BEHAVIOURAL RESPONSES OF LAYING HENS TO CARRIAGE ON HORIZONTAL AND INCLINED CONVEYORS

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Abstract

Groups of end-of-lay (spent) hens were subjected to three different treatments on a short flat-belt conveyor. Observations of bird behaviour indicated that the incidences of wing flapping, loss of balance and alarm calling significantly increased when birds were conveyed up and down slopes in comparison to being conveyed horizontally ($P<0.01$). Birds were significantly more hesitant when approaching the incline compared to the horizontal ($P<0.001$). However, differences in behavioural responses were not reflected in times spent in tonic immobility or open-field tests. There were no significant differences for the three treatments. It is possible that human contact, before and after conveying, was a more significant fear stimulus than the treatment itself.

Keywords: *animal welfare, behaviour, conveyors, fear, handling, hens, injury, open-field, poultry, tonic immobility*

Animal welfare implications

Hens are liable to injury and distress during manual handling to and from battery cages. Mechanical conveyors potentially reduce the duration of manual contact and could improve the welfare of hens during house depopulation and re-population. In poultry houses these conveyors will necessarily have to include slopes. The effects of slopes on bird behaviour and responses must be investigated at the earliest stages to ensure that improvements, based on bird welfare, can be included in the development of the conveyor system.

Introduction

The welfare of end-of-lay hens during house depopulation and transport is a cause for concern. Gregory and Wilkins (1989) found that commercial depopulation of battery houses, where the birds were recovered from the cages and carried to the transport vehicle with three birds in one hand and four in the other, resulted in an average of 24 per cent of birds with broken bones. They also found that the incidence of bone breakage could be halved by carefully removing birds from cages and carrying them individually

from the house. Thus there is clear evidence that there is not only the need but also the means of making a welfare improvement to commercial practice. However, since end-of-lay hens are of little economic value and good quality labour for poultry handling is difficult to recruit, it is unlikely that the industry will make this improvement.

The introduction of a mechanized hen handling system could improve bird welfare and reduce the labour requirement at depopulation. Physical damage to birds could be reduced if they were removed individually from the cage and moved out of the house without being handed from man to man, or carried, by their legs, over long distances. The Livestock Engineering Group at Silsoe Research Institute is developing a conveyor system for moving laying hens from battery cages to transport vehicles. This system is based upon conveyor modules 2.4m long by 0.5m wide which can be linked, in series, along the aisles of a battery house. Modules are also being developed which will enable the birds to be transported round corners and conveyed up and down inclines.

The implications for bird welfare of any proposed mechanical handling system must be given careful consideration. Comparisons of the stressfulness of harvesting broiler chickens by machine and by hand (Duncan *et al* 1986) indicate that stress can be reduced and welfare improved by the use of well designed machines. Reed (1974) investigated how chickens can be transferred from one conveyor to another, redirected through a 90 degree corner and conveyed up inclines of 23 degrees on belts with a smooth surface and 45 degrees on belts with a rough surface. However the implications for bird welfare were not stated. Scott and Moran (in press) showed that manual carrying of individual birds, inverted and held by their legs, was significantly more fear-inducing than conveying; also that mechanical noise can be aversive to birds. Rutter *et al* (in press) indicated that the noise of a mechanical conveyor was as aversive to the birds as the motion itself.

This study attempted to investigate whether birds found conveying more or less of a welfare insult than gentle manual handling and, furthermore, if travelling up and down sloping conveyors was more fearful than travelling along horizontal conveyors. Changes in behaviour, such as wing flapping and loss of balance, were used to assess the ease with which birds travelled on sloping conveyors. Levels of fear were assessed by the time hens spent in tonic immobility, a trance-like state, or by open-field tests, before they returned to normal behaviour.

Materials and methods

Subjects

Sixty commercial egg-laying hybrid (ISA Brown) hens, about 30 weeks old, were taken from a battery cage system and placed into the room (2.4m x 3.0m x 2.4m high) which served as a home pen throughout the experiment. They were kept on wood-shavings and allowed food and water *ad libitum*. Each bird was given an identity number (on a leg ring) and randomly allocated to the three treatments. There were 20 birds in each treatment group, half being tested using tonic immobility and half using an open-field test. The birds were allowed one week to acclimatize to their new environment before being subjected to any treatment.

Treatments

There were three treatments:

a. Conveying along three horizontal 2.4m conveyors.
b. Conveying along two horizontal 2.4m conveyors followed by a 2.4m conveyor ascending at 25 degrees.
c. Conveying along two horizontal 2.4m conveyors followed by a conveyor descending at 25 degrees.

