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A comparison of the behaviour of domestic chicks reared with or without a hen in enriched pens

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Abstract

Studies on the behaviour of domestic chicks raised by a hen suggest that the hen has a major influence on the development of pecking preferences in the chicks. The absence of a hen for commercially reared chicks could therefore be crucial for the development of feather pecking. In the present study, it was tested experimentally whether the presence of a hen has a significant effect on the incidence of feather pecks in laying hen chicks (white 'Lohman Selected Leghorn' hybrids). Groups of eight chicks were reared with a hen (five groups) or without a hen (seven groups) in enriched pens over the first 8 weeks after hatching. There was a synchronization in the behaviour of the hen and the chicks both with respect to the activity performed (resting, exploring, feeding, preening) and the pen area used at a given moment. Chicks raised by a hen spent significantly more time feeding, less time standing and less time on the perches than chicks housed without a hen. Flight responses were significantly more frequent in chicks reared without a hen. There was no significant difference in the rate of feather pecking interactions between chicks reared with and without a hen. In both rearing conditions, the chicks already started to peck at the feathers of conspecifics in the first week of life. It is concluded that the presence of a hen does not prevent the chicks from directing pecks at the feathers of conspecifics and that factors other than the absence of a hen must be crucial for the occurrence of serious problems with feather pecking in commercial housing systems for laying hen chicks. © 1998 Elsevier Science B.V.

Keywords: Chicken; Feather-pecking; Time budget; Synchronization; Flight response

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1. Introduction

In commercial housing systems, laying hen chicks are typically reared without a hen. They are thus deprived of a social stimulus which has a major influence on the behaviour of naturally raised chicks (Collias and Collias, 1967; McBride et al., 1969; Savory et al., 1978). When raised by a hen, the chicks not only follow her movements but are also curious about objects at which she directs her behaviour. The hen herself stimulates pecking in the chicks by tidbitting, pecking and scratching at a source of food (Wood-Gush et al., 1978). She is therefore likely to have much influence on the development of pecking preferences in the chicks.

Pecks directed at the feathers of conspecifics may cause serious economic and animal welfare problems both during the rearing and the laying period of domestic hens, as they may result in feather damage, injuries and mortality (Hughes and Duncan, 1972; Allen and Perry, 1975; Appleby and Hughes, 1991). Investigations into the development of this abnormal behaviour have been intensified over the last years, and much attention has been paid to non-social factors which promote feather pecking in laying hen chicks. It was found that providing chicks with incentives to stimulate foraging behaviour results in lower rates of feather pecking (Hughes and Duncan, 1972; Blokhuis, 1986, 1989; Blokhuis and Van der Haar, 1989, 1992; Huber-Eicher and Wechsler, in press), and it has been suggested that access to an adequate dustbathing substrate may be crucial to prevent chicks from redirecting dustbathing pecks at the feathers of conspecifics (Vestergaard and Hogan, 1992; Nørgaard-Nielsen et al., 1993; Vestergaard and Lisborg, 1993; Sanotra et al., 1995; but see Huber-Eicher and Wechsler, in press). A possible influence of the hen on the development of pecking preferences in the chicks was not considered in these studies. Fält (1978) comparing aggressive behaviour between brooded and non-brooded domestic chicks did not present data on feather pecking.

The present study was part of a research project that aimed at identifying factors which are of relevance for the development of feather pecking in laying hen chicks (Huber-Eicher, 1996). In accordance with Wennrich (1974) it was observed that chicks reared without a hen already readily peck at all sorts of stimuli, including the plumage of other chicks, during the first days after hatching. It was therefore hypothesised that in a more natural situation the behaviour of the hen would orient these explorative pecks at food items or at substrates which are likely to contain food items. In comparison to chicks reared without a hen, this could result in less experience with feathers as a pecking substrate and may prevent the development of excessive feather pecking. In order to test this hypothesis groups of eight chicks were reared with or without a hen and observed over the first 8 weeks after hatching. Given this experimental design we also aimed to quantify the effect of the hen on various aspects of the behaviour of the chicks. Data collection focused on the time budget, the synchronization of the behaviour of the chicks and the hen, the use of perches, the incidence of flight responses and the rate of feather pecking interactions. Flight behaviour was of interest because it has been suggested that fear and feather pecking may be positively associated (Craig et al., 1983; Blokhuis and Beuving, 1993; but see Jones et al., 1995).

