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The prevalence of feather pecking and development in commercial flocks of laying hens

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Abstract

Feather pecking and cannibalism remain serious problems when laying hens are intensely farmed, but there is not much data on the true prevalence of feather pecking under commercial conditions. A recent epidemiological survey estimated it to be 37.5%. To verify this value we collected data on the occurrence of feather pecking by means of direct observations. Twenty-five rearing flocks on commercial poultry farms were included in the study. Observations were made in weeks 5, 14, 20, 32 and 50. Additionally plumage condition was evaluated and mortality and egg production were recorded.

The observations revealed that 40.0% of all flocks had developed considerable frequencies of feather pecking (>30 feather pecking interactions per 30 individuals per 30 min) by week 5 and by week 14 this had risen to 77.3%. The frequency of feather pecking interactions increased significantly between weeks 5 and 14, then there was a significant decrease at week 20 and the level remained the same in week 32. Feather pecking became more damaging with increased frequency and with increasing age of the birds. Each week the relative amount of severe feather pecking was positively correlated to the overall frequency of feather pecking in a flock and the regression coefficient for these two measurements increased steadily from weeks 5 to 32. Very little damage to the plumage was recorded before week 20, but thereafter damage increased significantly in weeks 32 and 50. Feather pecking did not influence mortality, but egg production was negatively affected in week 32.

We conclude that more attention should be paid to the development of feather pecking during the rearing of laying hen chicks. Its consequences are not immediately evident, but frequencies of feather pecking remain high as the birds get older, with damage to the plumage increasing and egg production may be reduced. Therefore, all known risk factors such as a lack of access to elevated perches, high density or bad air quality should be controlled in order to prevent development of feather pecking during the rearing of laying hen chicks.

Keywords: Feather pecking; Rearing; Laying hen chicks; Mortality; Egg production

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1. Introduction

Feather pecking and cannibalism remain serious problems when hens are kept under commercial conditions (Savory, 1995). They cause reduced welfare of the birds and increased economical losses due to increased mortality, increased food consumption because of defeathering (Leeson and Morrison, 1978; Tullett and Macleod, 1980) and a reduction in egg production (Johnsen et al., 1998; El-lethey et al., 2000). Feather pecking and cannibalism are found in battery cages as well as in modified cages, deep litter and aviary systems (Allen and Perry, 1975; Bessei et al., 1984; Appleby and Hughes, 1991). While there is much debate as to what extent the different systems are affected, only a few studies present data on how prevalent these behavioural disorders actually are under the existing conditions of poultry farming (Gunnarsson et al., 1999). A representative survey revealed that in Switzerland, 37.5% of the flocks are judged by their owners as having problems with feather pecking during the rearing period (Huber-Eicher, 1999). Feather damage or more severe consequences of this behaviour, such as injuries or losses, were used as judgement criteria by 69.7% of the farmers, with milder forms of feather pecking overlooked as not having much consequences. The figure of 37.5% of affected flocks might therefore underestimate the true extent of the problem and a follow-up study was conducted to evaluate the prevalence and development of feather pecking during rearing by means of behavioural observations. We did not intend to reveal further risk factors, because this had been done previously by an in depth analyses of the survey data (Huber-Eicher and Audigé, 1999).

The extent of feather pecking was quantified in 25 commercial flocks during weeks 5 and 14. The observations continued when the birds were in lay (weeks 20, 32 and 50) in order to investigate the further development of feather pecking and the influence early experience with feather pecking might have on the frequency of this behaviour when in lay. As an indirect measure of feather pecking, we recorded the extent of damage to the tail feathers and the number of birds with naked patches. In addition, during the laying period we recorded mortality and egg production to see whether these production parameters are influenced by the amount of feather pecking.

2. Methods

2.1. Animals and housing

At the start a total of 63,310 birds in 25 commercial rearing flocks were included in the study: 6 flocks were brown hybrids (Bovans Brown, ISA Brown, Lohmann Brown), 9 flocks were white (Hisex, Hypex HN, Lohmann White-LSL) and 8 flocks were a mixture of both brown and white birds. In the remaining two flocks there were mixtures of brown, white and black birds. The mean flock size was 2532 birds, ranging from 305 to 8261. Of the flocks housed in deep litter systems, 10 had elevated perches and 5 were without. The rest of the flocks lived in one of three types of aviaries (Natura, Rhis-Boleg, Voletage) 66.7% of the flocks in deep litter systems were debeaked compared to 30% of the flocks in aviaries.

