



Poultry Research

The effect of large or small furnished cages on behaviors and tibia bone of laying hens

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ABSTRACT

This study aimed to investigate the effects of large furnished cages (LFCs) or small furnished cages (SFCs) on behavior and tibia bone of laying hens. Three hundred and sixty Hyline brown hens at 16 weeks of age were allocated into 3 treatments with 6 replicates: LFCs, SFCs, and conventional cages (CCs). The experiment was started at 18 weeks of age and finished at 34 weeks of age. The behaviors of focal animals were observed during 3 periods of 08:00–10:00, 13:00–14:00, and 16:00–17:00 on Wednesday in 20th, 24th, 28th, and 32nd week of age. Tibia bones were sampled and measured for tibia weight, length, density, and strength were measured. The results showed that walking behavior of LFC hens was significantly higher ($P < 0.05$) than CC hens. Standing and lying behavior for the hens in LFC was significantly more frequent than for those in SFC and CC ($P < 0.05$). Dust bathing and perching behavior in LFC was significantly more frequent than in SFC ($P < 0.05$). The hens in LFC performed significantly more comfort, drinking, preening, and fighting behavior than the SFC and CC hens ($P < 0.05$). Sand pecking was found to be significantly more frequent in LFC than SFC ($P < 0.05$). No significant effect was found on pecking by types of cages ($P = 0.20$). Tibia strength of the hens in LFC and SFC was significantly greater than CC ($P < 0.05$). Tibia weight in LFC was found to be significantly lower than SFC ($P < 0.05$). However, no significant effect was found on tibia density and tibia length by the types of cage ($P = 0.53$ and $P = 0.33$). The use of perches by the LFC hens was significantly higher than for the SFC hens ($P < 0.05$). In conclusion, LFC-allowed hens show more behaviors and had stronger or heavier tibias than the SFC and CC hens.

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Introduction

The conventional cages (CCs) for laying hens were widely used around the world due to low cost, high performance, easy management, and hygiene. Traditional cages lead to many welfare issues (Nicol, 1987). The CCs provide a barren environment, restrict the birds' movement and prevent them from performing natural behaviors such as nesting, perching, and sand bathing (Fraser, 2008). Depriving hens of an appropriate nest site could have several effects on the behavior before oviposition and is associated with increased pacing behavior (Mills and Wood-Gush, 1985). Out

of respect for animal welfare, the European Union had implemented, in accordance with EU directives, a ban in the use of CCs as of 2012, so that only nonbattery systems such as cage-free, free range, or furnished cages are allowed to be used in EU (Anonymous, 1999). Furnished cages contained a perch, nest box, and litter area and provided more space area per hen than the CC (Appleby and Hughes, 1995). It has been reported that many countries in EU, such as UK, Norway, Germany, and Denmark widely adopt furnished cage systems (Tauson, 2005).

Furnished cages can allow hens perform a range of natural behaviors considered most important to the birds, such as perching, nesting, dust bathing, foraging, comfort behaviors, and other activities that may not occur in the CC (Appleby, 2004; Nicol, 1987; Shimmura et al., 2008; Shimmura et al., 2009). The furnished cages also improve the hens' opportunity to exercise, thereby strengthening the bones (Abrahamsson et al., 1996) because hens housed in the furnished cages are provided with more space per

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bird. In addition, perches to cages can further improve bone strength due to increasing the type of activities (Tauson, 1984; Abrahamsson and Tauson, 1993; Vits et al., 2005). Furnished cages actually integrate the benefits of the CC system by maintaining hygienic condition and productivity level (Appleby, 1993) but also improve birds' welfare conditions (more activities and behavioral expression). From a commercial perspective, the furnished cage systems have similar production levels and feed conversion rates as the CCs (Abrahamsson et al., 1995; Guesdon and Faure, 2004).

Animals housed in artificial habitats are confronted by a wide range of potentially provocative environmental challenges. Many of the potential stressors may adversely affect animals living in confinement. Some confinement-specific stressors such as restricted movement, reduced retreat space, forced proximity to humans, reduced feeding opportunities, remained in abnormal social groups, and other restrictions of behavioral opportunity are considered (Morgan and Tromborg, 2007). Behavioral or physiological responses of the confined animals may clearly indicate the causes of those responses and may provide valuable information for improving management. With increasing concerns for better welfare of birds, the furnished cage designs attempt to meet the requirement of hens to express natural behaviors (Mench, 1998). To better understanding the effects of the design of furnished cages on hens, we compared behaviors and bone strength of laying hens in large furnished cages (LFCs) or small furnished cages (SFCs).