2. Methods

2.1. Animals and housing conditions

Twelve groups of eight chicks (white 'Lohman Selected Leghorn' hybrids) were reared in pens with a floor area of 260 cm × 90 cm (height 235 cm). Five groups were raised by a hen and seven groups were housed without a hen. The eggs from which the chicks hatched were all of the same breeder flock and were incubated together (Maino Incubator, type 0200) up to day 4 before hatching date. At this time, eight of these eggs were put underneath each of five broody hens which had been collected on different farms. The hens were of different age (range 7–17 months old) and of different strains. There were four brown to dark hybrids of egg-laying strains and one white hen of a broiler breeder flock. The hens had been sitting on eggs for an unknown number of days on the farms. In the experimental pens, they were put into a cardboard box (40 cm × 30 cm × 30 cm) that was open to one side and contained a nest made of long-cut straw. Before receiving eggs from the incubator the hens were sitting for at least 5 days on a clutch of eight unfertilised eggs in these nests.

The chicks in the incubator and the chicks under the hens hatched simultaneously. On the day of hatching 56 chicks from the incubator were randomly assigned to seven groups of eight and transferred to a pen without a hen. Eight chicks in four pens with a hen failed to hatch or died immediately afterwards and were replaced by chicks from the incubator on the day of hatching. All hens accepted the chicks and brooded them. As the chicks were not sexed at hatching, sex ratio varied between groups. There was, however, no statistically significant difference in the sex ratio between the two rearing conditions (Mann–Whitney U test, $n_1 = 7$, $n_2 = 5$, $U = 18$, $P > 0.05$, two-tailed). All together, there were 48.2% female chicks in the groups without a hen and 45% female chicks in the groups with a hen. One chick from a group without a hen died at 7 weeks of age. In the eighth week after hatching, the hens started to lay eggs again and to become aggressive towards the chicks. The hens were therefore removed, and the experiment was terminated.

The 12 groups were housed in identically structured, enriched pens that had three different floor areas each. In the rear of the pens, an area of 60 cm × 90 cm was filled with a layer of grey river sand (5 cm deep). In the middle of the pens, a floor area of 100 cm × 90 cm was covered with a mixture of wood-shavings and long-cut straw. This area contained a rack filled with hay, some beech branches, two cup drinkers and two perches (each 90 cm long, 40 and 60 cm above the ground). In the front of the pens, a floor area of 100 cm × 90 cm was made of wooden slats (width 1 cm, 2.5 cm apart, 20 cm above the ground) that were covered with a perforated plastic mat (polyester tissue coated with PVC) up to day 16 after hatching to prevent the chicks from falling between the slats. In the front area there was a suspended feeder (diameter 30 cm) that was automatically refilled with a commercial starter food (mash up to day 16, pellets thereafter), a water bowl (up to day 10), a dish filled with grey river sand (diameter 40 cm; up to day 16) and a red heating lamp. In the following, the three pen areas are addressed as sand area, litter area and feeder area. The enrichment of the pens was aimed at giving the hens various and adequate opportunities to influence the behaviour

of the chicks. Housing the groups in barren pens (e.g., on a slatted floor) would probably have resulted in higher levels of feather pecking in the chicks (Huber-Eicher and Wechsler, in press), but this would also have impeded the hens in orienting the pecking behaviour of chicks away from the feathers to more attractive substrates (i.e., sand, wood-shavings, long-cut straw or beech branches). As we were not interested in the absolute level of feather pecking but in differences in this behaviour depending on the presence or absence of a hen, we decided to maximise the opportunities of the hens to influence the behaviour of the chicks.

The heating lamps (250 W) were on for 24 h a day for the first 11 days after hatching. As chicks raised by a hen were brooded, the heating lamps in these pens were suspended 2 m above the ground. This was done to provide chicks reared with and without a hen with similar light conditions. On day 12 after hatching, the heating lamps were removed in pens with a hen and replaced in pens without a hen by ceramic lamps (250 W) which provided heat but no light (up to day 20). Each pen was illuminated by an incandescent light bulb (75 W). In addition, there was a fluorescent tube (36 W) per two pens. Light intensity at the height of the animals was about 60 lx. Day length was kept constant at 13 h (0500–1800) with a 15 min twilight phase at the start and end of the day.

