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Applied Research Note: Pretesting of a new housing system for breeding birds of layer strains in Sweden

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Primary Audience: Veterinarians, Animal Welfare Inspectors, Researchers, Advisors

SUMMARY

Pretesting of any new animal housing system in Sweden must include an evaluation of animal welfare. In 2013, a Swedish hatching company applied to the competent authority (**CA**) for permission to import, install, and bring into use a system with large furnished cages for breeding birds of layer strains, with ∼70 birds per cage (compared with the current 16 birds per cage). Pretesting of the system was conducted on 3 batches, ∼24,500 birds each of breeding hens and males of Lohmann Selected Leghorn and Lohmann Brown (**LB**) at the hatching company's facilities. Data recorded included clinical records at 3 different ages on 50 birds in each batch and data from official welfare monitoring during production and at slaughter. The birds in the batches had serious health and animal welfare issues, including high mortality, in particular among LB males. Mortality in the batches was more than double (9.6–11.0%) the average mortality (3.8%) reported for birds in conventional furnished cages (**CFC**) in Sweden during the same period. Compared with CFC birds in Sweden, prevalence of keel bone bursitis was also high in the batches and there were extensive feather damages, especially in hens. In addition, daily supervision was considered difficult to carry out safely in the system. Thus, the system raised important issues concerning bird health and welfare, and the recommendation to the CA was not to approve the system for the Swedish market. The CA decided to ban the system, a decision supported by the Swedish appeal court.

Key words: laying hen, bird welfare, health, bursitis, mortality

2021 J. Appl. Poult. Res. 30:100152
https://doi.org/10.1016/j.japr.2021.100152

DESCRIPTION OF PROBLEM

Since the 1970s, pretesting of any new housing system for farm animals in Sweden must include an evaluation of animal welfare before the system is cleared for use in Sweden (Hermansson and Gunnarsson, 2013). The Swedish Board of Agriculture is the competent authority (**CA**) in farm animal welfare monitoring and makes decisions in relation to pretesting of new techniques and systems for farm animals. In 2013, a Swedish hatching company applied to the CA for permission to import, install, and bring into use a furnished cage system for breeding birds of layer strains, with ∼70 birds per cage that had not previously been used in Sweden. The current legislation stated that furnished cages should have no more than 16 birds per cage. The CA required this new housing system to be pretested as new technology performed by the Swedish

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Table 1. Group size, hybrid, sex, and mortality (Mort.) in the three batches studied for white Lohman Selected Leghorn Converter (LSL) and Lohman Brown Converter (LB) layer strains.

House	Batch	Total	Hybrid	Incoming/depopulated	Week of age	Total	Females	Males	Proportion ♂/♀
1	1	23,440	LSL	Incoming	15	18,300	16,700	1,600	1:9.6
				Outgoing	72	16,930	15,410	1,520	
				Mort. (%)		7.5^{A}	7.7^{C}	5.0^{D}	
			LB	Incoming	15	5,140	4,650	490	1:9.4
				Outgoing	72	4,263	4,004	259	
				Mort. (%)		17.1^{B}	13.9^{D}	47.1^{C}	
	2	24,800	LSL	Incoming	17	18,800	16,800	2,000	1:8.4
				Outgoing	75	17,361	15,434	1,927	
				Mort. (%)		7.7^{B}	8.1^{C}	3.7^{D}	
			LB	Incoming	17	6,000	5,300	700	1:7.5
				Outgoing	75	4,963	4,544	419	
				Mort. (%)		17.3^{A}	14.3^{D}	40.1^{C}	
2	1	24,100	LSL	Incoming	15	18,150	16,000	2,150	1:7.4
				Outgoing	75	16,481	14,486	1,995	
				Mort. (%)		9.2^{B}	9.5^{C}	7.2^{D}	
			LB	Incoming	15	5,950	5,300	650	1:8.1
				Outgoing		4,974	4,598	376	
				Mort. (%)		16.4^{A}	13.2^{D}	42.2^{C}	

$^{A, B}$Values within a column with different superscripts differ significantly at $P < 0.001$ in χ^2 testing (LSL vs LB).
$^{C, D}$Values within a row with different superscripts differ significantly at $P < 0.001$ in χ^2 testing (♀ vs ♂).

University of Agricultural Sciences, a process described in this article. The CA decided that data recording on animal welfare and health should comprise 3 batches of production cycles, to provide sufficient information to support decision-making on the system. This article presents the animal health and welfare results from pretesting of the new housing system for breeding birds and the conclusions reached (Gunnarsson, 2018).