Materials and methods

The experimental design and animal management

Three hundred and sixty of healthy Hyline brown hens, 16 weeks of age, were randomly chosen from a commercial flock and divided into 3 treatment groups: LFCs, SFCs, and CCs. These 360 birds were allowed to be habituated to the LFC and SFC cage conditions for 2 weeks. The figures of the layout of LFC and SFC are shown in Figures 1 and 2. Each group included 6 replicates, each of which consisted of 40 hens for LFC, and 8 hens for SFC and 12 hens for CC. Detailed cage parameters of LFC and SFC are given in Table 1. The experiment started at 18 weeks of age and finished at 34 weeks of age. All experimental hens were housed in the same room and received an identical feed with metabolic energy content of 11.13 MJ/kg and crude protein of 16.08%. They were fed twice a day at 7 AM and 3 PM. Water was available ad libitum at 3 nipple drinkers in each cage. Mechanical ventilation was used to control the dust and ammonia concentration. Ambient temperature of the

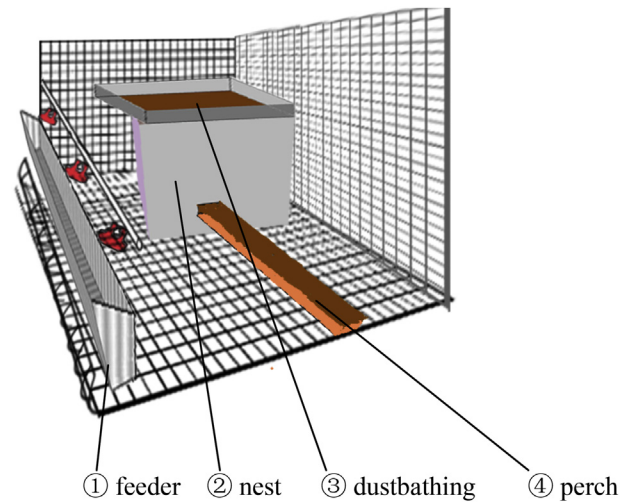


Figure 2. The detailed design of SFC. SFC, small furnished cage.

testing room was maintained at 18°C–29°C, and relative humidity was 45%–60% during the days. The light schedule was set for 16L:8D.

Measurement for behavior

Behavioral observations were conducted during 3 periods of 08:00–10:00, 13:00–14:00, and 16:00–17:00 on Wednesday during the 20th, 24th, 28th, and 32nd week of age. Behavioral data were recorded with video cameras (FS-EH303, Shenzhen Feihongxin Technology Company, Shenzhen) over 24 hours. Focal animal sampling and instantaneous sampling methods were adopted. In this study, state behaviors included walking, lying on the floor, standing, feeding, dust bathing, perching, and nesting. These behaviors were represented as the proportion of the total occurrences (%). Event behaviors included feather picking, preening, drinking, combating, comforting, dust pecking, and perch pecking and were represented as the number of occurrences (n) for that behavior. The definitions for state and event behavior are

Table 1
Parameters of LFC, SFC, and CC designs

Specification	LFC	SFC	CC
Cage size (cm)	300 × 100 × 100	120 × 50 × 45	192 × 33 × 35
Group size (hens)	40	8	12
Stocking density (hen/m ²)	13.3	13.3	18.9
Front height of cage (cm)	114	52	40
Rear height of cage (cm)	110	45	35
Floor area (cm ²)	30,000	6000	6336
Average floor area/bird (cm ² /hen)	750	750	528
Nesting box size (cm)	50 × 50 × 35	24 × 50 × 27	
The number of nesting box	4	1	
Dust-bathing size (cm)	60 × 35 × 4	24 × 50 × 4	
The number of dust baths	2	1	
Average dust-bathing area/bird (cm ² /hen)	105	150	
The length of long perch (cm)	300	96	
The length of short perch (cm)	100		
Perch allowance (cm/hen)	20	12	
Trough length (cm)	300	96	

CC, conventional cage; LFC, large furnished cage; SFC, small furnished cage.

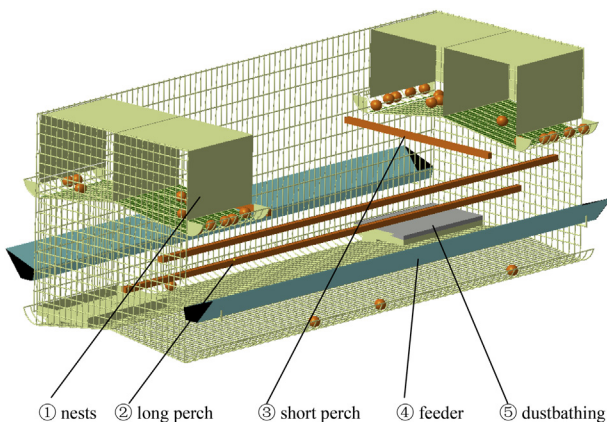


Figure 1. The detailed design of LFC. LFC, large furnished cage.

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