The groups were housed in 12 out of 16 pens built side by side along a corridor in a stable. Chicks in adjacent pens had no visual contact, as the pens were separated by plywood walls. These walls were 190 cm high and allowed auditory contact between all groups in the stable. The groups with and without a hen were assigned systematically to the pens so that there were no two groups with a hen in adjacent pens. On the narrow side of each pen, there was a glass door (72 cm × 142 cm) opening on to the corridor from where behavioural observations were made.

2.2. Data collection

Every group was observed for 20 min each for 4 days a week until the chicks were eight weeks of age. In every week, the four observations in a given pen were evenly distributed over daytime (between 0800 and 1700). During the observations 'all occurrences' (Altmann, 1974) of non-aggressive feather pecking interactions between individuals were recorded. In chicks housed with a hen, pecks directed at the plumage of the hen were also recorded. Only pecks at feathered parts of conspecifics were classified as feather pecking. Pecks at legs, beaks, combs or wattles were neglected. Repeated pecks directed at the same individual were recorded as one interaction. Every feather pecking interaction was attributed (with increasing intensity) to one of the following 4 types of behaviour: (1) 'Pecking' at a feather without pinching, (2) 'Pinching' a feather and pulling slightly, (3) 'Pulling' at a feather with a vigorous backward movement of the head, (4) 'Plucking' a feather. Interactions that were composed of repeated pecks were classified according to the most intense type of behaviour observed.

Every 5 min the 'all occurrences' sampling was briefly interrupted for a 'scan' sample (Altmann, 1974) of the activity of all chicks and (if present) the hen. The following mutually exclusive activities were differentiated: Resting (lying or sitting, breast on floor), standing, moving (walking or running), exploring (scratching or

pecking at litter or at inedible objects), feeding (standing with the tip of the beak less than 5 cm away from the rim of the feeder), drinking (standing with the tip of the beak less than 5 cm away from a drinker), preening (grooming its own feathers), dustbathing (the bird is showing vertical wing-shaking or has shown vertical wing-shaking before the scan and not yet finished this dustbathing bout). Brooding hens and brooded chicks were recorded as resting. In addition to the activity, it was noted in which floor area each animal was staying and whether it used a perch. At the end of each 20 min observation period it was recorded whether at least one chick showed a flight response (running more than 30 cm towards the rear of the pen) when the observer stood up in the corridor.

2.3. Statistical analysis

Data of the group with only seven chicks in weeks 7 and 8 were standardised to the normal group size of eight chicks. This was done by multiplying the number of chicks engaged in a given activity (synchronization data) and the frequency of feather pecking interactions by 8/7. For the comparison of the time budget between chicks reared with and without a hen the percentage of chicks engaged in each of the eight defined activities was computed for each group using all scan samples of the respective group collected over the first 8 weeks after hatching. No statistical tests between the time budget of the hens and the chicks were possible because of the small sample size. The synchronisation between the behaviour of the hen and her chicks was analysed for the four most frequent activities (resting, exploring, feeding, preening) and for the use of the feeder and the litter area. Due to the small sample size this analysis could not be done with activities that accounted for a small proportion of the time budget and with data on the use of the sand area which was rarely frequented by the hens. For each activity the average number of chicks engaged in that activity was computed separately for scans in which the hen showed the same activity and for scans in which she did not. Non-parametric statistics (Mann–Whitney U test, Wilcoxon signed ranks test; Siegel and Castellan, 1988) were used. Tables published by Rohlf and Sokal (1981) were used to assess statistical significance.

3. Results

Table 1 gives the percentage of observation time the chicks and the hens spent on the eight defined activities over the first 8 weeks of the rearing period. Chicks raised by a hen spent significantly less time standing and more time feeding than chicks housed without a hen. With the other activities there were no statistically significant differences between the chicks in the two rearing conditions. As can also be seen in Table 1, the time budget of the hens was very similar to the time budget of the chicks with respect to moving, feeding, drinking, preening and dustbathing. On the other hand, the chicks spent less time resting or standing and more time exploring than the hens.

