| Behaviour | Farm (*df* = 1) | Age (*df* = 3) | Time of day (*df* = 15) | Environment (*df* = 1) |
|---|---|---|---|---|
| *Rest* | 1.80 | 3.54 | 23.5 | 4.02* |
| *Sit* | 3.70 | 0.37 | 27.31* | 0.05 |
| *Stand* | 1.64 | 4.11 | 14.15 | 7.16** |
| *Locomotion* | 0.59 | 2.85 | 13.81 | 15.96** |
| *Feed* | 1.15 | 0.52 | 15.76 | 3.67 |
| *Drink* | 0.04 | 1.48 | 18.27 | 7.61** |

**Table 3** **Median (and inter-quartile range) of bout lengths (s) of different behaviours in the presence or absence of bales.** $*P < 0.05$; $**P < 0.01$.

| Behaviour | With bales | Without bales |
|---|---|---|
| *Rest* | 12.7 (0.0) | 60.7 (3.4)* |
| *Sit* | 67.7 (13.4) | 77.1 (14.5) |
| *Stand* | 17.3 (2.5) | 14.8 (2.0)** |
| *Locomotion* | 8.9 (4.2) | 6.8 (2.0)** |
| *Feed* | 49.5 (9.0) | 47.0 (20.5) |
| *Drink* | 29.0 (5.6) | 8.5 (11.0)** |

### *Counts*

Birds in the enriched environments interacted with bales in several different ways: by clustering around the base, by standing on top of them, or by pecking at them. The mean number of birds standing on one bale at any one time was 1.59 (SE = 1.76). In the houses without bales, the birds tended to cluster around the poles supporting the roof. The number of birds clustering around bales in the enriched environment and the number clustering around roof supports in both environments is shown in Figure 2. As the birds increased in size, it became more difficult to assess where one cluster ended and another began; the results are, therefore, shown for weeks two, three and four only. Figure 2a shows that in the houses with bales, birds clustered around these bales, with younger birds clustering more. However, their tendency to stand on top of the bales was not related to age. Figure 2b shows that in the houses without bales, birds clustered around the support poles at all ages but that the most clustering took place when the birds were youngest.

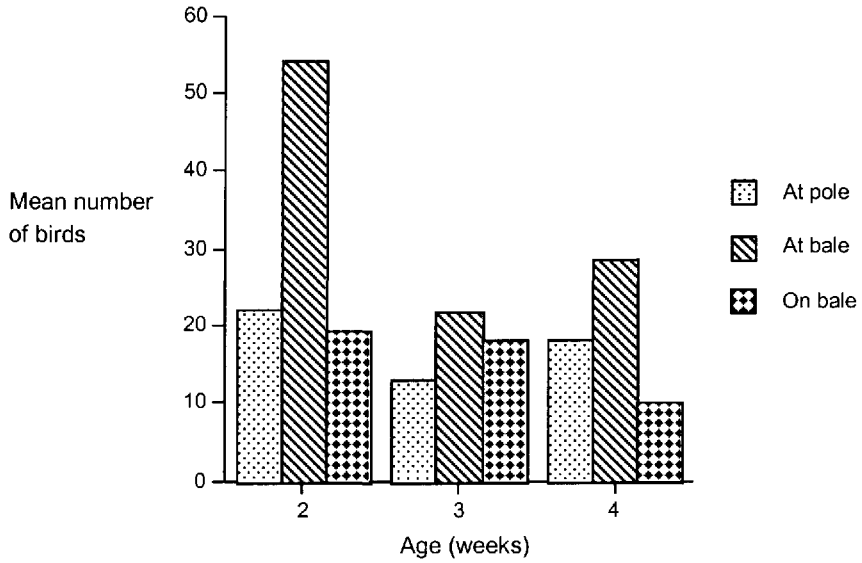


**Figure 2a** **Mean numbers of birds clustering around the 15 observed roof support poles, around the 15 observed bales and standing on the bales in enriched houses at three different ages.** The histograms represent the means of the four observation times during one day. There was no significant effect of age on tendency to stand on bales ($P = 0.368$, $df = 2$; Friedman test) but clustering around bales was related to age ($P = 0.039$, $df = 2$; Friedman test).

