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Early feather pecking as a form of social exploration: the effect of group stability on feather pecking and tonic immobility in domestic chicks

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Abstract

In two lines of White Leghorns that differ in their propensity to feather peck, feather pecking was already present 1 day after hatching. A significant line difference developed within 3 days and this difference remained in the following weeks. There was no clear relationship between feather pecking and ground pecking, instead feather pecking was associated with other socially orientated pecks. When chicks were confronted with feathers as an inanimate stimulus pecking at these feathers did not reflect pecking in a social context. These results suggest that feather pecking has an underlying social component, rather than being a redirected behaviour. To test the influence of social factors on feather pecking, chicks from the high feather pecking line were subjected to regular rehousing or regular rehousing plus confrontation with unfamiliar peers. Gentle feather pecking increased significantly in groups that were rehoused with unfamiliar peers. Directly after confrontation chicks displayed a preference in the total number of pecks toward these unfamiliar birds. Gentle feather pecking as a separate pecking orientation showed a similar trend. Increased righting times in a tonic immobility test were recorded in the experimental groups, hence frequent confrontation with unfamiliar peers may be experienced by chicks as stressful, which is consistent with the hypothesis that stress mediates the expression of feather pecking. In contrast to the dominant hypotheses in the field, we argue that gentle feather pecking at an early age plays an important role in the building (social exploration) and maintenance of social relationships between chicks.

Keywords: Familiarity; Feather pecking; Social exploration; Social stability; Tonic immobility; White Leghorn

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1. Introduction

Feather pecking is a substantial problem in today's poultry industry, both from an economical and from an animal welfare point of view. Pecking at and pulling out each others feathers causes decreased egg production (Johnsen et al., 1998), and even death (Blokhuis and Wiepkema, 1998). Although feather pecking occurs frequently in battery housing systems, the most severe problems are experienced in more animal friendly housing systems. So far, no management strategies have been developed that can prevent the occurrence of feather pecking. Feather pecking may therefore seriously hamper the introduction of more animal friendly housing systems (Blokhuis and Wiepkema, 1998; Nicol et al., 2001).

A fundamental approach to the phenomenon of feather pecking may yield insight in the mechanism underlying the development of behavioural pathologies in general, and may guide the search for practical solutions to feather pecking in particular. The two main theories concerning the causation of feather pecking consider feather pecking to be a redirected form of ground pecking, controlled either by a foraging motivation (Hoffmeyer, 1969; Blokhuis, 1986; Huber-Eicher and Wechsler, 1997) or by a dustbathing motivation (Vestergaard et al., 1993; Vestergaard and Lisborg, 1993; Savory, 1995). However, several authors have reported feather pecking at very early ages, even as soon as 1 day after hatching (Roden and Wechsler, 1998), when ground pecking is not yet fully developed and dustbathing behaviour hardly occurs. Furthermore, sudden increases of feather pecking frequencies in the period of 4–11 weeks after hatching (Hughes and Duncan, 1972), and around the onset of lay (Cuthbertson, 1978; Hughes, 1973; McKeegan and Savory, 2000) cannot easily be explained by either hypothesis.

In the past, there has been much focus on the effects of inanimate environmental conditions on the occurrence of feather pecking. But apart from environmental parameters such as light intensity (Kjaer and Vestergaard, 1999) and floor cover (Blokhuis and van der Haar, 1989; Huber-Eicher and Wechsler, 1997), feather pecking has shown to be related to social factors such as group size and density (Hughes and Duncan, 1972; Savory et al., 1999), and dominance rank (Hughes and Duncan, 1972; Vestergaard et al., 1993).

In today's poultry industry, chicks grow up in extremely large groups. In such large groups it seems unlikely that birds can recognise and remember all their flock mates (McBride and Foenander, 1962; Hughes et al., 1979) In large groups it is therefore likely that chicks would regularly meet unfamiliar peers. Interestingly, Zajonc et al. (1975) reported that if 1-day-old chicks were confronted with familiar or unfamiliar peers, they directed their pecks preferentially to unfamiliar chicks. These authors also showed that when pairs of chicks had the opportunity to familiarise without pecking interactions chicks did not show a preference in pecking orientation in the test condition. Zajonc et al. (1975) suggested that the opportunity to peck conspecifics may be a necessary condition in producing social discrimination. Further evidence linking pecking conspecifics to social exploration comes from studies on eye use during confrontations with familiar and unfamiliar peers (Vallortigara and Andrew, 1991; Vallortigara, 1992). The function of social recognition being dominant in the right hemisphere, chicks that had use of their left eye did discriminate in social pecking between familiar and unfamiliar chicks, whereas chicks that could not use the left eye did not (Vallortigara and Andrew, 1991; Vallortigara,

1992). Although these authors did not report on the exact pecking orientation (e.g. to the bill or to the plumage), it may well have been that feather pecking was involved. Therefore, we explored the possibility that feather pecking develops from early social exploratory behaviour.