MATERIALS AND METHODS

Animals and Housing

This study comprised only clinical scoring of commercial birds with the general aim of ensuring good animal welfare. Owing to the expected low severity of potential welfare hazards in the context of legislation for animal experimentation the housing, this study did not require approval from the ethics committee for animal experiments as per Swedish or European Union legislation.

A cage system consisting of large furnished cages (**LFC**), with 73 birds per cage was installed in 2 houses on 2 separate properties, owned by a hatching company, in Western Sweden. The pretesting included 2 layer batches in house 1 (batch 1 [**H1B1**] and batch 2 [**H1B2**]) and 1 batch in house 2 (**H2B1**). The insulated buildings had additional heating and mechanical negative-pressure ventilation systems, and there were separate ventilation systems for gas extraction from the manure pits. Each cage has 189.6 cm of wire mesh +70.6 cm of litter area (length), 81.8 cm (height) and width 230 cm (width), giving total available area of 59,846 cm^2, or 820 cm^2 per bird, including 220 cm^2 littered area per bird. The area of the colony nest per cage was 35 cm × 230 cm = 8,050 cm^2, which corresponds to about 82 hens per m^2. Each LFC had 2 feed chains of 230 cm giving available feed trough length of 12.6 cm per bird. Water was supplied by 8 nipples per cage, that is, 9 birds per nipple. Each cage had 5 metal perches (Ø 33 mm) on top of feed and water lines (i.e., ∼30–50 cm above cage floor), and the perch availability was at least 15 cm per bird. Wood shavings in litter areas were replaced regularly. There were 3 levels of cages, and the total height was ∼3.5 m.

Breeding parent flocks of white Lohmann Selected Leghorn Converter (**LSL**) and Lohmann Brown Converter (**LB**) were studied, and the flock information is found in Table 1. The maximum number of birds placed per house was, as per application, 24,528 birds (not beak-trimmed) (i.e., 22,176 females and 2,352 males) that were housed in 336 LFC containing ∼7 males and ∼66 females (∼1:9.4). The birds were fed a recommended commercial diet, and the manure was removed twice a week by mechanized rubber belts under each level of cages.

Data Recording

Farm staff kept daily records including mortality, but no postmortem examination of dead or culled birds was performed. Clinical bird scoring was performed at 35 to 38, 55, and 71 to 74 wk of age. Within each hybrid, 1 bird was caught and scored from selected cages, and randomization was performed at each scoring age. A modified version of methodology developed by Gunnarsson et al. (1995) and the Welfare Quality Consortium (2009) was used for assessing bird welfare in relation to housing and management (details in Table 2). Fifty randomly selected females and 4 to 6 males were scored by an experienced technician on each occasion and proportionally to number of LB and LSL birds. When applicable, chi-square (χ^2) tests were used to investigate associations.

RESULTS AND DISCUSSION

Mortality

The mortality in the 3 batches studied (H1B1, H1B2, H2B1) was 9.6 to 11.0% and was significantly higher (χ^2, $P < 0.05$) for LB birds (16.4–17.3%) than for LSL birds (7.2–9.5%) (Table 1). Based on reference values in the management guidelines in Lohmann Tierzucht GmbH (2019), there should have been no difference in mortality between the strains. The higher mortality observed may be partly because the space allowance for LB birds was lower in practice, as their BW can be expected to be 1.9 to 2.2 kg, compared with 1.7 to 1.9 kg for LSL as per LT, while the number of birds per cage was the same. Furthermore, mortality was significantly higher (χ^2, $P < 0.05$) for LB males (40.1–47.1%) than forLB females (13.2–14.3%), whereas LSL males had significantly lower (χ^2, $P < 0.05$) mortality (3.7–7.2%) than LSL females (7.7–9.5%) (Table 1). Higher numbers of males died at an early age in batches H1B2 and H2B1 compared with H1B1, although mortality was high for LB males throughout the production period in all batches (Table 1). The pattern of mortality in relation to gender and hybrid was similar in all 3 batches studied. No statistics on the health and mortality of layer breeding batches in Sweden were available at the time of the study. However, compared with a Swedish survey values for mortality in birds in table egg production batches in conventional furnished cages mortality (3.8%, range: 2.6–5.3%), mortality in the present study was almost three-fold higher (9.6–11.0%) (Svenska Ägg [The Swedish Egg Board], 2016).