The activity of the chicks at a given moment was associated with the activity of the hen at that moment (Table 2). The average number of chicks that was resting, exploring,

Table 1
Mean (and range) percentage of observation time the five hens, the chicks in the five groups with a hen and the chicks in the seven groups without a hen spent on different activities over the first 8 weeks of the rearing period. Data of chicks reared with and without a hen were compared using the Mann–Whitney U test, two-tailed

Activity	Hens	Chicks with a hen	Chicks without a hen	P
Resting	30 (15–75)	23 (21–27)	22 (18–28)	n.s.
Standing	23 (2–34)	5 (4–6)	7 (5–8)	< 0.02
Moving	0.5 (0–2)	0.5 (0–1)	0.5 (0–1)	n.s.
Exploring	13 (2–23)	36 (30–40)	38 (31–42)	n.s.
Feeding	17 (9–23)	19 (16–21)	16 (12–18)	< 0.05
Drinking	3 (2–6)	4 (2–5)	3 (2–4)	n.s.
Preening	13 (8–20)	12 (8–14)	13 (11–18)	n.s.
Dustbathing	1 (0–3)	1 (1–2)	0.7 (0–1)	n.s.

feeding or preening was significantly higher for scans in which the hen showed the same activity compared to scans in which the hen did not perform the respective behaviour. Similarly, the number of chicks located in the feeder area or in the litter area was significantly greater if the hen was in the same pen area in a given scan.

The hens spent only 2% of the observation time on the perches which seemed to have an effect on perch use by the chicks. In comparison to chicks housed without a hen (18%), chicks raised by a hen spent a significantly smaller proportion of the observation time on the perches (7%; Mann–Whitney U test, $n_1 = 7$, $n_2 = 5$, $U = 35$, $P < 0.01$, two-tailed). The presence of a hen had no significant effect on the age of the chicks at the first occurrence of perching (without hen average day 17, with hen average day 19; Mann–Whitney U test, $n_1 = 7$, $n_2 = 5$, $U = 13.5$, $P > 0.05$, two-tailed).

Table 2
Comparison of the average ($\pm$SE) number of chicks engaged in a given activity or located in a given pen area between scans in which the hen showed the same or a different activity than the chicks and between scans in which the hen was in the same or a different pen area (n = five groups of eight chicks each, Wilcoxon signed ranks test, one-tailed)

Activity/Pen area of the chicks	Activity/Pen area of the hen		P
	Same	Different	
Activity			
Resting	4.6 ± 0.7	1.1 ± 0.1	< 0.05
Exploring	4.8 ± 0.2	2.6 ± 0.1	< 0.05
Feeding	3.2 ± 0.3	1.1 ± 0.1	< 0.05
Preening	2.5 ± 0.2	0.8 ± 0.1	< 0.05
Pen area			
Feeder area	4.6 ± 0.3	1.3 ± 0.1	< 0.05
Litter area	5.8 ± 0.2	2.9 ± 0.2	< 0.05

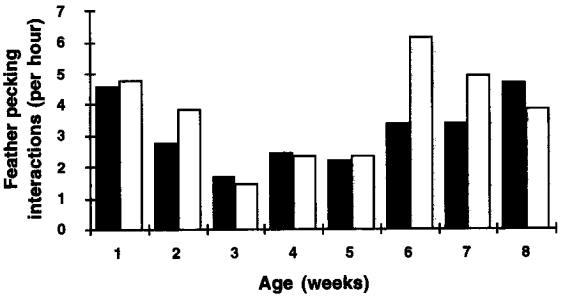

Fig. 1. Average rate of feather pecking interactions (per group of eight chicks per hour) in seven groups housed without a hen (black bars) and five groups raised by a hen (white bars) over the first 8 weeks after hatching.

Chicks reared both with and without a hen were observed to peck at the feathers of conspecifics. The behaviour was already present in the first week of age, and in both rearing conditions there were similar changes in the rate of feather pecking interactions over time (Fig. 1). The average rate of feather pecking interactions over the first 8 weeks of the rearing period did not significantly differ between chicks housed without a hen and chicks raised by a hen (3.2 versus 3.8 interactions per group of eight chicks per hour; Mann–Whitney U test, $n_1 = 7$, $n_2 = 5$, $U = 12$, $P > 0.05$, two-tailed). The rearing conditions also had no significant influence on the percentage of feather pecking interactions that were assigned to the four defined types of this behaviour. Most feather pecking interactions ($n = 437$, data of all 12 groups combined) were classified as pecking (63%) or pinching (33%) and only few as pulling (3%) or plucking (0.5%). Interestingly, chicks raised by a hen directed 50% of their feather pecking interactions at the hen.