Meeting unfamiliar conspecifics is stressful for adults chickens (Grigor et al., 1995; Lindberg and Nicol, 1996). Since higher levels of fear have been reported in birds from cages where feather pecking had occurred (Hughes and Duncan, 1972), and a positive correlation between righting time (in a tonic immobility test) and the rate of severe feather pecking was found (Vestergaard et al., 1993), we explored the possibility that meeting unknown chicks induces increased levels of stress in young chicks that may be related to the occurrence of feather pecking behaviour.

In this study, we report on the early development of feather pecking in two lines of White Leghorns that differ in their propensity to feather peck (Blokhuis and Beutler, 1992; Blokhuis and Beuving, 1993), their behavioural and physiological reaction to manual restraint (Korte et al., 1997, 1999), and open field behaviour (Jones et al., 1995). To study whether line differences in feather pecking are not only apparent in a social context, feathers were offered as non social stimuli and pecking at these feathers was compared to feather pecking. Next, we report on the effects of social stability of groups on the frequency of feather pecking and the tonic immobility response. If feather pecking indeed develops from early social exploration, we predict that feather pecking will be higher in groups experiencing high levels of social instability and that there is a preference to direct these pecks toward unfamiliar peers.

2. Methods

2.1. Experiment 1

2.1.1. Subjects and housing

Two mixed-line mixed-sex groups of 18 chicks (nine HP and nine LP chicks per group) were kept in pens of 1.5 m × 1.6 m. Chicks were kept on an LD-cycle of 18:6 h, heat was provided by a 250 W red light heat source, floor cover consisted of wood shavings, food (DfK chick crumbs 1 and 2, Hendrix UTD) and water were provided ad libitum. Chicks were individually colour marked (blue or green) with a felt tipped water proof marker on the head, neck, back, lower back, wing, or combination of body parts. Colour and coloured body part combinations were matched for line between the two groups.

2.1.2. Observations

All the chicks in group 1 were observed once in weeks 1, 2 and 3 after hatching. Group 2 was followed more in detail and all chicks were observed 1, 3, 4, 8, 10, and 16 days after hatching. Pecking behaviour was recorded pair wise (1 HP and 1 LP chick simultaneously) for 30 min in each observation session by one observer sitting in front of the cage. Observations took place throughout the day.

In group 1, the following pecking orientations were recorded: object pecks—all pecks to the cage wall, water tower, etc.; ground pecks—all pecks directed toward the ground at

least 10 cm away from the food dispenser; feather pecks—all pecks directed toward the plumage of cage mates; social pecks—all pecks including aggressive pecks toward cage mates not aimed at the plumage.

In group 2, we used the same pecking ethogramme as in group 1, but in addition social pecks were scored in two separate categories namely: (1) aggressive pecks—short-fast pecks directed mainly to the head and (2) social pecks—all non-aggressive pecks towards cage mates not directed toward the plumage. One extra pecking orientation was also recorded: particle pecks—all pecks directed toward particles lying on the plumage of cage mates that were visible to the observer.

2.1.3. Choice test

At the beginning of the fourth week after hatching the chicks of group 1 were presented in the home cage with two cards hanging next to each other. One card was covered with wood shavings, the other with feathers (collected from the home cage floor), it was recorded which bird pecked how many times at the different cards in four separate trials lasting 15 min each. The chicks of group 2 were presented with two similar cards in two separate trials lasting 15 min, 14 and 18 days after hatching.

2.2. Experiment 2

2.2.1. Subjects and housing

Directly after hatching 48 chicks of the HP line were randomly assigned to either control or experimental groups (each consisting of four individuals) and individually colour marked with a single colour (green, blue or black) with a felt tipped water proof colour marker on the head, neck, back, wing or a combination of body parts (colour markings were equal across treatments) and housed in identical cages.

The cages measured 0.65 m × 1.0 m × 0.65 m (length × width × height). Heat was provided via a 250 W red heat light. Chicks were submitted to a LD-cycle of 14:10 h (lights on at 7:00 a.m.), the heat source provided red light and heat for 24 h per day during the entire experiment. The floor cover consisted of shredded Hemp stalks (Hempflax b.v. Holland) with an additional handful of hay. Food (DfK chick crumbs 1 and 2, Hendrix UTD) and water were available ad libitum.