The intersections between the conveyor modules are shown in Figure 1. Each conveyor belt had a polyurethane 'waffle structure' surface with 0.5mm deep ribs at 1.5mm pitch.

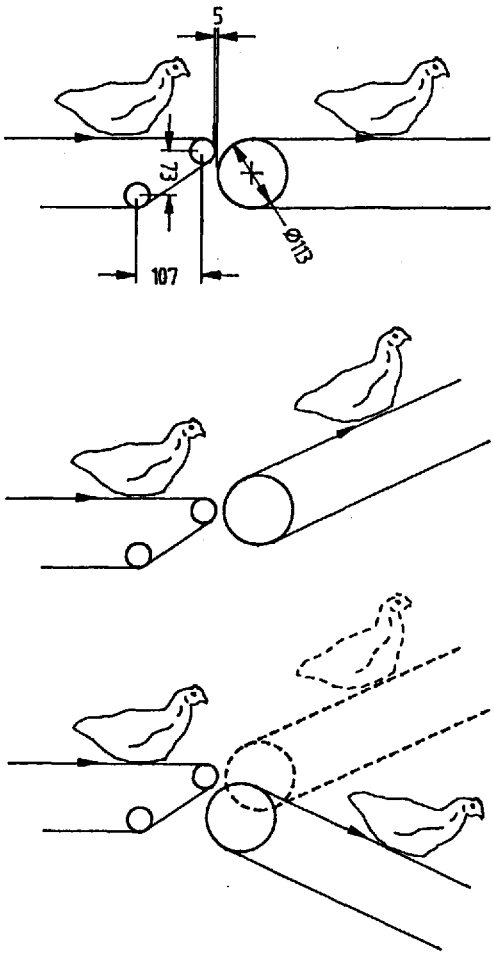

Figure 1 **Diagrams of the intersections between the second and third modules (all dimensions are in mm).**

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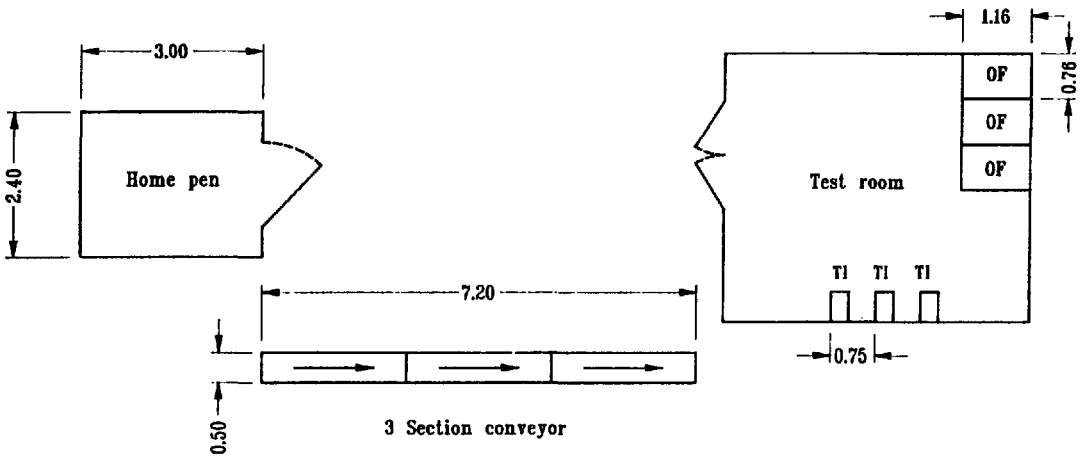

Figure 2 **Layout of the treatment area (all dimensions are in m).**

The treatment area was set out generally as shown in Figure 2.

On day 1 of the experiment, all 60 birds were subjected to the same gentle manual treatment. Each bird was selected at random, picked up and removed singly from the home pen. They were held firmly, but not tightly, by their sides, with wings folded, and carried manually to the test room over the same distance, and at approximately the same rate (0.5m/s), as they were to be conveyed later in the experiment. The birds were then placed into either tonic immobility (Gallup 1979, Jones 1986) or open-field test (Jones 1982, Jones & Faure 1982) according to their identity number. After testing, the birds were placed in a holding pen prior to being returned to the home pen at the end of the experiment. The birds remained in the home pen during day 2.