Feather Damage

Plumage deteriorated with increasing age in all categories of birds in all batches studied (Table 2). This is a common finding in other studies of feather damage and feather pecking in laying hens (Algers et al., 1995; Gunnarsson et al., 1995; Bestman et al., 2017). Feather pecking depends on for example, the birds being able to pick and eat each other’s feathers, but in cage systems also on the equipment and activity of the birds, which can increase wear on feathers. The feathers of the females were, as expected from the mating act, worse than those of the males, but feather damages also were common on the males. The feather damage in the system pretested in the present study was extensive and similar same across all 3 batches studied, indicating that it is partly dependent on the housing system. (Table 2).

Keel Bone Deviation

The incidence of moderate keel bone deviation (**KBD**) increased over time in all batches (Table 2). Although moderate KBD was common (up to 28% in batch H1B1), the incidence of severe KBD was low (max. 4%). The incidence of moderate KBD was highest in H1B1 for both females and males. Moderate KBD was significantly more common in LB females (27 of 120) than in LSL females (31 of 331) (χ^2; $P < 0.001$; $n = 451$). The prevalence of KBD, which may be due to bending or microfracturing of the sternal

Table 2. Clinical health (%) in the hens of the three batches studied for white Lohman Selected Leghorn Converter (LSL) and Lohman Brown Converter (LB) layer strains, at different week of age (n = 50 in all groups, except H2B1 74 wk of age where n = 51).

Body part	Score	H1B1 week 37	H1B1 week 55	H1B1 week 71	H1B2 week 38	H1B2 week 55	H2B2 week 74	H2B1 week 35	H2B1 week 55	H2B1 week 74
Plumage/Front of the neck	No or very few feathers damaged	86	28	16	70	18	62	88	30	53
	Few feathers damaged, featherless areas <5 cm^2	8	14	6	14	12	2	4	18	10
	Featherless areas ≥ 5 cm^2 (<75 featherless)	6	26	28	4	16	10	0	12	8
	Featherless area ≥ 5 cm^2, (>75 featherless)	0	32	50	12	54	26	8	40	29
Plumage/Head back of the neck	No or very few feathers damaged	90	50	40	54	32	64	76	40	63
	Few feathers damaged, featherless areas <5 cm^2	4	8	12	4	4	2	10	6	6
	Featherless areas ≥ 5 cm^2 (<75 featherless)	4	28	14	6	16	6	8	16	4
	Featherless area ≥ 5 cm^2, (>75 featherless)	2	14	34	36	48	28	6	38	27
Plumage/Back	No or very few feathers damaged	96	28	12	58	10	56	74	24	35
	Few feathers damaged, featherless areas <5 cm^2	4	14	2	18	6	4	18	6	6
	Featherless areas ≥ 5 cm^2 (<75 featherless)	0	22	4	12	12	0	8	2	6
	Featherless area ≥ 5 cm^2, (>75 featherless)	0	36	82	12	72	40	0	68	53
Plumage/Wings	No or very few feathers damaged	84	14	0	2	2	0	32	4	0
	Few feathers damaged, featherless areas <5 cm^2	16	46	20	96	12	38	68	74	29
	Featherless areas ≥ 5 cm^2 (<75 featherless)	0	38	70	2	62	40	0	22	43
	Featherless area ≥ 5 cm^2, (>75 featherless)	0	2	10	0	24	22	0	0	27
Plumage/Tail	No or ≤ 5 tail feathers damaged	24	0	2	2	0	0	12	2	6
	6–10 tail feathers damaged	40	8	4	32	4	16	42	20	14
	9–12 tail feathers highly damaged	34	80	6	62	10	28	42	56	27
	≥ 13 tail feathers highly damaged and/or almost bare	2	12	88	4	86	56	4	22	53
Plumage/Breast	No or very few feathers damaged	30	2	8	2	2	4	16	4	8
	Few feathers damaged, featherless areas <5 cm^2	10	10	0	6	0	2	14	6	6
	Featherless areas ≥ 5 cm^2 (<75 featherless)	18	4	6	4	2	2	14	2	6
	Featherless area ≥ 5 cm^2, (>75 featherless)	42	84	86	88	96	92	56	88	80
Plumage/Belly	No or very few feathers damaged	80	20	10	40	24	48	60	20	29
	Few feathers damaged, featherless areas <5 cm^2	2	6	2	6	4	0	4	8	2