2.2.2. Experimental design

Six groups of four chicks were reallocated to a new cage 12 times during the first 15 days after hatching (controls). The six experimental groups each consisted of two pairs of chicks (randomly paired at hatching). These pairs were reallocated to another cage at the same time as the control groups were, but in such a way that they were housed with an unfamiliar pair. Only during the 12th and last reallocation the experimental pairs were housed with the pairs they had been originally housed with.

From day 17 to 27 after hatching chicks stayed in their last cage and group composition. Except for general care taking and taking biometrical measurements of chicks (age 20 days), chicks were not disturbed during this period. Twenty-eight days after hatching the four chicks in each control group were randomly divided into two pairs. Each of these control pairs was then reallocated to another cage. Simultaneously, the experimental

groups were subdivided again into the original experimental pairs, which were both reallocated and housed with either one of the two control pairs.

2.2.3. Observations

Pecking behaviour of all birds in all groups was recorded in three separate periods of 15 min, starting 1, 3, and 6 h, respectively after every fourth rehousing procedure. On the third observation day an additional 15 min observation was performed in the second observation session. When control pairs were confronted with experimental pairs pecking behaviour was recorded for 30 min immediately following the reallocation protocol.

During each observation session all pecking interactions between all birds in one cage were recorded simultaneously by one observer sitting in front of the cage speaking into a tape recorder. All individual pecks (dealt as well as received) were recorded. We distinguished the following pecking orientations towards cage mates: (1) feather pecks—pecks directed toward the plumage; (2) social pecks—non aggressive pecks toward feet, bill, comb and wattle; (3) particle pecks—pecks towards particles lying on the plumage and (4) aggressive pecks—short -fast pecks mainly directed toward the head region.

2.2.4. Tonic immobility

One day after the last observation session (16 days after hatching) chicks were submitted to a tonic immobility test and the righting times were scored. Tonic immobility was induced by catching a chick and placing it on its back on a wooden box located directly in front of the home cage. The chick was restrained for 10 s and then released, if a chick got up within 10 s after release the induction procedure was considered a failure and subsequently repeated. We recorded the time (s) it took for the bird to right itself.

2.2.5. Statistics

Data on the number of pecks in the results section are expressed as median and range of the number of pecks per 15 min. All data were analysed with non-parametrical statistics. Correlations: Spearman rank; differences between groups: Mann–Whitney U (MWU) and differences between pairs Wilcoxon signed rank (WSR), All P-values presented are two-tailed. In Experiment 2, the statistical unit was original group or pair corrected for the number of chicks in a group or pair. Because the tonic immobility test was performed only once at the end of the period of rehousing, the statistical unit was the average time in a group at the moment of induction.

2.2.6. Ethical note

Since feather pecking, even at an early age, can inflict severe damage to chicks, chicks were closely monitored for signs of physical damage. Throughout the experiment, antiseptic anti-feather pecking spray and recovery cages were available. However, no such measures had to be applied since severe pecking and pulling out of feathers was virtually absent. At the end of the experiment, all chicks were in a healthy state and donated to several private persons. All experiments were performed with the permission of the animal experiments committee of the University of Groningen (approved by the Dutch Government) under license number DEC2324 and DEC2672.

3. Results

3.1. Experiment 1

3.1.1. Pecking behaviour in groups 1 and 2

Summarised over all three observation periods HP chicks in group 1 feather pecked more (3.2 (range: 1.3–10.8)) than the LP chicks (0.5 range (0.2–3.0), MWU: $N1 = N2 = 9$, $U = 8.0$, $P < 0.01$). There were no differences detectable in the total number of ground pecks (HP: 9.8 (3.5–24.0), LP: 8.3 (1.2–22.8)), and the number of object pecks (HP: 4.3 (0.3–11.3), LP: 5.7 (0.5–19.3)). HPs tended to perform more social pecks than LP chicks, but this difference was not significant (HP: 2.2 (0.3–3), LP: 0.7 (0–3.2), MWU: $N1 = N2 = 9$, $U = 20.5$, $P = 0.08$).