On day 3, the birds were again selected at random, removed from the home pen in exactly the same manner as on day 1, and subjected to the appropriate conveyor treatment. Immediately prior to each bird's treatment, the position of the third conveyor was adjusted according to the treatment dictated by the identity of the bird. This adjustment could be made within a few seconds of removing a bird from the home pen. The birds were nominally conveyed for 14.4s though this time necessarily increased if the birds hesitated at any stage during conveying. Birds were placed into either tonic immobility or open-field tests as before so that individuals received the same test on day 1 and day 3.

Behavioural observations during conveyance

Video recordings were made of the birds as they were moved along the belt. The number of wing extensions and flappings, losses of balance, escape behaviours, alarm calls, uncompleted rides, and hesitations at transition to the third conveyor for the birds in the three groups, were recorded.

Tonic immobility and open-field tests

Tonic immobility is a condition in which a bird remains in a trance-like state, the duration of which is directly related to the level of fear (Gallup 1979, Jones 1986). Open-field experiments investigate how quickly an animal returns to normal behaviour patterns after exposure to a frightening or novel stimulus (Jones 1982, Jones & Faure 1982) and can also indicate levels of exhaustion. As space to carry out tests was severely limiting, the tonic immobility (TI) and open-field (OF) tests were carried out in the same room. The arrangement of the test area is shown in Figure 2.

The TI tests used wooden cradles to support the inverted bird. The cradles were 75cm apart, though birds were seldom tested in adjacent cradles to reduce the risk of disturbance. The duration of tonic immobility was recorded.

The OF areas were made with three yellow plastic drawers from a modular broiler transport container. These drawers were 111cm x 77cm x 23cm high. They were placed side by side and a 39cm high hardboard partition was placed around each open-field to limit bird interaction. A rectangle (40cm x 35.5cm) was drawn at the centre of the bottom of each drawer. A test bird was placed within the rectangle and the latency for the bird to take the first step outside that area recorded. During the test, adjacent birds were nominally 77cm apart.

Results

The results from a χ^2 test of the behavioural observations are presented in Table 1 and Figure 3.

Table 1 A comparison of the incidence of behaviours of birds on a horizontal conveyor (O°), ascending conveyor (+25°) and descending conveyor (-25°).

Incline	Wing extension	Wing flap	Lost balance	Escape	Alarm calls	Failed ride	Hesitation
0°	10	5^a	1^a	3	1^a	2	0^a
+25°	10	14^b	9^b	6	3^b	1	9^b
-25°	9	12^b	9^b	9	10^c	4	8^d

The superscripts represent results from a χ^2 test: differences between a, b and c represent $P<0.01$; differences between a and d represent $P<0.001$.

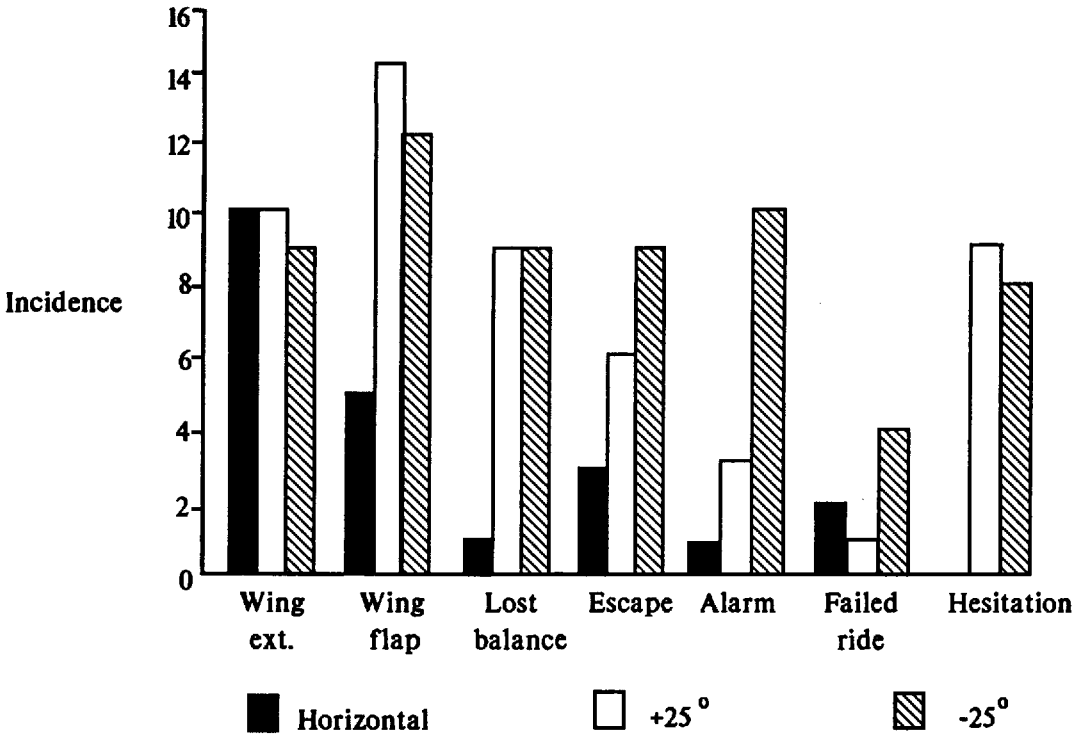

Figure 3 Occurrence of behaviours during conveying, showing total number of incidences per group.