The presence of a hen had a clear effect on the incidence of flight behaviour in reaction to the standing up of the observer at the end of an observation period. The percentage of observation periods ($n = 32$ periods per group over 8 weeks) in which at least one of the chicks showed a flight response was significantly higher in chicks housed without a hen than in chicks raised by a hen (average 43% vs. 16%; Mann–Whitney U test, $n_1 = 7$, $n_2 = 5$, $U = 33.5$, $P < 0.02$, two-tailed).

4. Discussion

The results of our study show that the activity of the chicks was significantly associated with the activity of the hen at a given moment. The average number of chicks that was resting, preening, exploring or feeding was significantly higher when the hen was engaged in the same activity. Savory et al. (1978) observing the behaviour of domestic fowl in the wild also noticed that the behaviour of the chicks was often the same as that of the hen. They did not, however, provide data to demonstrate such a behavioural synchronization. We also found that the hen had a significant effect on the pen area used by the chicks.

The time spent feeding was significantly increased in chicks raised by a hen

compared to chicks housed without a hen. There are several descriptive reports that the hen stimulates feeding in the chicks by pecking and tidbitting (Baeumer, 1955; McBride et al., 1969; Savory et al., 1978; Wood-Gush et al., 1978). In our study, we could quantify this stimulation by showing that the number of chicks feeding at a given moment was significantly increased if the hen was also feeding.

There were several results indicating that chicks housed without a hen may be more fearful than chicks raised by a hen. First, chicks reared without a hen showed significantly more flight responses in reaction to the standing up of the observer at the end of an observation period. This is probably due to the fact that the hens were habituated to the presence of human beings and thus, did not respond themselves to the movement of the observer. Second, chicks reared without a hen spent significantly more time standing which may indicate that vigilance was increased in these birds. Third, chicks reared without a hen spent significantly more time on the perches. As hens in the wild only start to take their chicks into the trees for rest at night when they are 6–14 weeks of age (McBride et al., 1969; Wood-Gush et al., 1978), it has to be considered as normal that the chicks raised by a hen spent relatively little time on the perches. On the other hand, the increased perch use observed in chicks housed without a hen may indicate that these birds felt less secure on the floor.

The presence of a hen had no significant effect on the incidence of feather pecking interactions. In both rearing conditions the chicks already directed pecks at feathers of conspecifics during the first week of age, which is in accordance with qualitative observations made by Wennrich (1975). We therefore conclude that the behavioural organisation of chicks is not designed to exclude any feather pecks. Such pecks may be under the control of exploratory behaviour or pecks directed at particles on the plumage of other chicks. Blokhuis and Arkes (1984) reported that about 20% of all feather pecks recorded in groups of chicks housed in pens with litter were directed at particles on other chicks. We also observed that preening chicks sometimes started to peck at the feathers of neighbouring birds, possibly not differentiating between their own and the feathers of other birds. To our surprise, the chicks raised by a hen directed 50% of their feather pecking interactions at the hen. As there was no difference in the overall rate of feather pecking interactions between the chicks reared with and without a hen, the attractiveness of the plumage of the hens seemed to draw attention away from the plumage of other chicks.

The rates of feather pecking interactions observed in our study were generally low (less than 0.5 interactions per chick per hour) and only few interactions were classified as pulling (2.7%) or plucking (0.5%). As a consequence, there was no serious problem with feather pecking resulting in noticeable feather damage or injuries, either in groups raised by a hen or in groups housed without a hen. This contrasts with reports on feather damage and injuries caused by feather pecking in studies with laying hen chicks of similar age but reared in a barren environment (Hughes and Duncan, 1972; Allen and Perry, 1975; Huber-Eicher and Wechsler, in press). We therefore conclude that factors other than the absence of a hen are crucial for the development of serious forms of feather pecking in commercial housing systems for laying hen chicks. Given the enrichment of our experimental pens we can, however, not exclude that a hen could influence feather pecking in chicks reared in a barren environment.

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