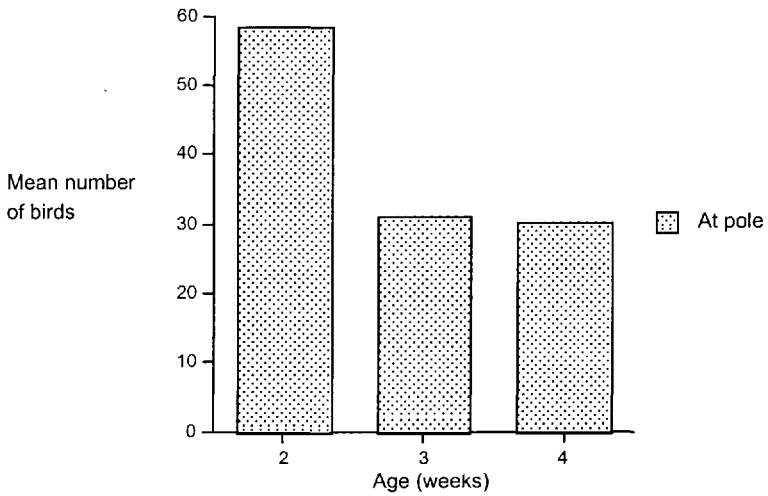


**Figure 2b** **Mean numbers of birds clustered around the 15 observed roof support poles in the unenriched houses at three different ages.** The histograms represent the means of the four observation times during one day. There is a significant effect of age on the numbers of birds seen clustering ($P = 0.002$, $df = 2$; Friedman test).

### *Mortality*

The mean mortality of the flocks with bales was 5.56 per cent. That of the flocks without bales was 4.25 per cent. Leg culls were 0.83 per cent and 0.42 per cent, respectively.

## Discussion

Growing broilers of all ages interacted with the straw bales, either standing on top of them or clustering close to them. However, the most striking result of this study was that the time spent performing all recorded behaviours except feeding was affected by the presence or absence of straw bales even in birds that were not directly interacting with the bales when observed. There were increases in standing and locomotion and decreases in sitting and resting in the enriched environment. Bout lengths of locomotion were also longer when bales were present. There is, thus, now quantitative evidence for the RSPCA's view that indoor chickens on farms can be kept active by enriching their environment.

The lack of difference in the amount of feeding between the two types of environment is not altogether surprising as, although feeding is a time-consuming behaviour (Dawkins 1989), it has been suggested that birds may achieve a constant amount of feeding time each day (Bubier 1996a). Bubier (1996b) also found that total time spent feeding by laying hens did not differ between hens kept in a normal pen and those kept in a pen enriched with various types of objects, although the frequency of feeding bouts was greater in the enriched environment.

A possible difficulty with interpreting these results might be the decrease in available floor space caused by the bales themselves; as they grew older, birds would have become constrained in their movements because less space was available in their enriched environment. However, the birds used the bales to perch upon and so there was effectively no decrease in space; in any case, the frequency of standing, walking and running was actually greater in the enriched environment with its 'constrained' space. This would indicate that broiler chickens with the same space allowance (17.4–18.0 birds per $m^2$ at finishing weight of 1.95 kg) are not constrained in their movements by lack of available space but rather by the lack of motivating factors to perform certain 'active' behaviours (Wood-Gush & Beilharz 1983). The presence of bales in this study acted as a stimulus to increase activity levels in the enriched houses.

### *Animal welfare implications*

The importance of enriching the environment of both zoo and farm animals has been repeatedly stressed in recent years (eg Appleby & Hughes 1991; Newberry & Estevez 1997; Mench *et al* 1998; Shepherdson *et al* 1998), and some form of enrichment has increasingly become a requirement either in law or as part of a code of practice. However, as far as farmers are concerned, these enrichments may have considerable implications for cost and/or disease-risk when applied on a commercial scale. Consequently, it is important to show that the recommended enrichments actually do benefit the animals themselves despite their costs, and that they do not simply reflect well-meaning but human-centred views of the way in which animals should be kept. This study has shown that the RSPCA's 1997 'Freedom Food' recommendation does indeed result in the predicted increase in activity of broiler chickens kept indoors. Even birds of widely used strains bred to achieve target slaughter weight in just over six weeks walk and run more frequently when supplied with straw bales. Not only is there a direct effect of the bales in that birds peck at and jump upon them, but also an indirect effect such that, even away from the bales, there is more activity.



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The European Commission Report (2000) identified as a major welfare issue in broilers the extent to which low levels of activity are caused by simple physical incapacity to carry out physical activity or, alternatively, the extent to which they are caused by reduced motivation for active behaviour. Our results show that simple physical incapacity cannot be the complete answer, because more active behaviour can be significantly increased by the addition of a relatively small change to the environment. Furthermore, the fact that this study was carried out on commercially run farms as part of a company's normal production shows that environmental enrichment can be successfully incorporated into commercial broiler production.

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