Between weeks 16 and 18, birds were moved to the laying houses. Nineteen flocks were moved to the same type of system as the one they were reared in (two × deep litter without elevated perches, five × deep litter with elevated perches, 12 × aviary). Three flocks changed from deep litter without elevated perches to deep litter with elevated perches; one flock changed from deep litter with elevated perches to an aviary system; one flock from an aviary system to deep litter without and one from an aviary to deep litter with elevated perches. For five flocks it was not appropriate to continue with observations because they were mixed with birds from flocks not included in the study. One flock was excluded because of incomplete data. Four rearing flocks were split up into two laying hen flocks each and one rearing flock was divided into three different laying hen flocks.

2.2. Data collection

2.2.1. General procedure

Observations were made when the birds were 5, 14, 20, 32 and 50 weeks old. The observation of a single flock took 1 day. In order to give the birds enough time to become accustomed to the observer, he would sit on a chair in the litter area at least 1 h before the start of the observation. During this hour he would define the observation area. It was defined as an area of maximal 2 m^2, containing consistently about 20 birds (±5 birds). The values of 2 m^2 and 20 birds are derived from earlier experimental work and pilot observations on commercial farms, where it was found that in this way it is possible to reliably note all feather pecking interactions. The observed area lay within the littered area, adjoining the lowest tier (aviary systems) or the dung pit (deep litter systems), including the edge and a strip of 30 cm on the tier or the pit.

The observation period following this introductory phase lasted for 2 h, 1 h before and 1 h after the middle of the photoperiod. It was divided into four blocks of 30 min (Fig. 1). At the start of each block the activity of a certain number of birds was scanned. This took 2 min and was repeated every 10 min. This data was gathered with respect to another research question, but the results are not presented here. After the scan, the number of birds in the observation area were counted. This number was necessary to calculate the frequency of feather pecking interactions (see below) which is given as interactions per 30 individuals per 30 min. It took less than 10 s and was repeated every 5 min. Following the counting, all occurrences (Altmann, 1974) of feather pecking interactions between individuals in the observation area were recorded until the full 5 min was reached. Repeated pecks to the same individual were judged as one interaction. An interaction ended, when there were no pecks for 4 s. Only pecks to feathered parts of the body were classified as feather pecking. An interaction was classified as ‘gentle’ (gentle pecks at feathers, not resulting in feathers being pulled out, and neither does the receiver show a reaction to the peck) or ‘severe’ (forceful pecks, sometimes feathers are pulled out and the receiver of the peck may move away). The frequency of ‘severe’ feather pecking interactions is given as a percentage of all feather pecking interactions observed. When not otherwise stated, the given frequencies of feather pecking interactions include ‘severe’ and ‘gentle’ interactions.

During the first 5 min of an observational block, recording of feather pecking was replaced by recording of damage to tail feathers. Starting from the nearest bird, all tails in