In group 2, that was followed in more detail, chicks of both lines directed pecks towards the plumage of cage mates already 1 day after hatching (Fig. 1). Initially feather pecking frequencies were similar, but from 3 days after hatching onwards HP chicks feather pecked more than LP chicks (age 3 days HP: 2.0 (0.5–9.0), LP: 0.5 (0–4.5), MWU: $N1 = N2 = 9$, $U = 17.5$, $P < 0.05$; overall: age 1–16 days, MWU: $U = 1.0$, $P < 0.001$). Overall HP chicks performed more feather pecking and less ground pecking than LP chicks (Table 1). As in group 1, HP chicks tended to direct more pecks (other than feather pecks) than LP chicks to cage mates (social pecks plus aggressive pecks) HP 2.7 (1.3–4.7), LP: 1.7 (0.3–3.1), MWU: $U = 18.0$, $P = 0.052$). Across both groups (corrected for the difference in observation time) there was no difference between the two lines in ground pecking (MWU: $N1 = N2 = 18$, $U = 134.5$, $P > 0.35$), but HPs performed more feather pecking (MWU: $U = 25$, $P < 0.001$) and more social pecking (MWU: $U = 85$, $P < 0.02$) than LPs did.

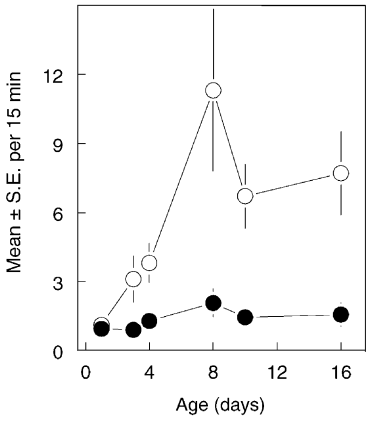

Fig. 1. Group 2: the development of feather pecking in two lines of White Leghorn chicks as a function of age in days. Dots represent group means ± S.E. (number of feather pecks per 30 min). Closed dots depict the high-feather pecking line and open dots the low feather pecking line.

Table 1
Grand totals per chick in group 2 median (range) of total number of recorded pecks per 15 min

Pecking orientation	HP median (range)	LP mean (range)	MWU (*P*-value)
Feather pecks	4.8 (1.9–9.2)	1.4 (0.5–1.9)	<0.001
Social pecks	2.4 (0.9–3.3)	1.5 (0.3–2.5)	0.052
Particle pecks	1.3 (0.1–2.5)	0.5 (0.2–2.3)	ns
Aggressive pecks	0.3 (0.1–15.8)	0.2 (0.2–0.6)	ns
Ground pecks	15.6 (5.0–22.6)	22.0 (11.2–38.1)	<0.03
Object pecks	1.0 (0.1–4.1)	1.3 (0.25–3.7)	ns

Table 2
Median (and range) number of pecks at wood shavings or feathers lines per group per 15 min

Pecks at cardwith	HP group 1	LP group 1	HP group 2	LP group 2
Wood shavings	0.5 (0–281.5)	12.5 (0–55)	0 (0–36)	0 (0–110)
Feathers	0 (0–1.5)	0 (0–3.8)	0 (0–1)	0 (0–3)

3.1.2. Choice test

Despite the line difference in feather pecks as described earlier, in both groups there were no differences between the lines in the number of pecks directed at cards covered with feathers nor in the number of pecks to the cards covered with wood shavings (Table 2; all *P*-values >0.45). Moreover, in both lines in both groups there were no correlations detectable between the number of pecks directed at the cards covered with feathers or wood shavings in the choice test and the variables feather pecking, ground pecking, object pecking, and social pecking measured during the regular observation periods (all *P*-values >0.1).

3.2. Experiment 2

3.2.1. Pecking behaviour

Chicks that grew up in unstable groups feather pecked more than chicks growing up in stable groups (Table 3; MWU: $N = 6$ versus $N = 12$, $U = 14$, $P < 0.05$). There were no differences between the treatments in the three other pecking orientations, but in total

Table 3
Experiment 2: overall median (range) number of pecks corrected for the number of birds per 15 min

Pecking orientation	Control ($N = 6$) median (range)	Experimental ($N = 12$) median (range)	MWU (*P*-value)
Feather pecks	4.5 (2.4–7.1)	6.9 (3.3–47.9)	<0.05
Social pecks	1.4 (1.2–2.2)	1.9 (0.6–3.6)	ns
Particle pecks	1.3 (0.8–3.1)	1.4 (0.7–3.2)	ns
Aggressive pecks	0.3 (0.1–0.4)	0.3 (0.1–0.9)	ns