continued

Table 2. Continued

Body part	Score	H1B1 week 37	H1B1 week 55	H1B1 week 71	H1B2 week 38	H1B2 week 55	H2B2 week 74	H2B1 week 35	H2B1 week 55	H2B1 week 74
	Featherless areas ≥ 5 cm^2 (<75 featherless)	8	8	6	6	4	6	8	2	8
	Featherless area ≥5 cm^2, (>75 featherless)	10	66	82	48	68	46	28	70	61
Skin lesion on body	No lesion	100	90	86	98	92	98	100	96	98
	Pecking wound ≥ 0.5 cm	0	6	12	2	4	2	0	2	2
	Scratches	0	2	0	0	4	0	0	2	0
	Other lesion	0	2	2	0	0	0	0	0	0
Keel bone damage	No deviation 0.5 cm	86	82	72	96	92	84	100	92	80
	Deviation 0.5-1 cm	14	18	28	4	8	12	0	8	20
	Deviation > 1 cm	0	0	0	0	0	4	0	0	0
Keel bone damage	Normal	100	100	98	98	90	92	100	86	84
	Bursitis	0	0	2	2	10	8	0	14	16

Abbreviations: H1B1, house 1 batch 1; H1B2, house 1 batch 2; H2B1. house 2 batch 1.

bone, has increased recently, and risk factors such as genetics, feed, and housing have been identified (Riber et al., 2018). However, the prevalence in this study was twice as high as that reported for Sweden in the 1990s (Algers et al., 1995), but owing to lack of more recent data, it was not possible to determine if the present welfare problem could be attributed to the LFC system.

Keel Bone Bursitis

Keel bone bursitis (**KBB**), that is, skin lesions indicating inflammation of the subcutaneous mucosal sac (Gunnarsson et al., 1995), was found in all batches (incidence up to 16%) (Table 2), and it was significantly more common in LSL females (24 of 331) than in LB females (2 of 120) (χ^2; P = 0.025; n = 451). In batch H1B1, KBB was found only at 71 wk of age, but the incidence was higher in the other 2 batches and the incidence increased over time, and levels were higher than those reported in previous studies (Algers et al., 1995; Gunnarsson et al., 1995; Jung et al., 2019). In agreement with previous research (Gunnarsson et al., 1995; Riber et al., 2018), no significant association between KBB and KBD was found (χ^2; P = 0.44; n = 451). The results of KBB in this study were confirmed in the official meat records from the Swedish Food Agency. The Swedish Food Agency considered the incidence in the flocks to be very high, that is, up to 8.3% of all slaughtered birds and up to 69% of the total number of rejections, and these findings invoked legal action from the CA. Therefore, it was concluded that the increased incidence of KBB was related to the LFC housing system studied.

Supervision

The system studied was complex, as the LFC were deep, and contained equipment that partly obstructed easy supervision of all birds in the group. The CA noted during inspections that "the installation of technical equipment for water supply partially hindered the staff in their ability to perform supervision satisfactorily" and that "the various cages were found to be too deep to be able to carry out satisfactory daily supervision in an acceptable manner." Furthermore, the 3 levels of cages were high (3.5 m), and the top cages could not be inspected without a ladder, which further impaired easy supervision of bird welfare and made it difficult to remove dead or sick birds from the top cages. At the inspection visit before removal of a batch for transportation to slaughter, the CA found that the staff "experienced the cages very, very difficult to empty and work in." The risk of injury to both birds and personnel was considerable. The CA concluded that it was doubtful whether daily supervision could be carried out in a satisfactory manner in the cages, while when emptying the system, there was a great risk of both birds and personnel being injured.

Pretesting Decision

The results from pretesting of the LFC system for breeding birds revealed important bird health and welfare issues. These included, compared to what has previously been reported in other Swedish layer flocks (Algers et al., 1995; Svenska Ägg [The Swedish Egg Board], 2016), increased mortality in LB males, high prevalence of KBB, and increased feather damage, particularly in female birds. Furthermore, owing to the design of the system, daily supervision was found to be difficult to carry out safely. Based on these results, the CA decided that the system did not meet the requirements set in Swedish animal welfare legislation and therefore rejected its marketing and use in Sweden. The owner of the hatching company appealed the decision, but it was upheld by the Swedish appeal court on April, 6 2020.

ACKNOWLEDGMENTS

The author thank research technician Anne Larsen at Swedish University of Agricultural Sciences and the staff at the pretesting farm for valuable help with data recording, and Lina Göransson for valuable comments on the manuscript. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

DISCLOSURES

The author declares no conflicts of interest.

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