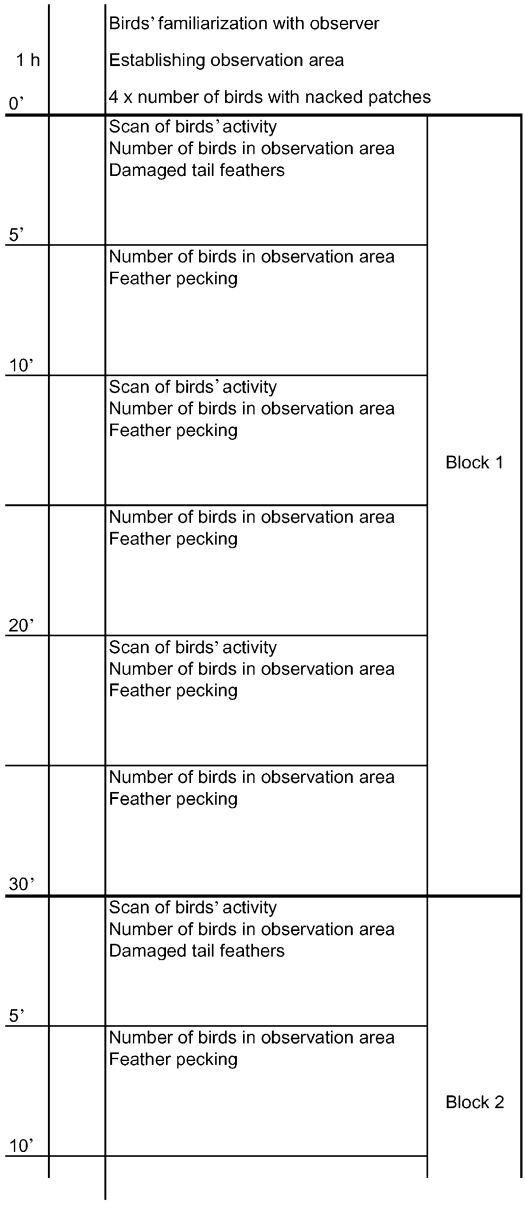

Fig. 1. Structure of observational blocks.

view were assessed until 10% of the total number of birds in the pen had been observed. Tails were judged to be damaged when feathers were missing, broken off or when clear signs of pecking to the vane of the feathers was detected. The number of birds with damaged tail feathers is given as a percentage of the total number of birds assessed. To get a

second indirect measurement of feather pecking in addition to damaged tail feathers, we recorded the number of birds with naked body parts equal to 2 cm in diameter or larger. This was done four times during the hour before the start of the first observation block and in the same way that the damaged tail feathers were recorded.

The farmers reported any casualties. To calculate the mortality we summed up the number of dead birds over the first 14 weeks and then from the change to the laying system up to week 50. Mortality is given as a percentage of the number of day-old chicks and number of hens introduced into the laying system, respectively. Egg production was calculated for week 22 (before that not all of the farmers had reported the number of collected eggs), weeks 32 and 50. The mean number of eggs per day in a week is given as percentage of the number of hens in the pen at the start of the week.

2.2.2. Data collection schedule

The observations in weeks 5 and 14 were done as described above except that the number of birds with naked body parts was not recorded. This was not appropriate because feather pecking in this time did not lead to defeatherd parts, probably due to the continuously growth/regrowth of feathers in chicks. In weeks 20 and 32, the observation started 1 h later because of practical reasons. No behavioural observations were done in week 50. We contented ourselves to record damages to the tail feather and naked body parts as described earlier.

2.3. Statistical analyses

On some farms we were not able to collect all the necessary data. Therefore, two flocks had to be excluded from the analyses of feather pecking in week 14.

Whenever necessary data were transformed to achieve normality. If this was not possible by transformation, we used non-parametric tests. Means and medians are given when using parametric or non-parametric tests, respectively.

3. Results

The quantitative behavioural observations revealed that 40.0% of all flocks had developed considerable frequencies of feather pecking interactions (>30 interactions per 30 individuals and per 30 min) by week 5 and that this percentage increased to 77.3% by week 14. The frequency of feather pecking changed over time from weeks 5 to 32 (ANOVA with repeated measures, $F = 3.87$, d.f. $= 3$, $P = 0.013$, Fig. 2). Frequencies of feather pecking interactions increased from weeks 5 to 14 (univariate F-test, $F = 7.87$, d.f. $= 1$, $P = 0.010$) and decreased from weeks 14 to 20 ($F = 9.75$, d.f. $= 1$, $P = 0.005$). No statistically significant difference was found between weeks 20 and 32 ($F = 0.67$, d.f. $= 1$, $P = 0.424$).

The frequency of feather pecking at the end of the rearing period affected feather pecking later on. There was a positive relation between the frequency in week 14 and the amount of feather pecking in week 20 (linear regression, $F = 5.207$, d.f. $= 1$, $P = 0.033$). No statistical evidence was found for a similar relation between the frequency of feather pecking interactions in weeks 14 and 32 ($F = 0.593$, d.f. $= 1$, $P = 0.450$).