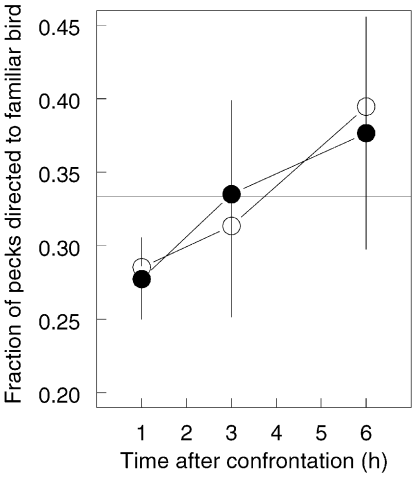

Fig. 2. Fraction of pecks directed at familiar conspecifics as a function of time (h) after confrontation. Dots represent group means and S.E. Open dots represents the fraction of all pecks (including feather pecking) directed at familiar conspecifics, the closed dots feather pecking separately. Closed line represents expected fraction of pecks directed toward familiar birds when pecks are randomly distributed over two unfamiliar and one familiar conspecific ($y = 0.33$).

experimental pairs were more engaged in pecking each other (feather pecks + aggressive pecks + social pecks) than the control birds were (controls: $N = 6$, 6.2 (3.9–8.7); experimentals: $N = 12$, 9.5 (4.2–50.8); MWU: $U = 12$, $P < 0.03$). When random control pairs were confronted with experimental pairs, there was no difference in feather pecking detectable between both groups (experimentals: 3.9 (1.3–8.5); controls 4.1 (1.3–5.0) pecks/30 min; MWU: $N1 = N2 = 6$, $U = 13$, $P > 0.45$).

3.2.2. Preferential pecking direction

Across all observation days chicks tended to direct more feather pecks to an unfamiliar bird (corrected for the number of unfamiliar birds) than to the one familiar bird in the observation period directly proceeding the reallocation (Fig. 2; WSR: $N = 18$, $Z = 1.742$, $P = 0.08$). In total, birds directed more pecks to an unfamiliar chick (feather pecks + aggressive pecks + social pecks) than to the one familiar chick directly after confrontation (Fig. 2; WSR: $N = 18$, $Z = 2.199$, $P < 0.05$). The tendency of feather pecking and the difference in all pecks directed at unfamiliar conspecifics disappeared as the time after confrontation increased.

3.2.3. Tonic immobility

Total righting time of whole groups recorded in the tonic immobility test was longer in experimental groups than in control groups (median (range) in (s): experimentals ($N = 6$), 90.4 (41.3–122.0); controls ($N = 6$), 42.5 (17.8–86.3); MWU: $U = 5.0$, $P < 0.05$). There was no relation detectable between righting time and feather pecking frequencies within the treatments.

4. Discussion

4.1. Feather pecking as social behaviour

Our results indicate that early feather pecking is part of normal social behaviour and is not clearly related to dustbathing (Vestergaard et al., 1993; Vestergaard and Lisborg, 1993; Savory, 1995) or foraging (Hoffmeyer, 1969; Blokhuis, 1986; Huber-Eicher and Wechsler, 1997) as suggested in the literature.

Feather pecking was mainly seen under the heat source where chicks gathered in order to heat up and rest, and took place particularly around the onset and offset of resting bouts. In both experiments it was never observed that feather pecking was preceded nor directly followed by ground scratching. The first dustbathing behaviours were seen only 1 week after hatching and were not associated with feather pecking. In both groups there was a tendency that HP chicks pecked (not including feather pecks) more at cage mates, whereas pecks directed to the environment showed no clear difference. Moreover, we showed that feather pecking frequencies in the home cage were not associated with pecks to inanimate stimuli: (1) pecking behaviour toward feathers presented as inanimate stimuli did not differ between the lines, whereas feather pecking did, and (2) pecking at the cards was not associated with behavioural variables measured during regular observation sessions. It seems therefore unlikely that at this early age feather pecking is controlled by either a dustbathing motivation or by a motivation to explore the environmental surroundings. The data rather indicate that feather pecking has a strong social component.

Zajonc et al. (1975) showed that chicks directed more pecks to unfamiliar peers than to familiar peers in the first few minutes after exposure to conspecifics. These authors argued that pecking at conspecifics served as a tool for social recognition in this highly social species. Experiment 2 (frequent confrontation with strangers) produced two lines of evidence that support the hypotheses that (1) feather pecking indeed has an underlying social motivation and (2) belongs to the normal social repertoire of young chicks. Firstly, frequently meeting unfamiliar birds increased feather pecking in these groups. Secondly, when confronted with unknown strangers chicks preferentially directed pecks to these unfamiliar chicks, and feather pecking itself showed the same pattern.