Table 2 Mean $\log_{10}$ duration of TI and OF tests for birds in the different groups on day 1 (gentle handling) and day 3 (by conveyor).

Groups (6 groups each of 10 hens)	$\log_{10}$ duration (s)		
	Gentle handling (day 1)	By conveyor (day 3)	Incline of conveyor
TI test	2.04 ± 0.18	1.87 ± 0.12	0°
OF test	2.23 ± 0.26	1.81 ± 0.29	
TI test	2.24 ± 0.19	2.20 ± 0.13	+25°
OF test	2.12 ± 0.29	1.91 ± 0.40	
TI test	1.99 ± 0.10	1.95 ± 0.11	-25°
OF test	2.31 ± 0.15	2.43 ± 0.24	

Table 3 Mean ranks from a Kruskal-Wallis ANOVA (of log_{10} duration) for TI and OF comparing conveying with gentle manual handling.

Groups (n=10)	Gentle handling (day 1)	By conveyor (day 3)	Incline of conveyor
TI test	25.5	34.2	0°
OF test	27.7	37.3	
TI test	25.6	32.5	+25°
OF test	25.0	25.6	
TI test	31.5	33.7	-25°
OF test	36.7	30.7	

No significant difference was found between gentle manual handling and any of the treatments, as measured by the durations of the TI (H=2.551, n=10) and OF (H=4.803, n=10) tests.

The data from the tonic immobility and open-field tests (Table 2) were subjected to a Kruskal-Wallis non-parametric one-way analysis of variance (Siegel 1956). The mean ranks are presented in Table 3.

Discussion

The comparisons made of durations in the TI and OF tests of the gentle handling on day one and the three conveying treatments on day 3 showed no significant changes in durations or the ranking of the groups.

The results from behavioural observations indicate that birds subjected to the sloping conveyors appeared more aroused compared to those subjected to horizontal conveying. The birds apparently suffered difficulty at the transition from the horizontal to the inclined conveyor and were prone to losses in balance accompanied by problems with grip on the gradient. This was reflected in wing flapping and the occurrence of behaviours to regain balance, but there was no significant difference in the number of birds failing to complete the journey. The observations of bird behaviour indicate that there are some changes in bird response on sloping conveyors compared to horizontal conveyors. Problems are likely to occur at the point where there is a transition from horizontal to sloping conveyors. Care must therefore be taken in the design of this part of such a system. The results indicate that conveying up and down slopes is possible. However differences in behavioural responses on the conveyors for the three treatments are not reflected in the results from TI and OF tests. The TI and OF results from day 1 indicate that no group was more frightened than any other when handled manually.

All birds exposed to conveying on day 3 also were necessarily manually handled on to and off the conveyors. Thus any significant differences between groups on day 3 could reasonably have been attributed to the conveying treatment. However it is difficult

to compare directly the data from day 1 with those from day 3 since all birds on day 3 had previously been exposed to the TI and OF tests. It can be argued that as a result, the birds may habituate to such treatment and therefore the durations in the TI and OF tests would be reduced, while any frightening stimulus from conveying would act to increase the durations in TI and OF. As a result no firm comparisons between manual handling and conveying can be made from these results. However it can be argued that the habituation resulting from a single exposure to TI and OF is not likely to cause marked changes in duration in these tests. If conveying had proved to be a particularly frightening experience the subsequent increase in times spent in TI and OF would have overcome the expected reductions in test durations from such habituation. Nevertheless firm conclusions about the suitability of conveying on slopes cannot easily be drawn without further investigations. The group sizes (n=10) may be too small for any effects to be determined by tonic immobility and open-field observations.

This first study showed that birds were able to travel on sloped conveyors but found it more disturbing than level conveying and displayed more behaviours associated with loss of balance. With some modifications to the system, such as an improved transition between horizontal and sloping conveyors and a belt surface which birds can grip better, it is likely that birds will be able to move on to the slope more easily and maintain their balance.

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