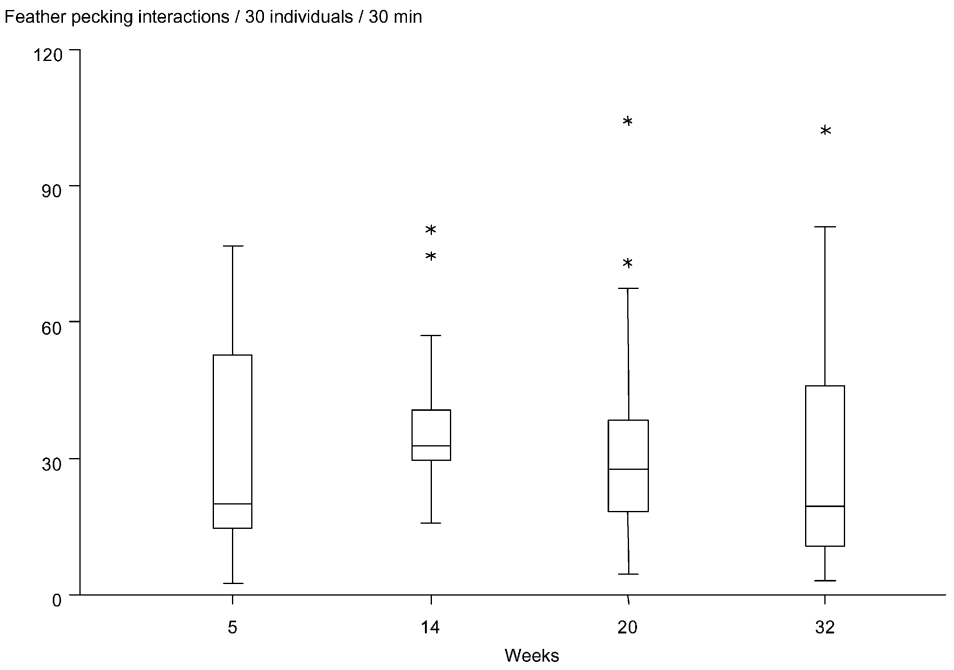

Fig. 2. Frequencies of feather pecking interactions in 25 commercial flocks of laying hens at different ages (box plots).

In weeks 5, 14, 20 and 32 the mean percentage of severe feather pecking interactions was 12.6, 24.2, 30.8 and 35.2%, respectively, and was significantly correlated with the frequencies of all feather pecking interactions observed in a pen (week 5: $r = 0.591$, $P = 0.002$; week 14: $r = 0.584$, $P = 0.003$; week 20: $r = 0.645$, $P < 0.001$; week 32: $r = 0.825$, $P < 0.001$). A further analysis of this relation revealed that the regression coefficient ($b_{y,x}$) calculated by linear regression differed between the 4 weeks. It increased steadily from weeks 5 to 32 (week 5: $b_{y,x} = 0.331$; week 14: $b_{y,x} = 0.419$; week 20: $b_{y,x} = 0.642$; week 32: $b_{y,x} = 0.837$). That is, while an increase in frequency of feather pecking interactions by 10 was associated with an increase of the percentage of severe feather pecking interactions by 3.31% in week 5, it was 8.37% in week 32.

The percentage of birds with damaged tail feathers did not significantly differ between weeks 5, 14, 20 and 32, but was significantly increased in week 50 (medians: 5.9, 7.2, 4.5, 5.3 and 71.0%, respectively; Friedman two-way ANOVA by ranks: $F_r = 51.173$, d.f. $= 4$, $P < 0.001$, multiple comparison following Siegel and Castellan (1988); Table 1). Birds with naked patches were not observed during the rearing period (weeks 5 and 14, qualitative observations) and very rarely in week 20 (median 0%, Table 1), whereas the number of birds with naked body parts significantly increased in week 32 (median 9.7%) and again markedly in week 50 (median 92.4%; Friedman two-way ANOVA by ranks: $F_r = 40.783$, d.f. $= 2$, $P < 0.001$, multiple comparison following Siegel and Castellan (1988)). The percentage of birds with damaged tail feathers and the percentage

Table 1
Percentage of birds in a flock with damaged tail feathers and percentage of birds with naked body areas[a]

Measure	Week				
	5 (%)	14 (%)	20 (%)	32 (%)	50 (%)
Damaged tail feathers (median)	5.9	7.2	4.5	5.3	71.0
Naked body areas (median)			0.0	9.7	92.4
Mortality (mean)		1.7		2.4	6.0
Egg production (mean)			Week 22: 67.8	90.8	85.3

[a] Mortality is the number of losses up to weeks 14 and 50 in percentage of all birds at day 1 or the number of birds moved to the laying house, respectively. Egg production is the number of eggs collected during the week in percentage of all birds in a flock at the start of the week.

of birds with nacked patches were significantly correlated in weeks 32 and 50 (week 32: $r = 0.651$, $P < 0.001$; week 50: $r = 0.446$, $P = 0.033$).