In a recent paper, Zeltner et al. (2000) showed that feather pecking is socially transmittable. By mixing groups of high and low rate feather peckers these authors demonstrated that feather pecking increased in the low rate groups. Social transmission of feather pecking could explain the higher rate of feather pecking in our experimental groups since all chicks in the experimental pairs met all other pairs. More chicks were therefore exposed to high rate peckers in the experimental groups than in the control groups. However, social transmission can not explain the tendency to direct more feather pecks towards unfamiliar birds directly after confrontation. Zeltner et al. found no such preference, but this may be due to their relatively long time span between mixing the groups and the start of their first behavioural recordings. The disappearance of the preference to peck unfamiliar birds suggests that birds get acquainted in a relatively short time span.

If feather pecking is not a redirected form of ground pecking, but serves a role in social exploration, why do birds still direct feather pecks at birds they already are well acquainted

with? Several authors have suggested that a certain basal level of feather pecking may actually be a form of allopreening (Blokhuis, 1986; Vestergaard et al., 1993). Allopreening plays a role in reducing aggression and the formation and maintenance of social bonds (Harrison, 1965; Wood-Gush and Rowland, 1973). This may explain the tolerance for being (harmlessly) pecked.

So far, the argument that feather pecking is part of the normal social behavioural repertoire of young chicks concerns mild forms of feather pecking. However, severe feather pecking (pulling out feathers) is the main cause of damage (Vestergaard et al., 1993; Bilčík and Keeling, 1999; Cloutier et al., 2000, but see also Leonard et al., 1995). Recently, it has been questioned if gentle feather pecking is governed by the same motivational system as severe feather pecking (Bilčík and Keeling, 1999; Kjaer and Vestergaard, 1999). In this study a relationship between severe and gentle feather pecking could not be investigated since feather pecking during the first 2 weeks of life was almost exclusively gentle. In a separate study (Riedstra and Groothuis, manuscript in preparation) where severe feather pecking developed, the latter was initially always embedded within bouts of gentle feather pecking. Furthermore, the difference in severe feather pecking between the two lines we used was reflected already in early gentle feather pecking. Therefore, it seems likely that severe feather pecking is an intensified form of gentle feather pecking. However, factors inducing the transmission from the latter to the former needs further study.

4.2. Feather pecking and social stress

As in adult chickens (Grigor et al., 1995; Lindberg and Nicol, 1996), it seems that young chicks experience confrontations with unknown birds as a stressful event as indicated by the prolonged righting times in the tonic immobility test. Since prolonged righting times are associated with elevated corticosterone levels (Jones, 1986; Jones et al., 1988) social instability may therefore affect the well being of young chicks.

Several studies show a positive association between feather pecking and righting time (Blokhuis and Beutler, 1992; Vestergaard et al., 1993). This result could be confirmed only at the group level. The increased feather pecking frequencies and increased righting times in the experimental groups relative to the control groups supports the idea that stress mediates the occurrence of feather pecking (Korte et al., 1997; Vestergaard et al., 1997; Korte et al., 1999).

The development of (gentle) feather pecking at very early ages has a gentical background as suggested by the early divergence in this behaviour between the two selection lines. Although the difference in feather pecking behaviour between chicken breeds is well established (Hughes and Duncan, 1972; Cuthbertson, 1980; Craig and Lee, 1990; Blokhuis and Beutler, 1992; Kjaer and Sørensen, 1997; Wechsler and Huber-Eicher, 1998; Kjaer et al., 2001), to our knowledge this is the first study (together with van Hierden et al., submitted for publication) in which a consistent line difference is identified early after hatching.

Selection on the early expression of gentle feather pecking seems feasible since the propensity to feather peck in adult life (Blokhuis and Beutler, 1992; Blokhuis and Beuving, 1993) seems to be present in gentle feather pecking early in life. Since in a commercial setting feather pecking may help birds to cope with the socially instable environment, selecting against feather pecking may trade-off against more undesirable alternatives.

In todays' poultry industry, chickens are generally housed in two conditions that may exert extreme pressure on the social life of individuals. The expression of feather pecking in battery housed chickens may primarily serve a role similar to allopreening, because the forced close proximity of higher and lower ranking individuals inhibit the possibility to react to conflicts properly (flee), feather pecking may be functional in reducing aggression. In contrast, for chickens living in large groups, the demand for social exploration may be high, because of the excessive number of surrounding unfamiliar birds.

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