Mean mortality up to week 14 was 1.7%. During the laying period (up to week 50) it amounted to 6% (Table 1). Mortality was not influenced by the frequency of feather pecking, neither in week 14 nor in week 32 (linear regression; week 14: $F = 0.019$, $P = 0.893$; week 32: $F = 0.201$, $P = 0.658$). Mortality in week 50 was not affected by feather pecking rate in week 32 ($F = 0.443$, $P = 0.513$). Mean egg production reached 67.8% in week 22, 90.8% in week 32 and 85.3% in week 50 (Table 1). Egg production measured in week 22 was not affected by feather pecking rates in week 20 (linear regression; $F = 0.018$, $P = 0.895$), but rates in week 32 did negatively affect production in week 32 ($F = 15.57$, $P < 0.001$) but not in week 50 ($F = 0.600$, $P = 0.448$).

4. Discussion

Feather pecking could be observed already in the first few weeks of live. Forty percent of all flocks showed frequencies of feather pecking equal or higher than 30 interactions per 30 individual per 30 min by week 5. From our previous work we know that with such frequencies birds start to develop distinct ways of feather pecking like stereotype plucking of the tail feathers or pulling out single feathers and that first damages to the plumage may be observed. By the end of the rearing period 77.3% of the flocks showed such or higher frequencies of feather pecking. This is a considerably higher percentage than the 37.5% previously estimated on the basis of the information supplied by the farmers (Huber-Eicher, 1999). The reason for this maybe that farmers usually do not try to observe the behaviour when checking their flocks for the occurrence of feather pecking, but are looking for damages to the plumage or for injuries. Because feathers are moulted three times during the rearing period (Appleby et al., 1992) and because feather pecking is not yet so damaging as later on (lower percentages of severe feather pecking) the amount of feather pecking in a flock is concealed during this time when only judged by feather damages.

The development of feather pecking early in life may affect feather pecking behaviour later on, as was shown by Johnsen et al. (1998) for small groups and under experimental conditions. These results are confirmed for large groups under commercial conditions by

our study. Flocks with high frequencies in week 14 were also among the flocks with the highest frequencies in week 20, after they had been moved to the laying houses. However, the mean frequency of feather pecking significantly *decreased* from weeks 14 to 20. This was unexpected because the change to the laying house is associated with stress (catching, transportation, change of barn, sometimes change of housing systems, new lightning regime, change of feed) and stress may increase feather pecking (El-lethey et al., 2000, 2001). One possible explanation for our finding is that the change to the new environment distracted the birds and moved their attention away from the feathers of conspecifics, whereby the novelty was not so big as to induce fear. Fear again would have increased feather pecking (Blokhuis and Beutler, 1992; Vestergaard et al., 1993).

The quality of feather pecking changed with increasing frequency as indicated by the positive correlation between frequencies of feather pecking and the percentages of it delivered as severe feather pecking. This is in accordance with the finding of Wechsler et al. (1998) in small flocks and Huber-Eicher and Sebö (2001) in commercial flocks. The new finding in the present study is the fact that quality of feather pecking is not only influenced by frequency but also by the age of the birds. When analysing the relationship between the frequency of feather pecking and the percentage delivered as severe feather pecking it was found that the coefficient steadily increased from weeks 5 to 32, indicating that hens showing the same frequency, deliver an increasingly percentage of it as severe, the older they get. This might be one reason for the steep increase of damaged tail feathers and naked body areas in the laying period, especially between weeks 32 and 50. We cannot exclude an increase in frequency, because we do not have such data for week 50, but it is improbable that it would increase to such an extent.

From our results we conclude, that more attention should be paid to the development of feather pecking during rearing of laying hen chicks. Feather pecking is more widespread than expected, probably mainly because feather pecking is not yet so severe, eventual damage to the plumage is masked by the re-growth of the feathers and it does not yet cause losses. It is important that chicks develop no or as little as possible feather pecking during rearing because the amount of feather pecking during rearing influences feather pecking later on and with higher frequencies of feather pecking and with increasing age of the birds feather pecking gets more damaging. By raising laying hen chicks in adequate housing conditions, reducing known risk factors (Huber-Eicher and Audigé, 1999) as much as possible, the farmer may reduce the amount of feather pecking later on (week 20) and thereby improve the plumage condition of the birds and egg production (week 32).

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