

Literature Featherpecking - A good start

Bestman, M., et al. (2009). "Influence of farm factors on the occurrence of feather pecking in organic reared hens and their predictability for feather pecking in the laying period." Applied Animal Behaviour Science **121**(2): 120-125.

Feather pecking is one of the most obvious welfare problems in laying hens. It is seen in all types of housing systems. Although banned in some countries, beak trimming is generally used to reduce the damage caused by this behaviour. In organic farming, where beak trimming is prohibited, the animals are being kept in a less intensive way than in conventional farming in order to improve their welfare. However, feather pecking is also seen in organic laying hens. Generally, rearing circumstances play an important role in the development of this behaviour. Therefore, rearing flocks were monitored for feather pecking and the relations between rearing factors and feather pecking at a young and at an adult age were analysed. Also the correlation between feather pecking during the rearing period and feather pecking during adult life was studied. Twenty-eight commercial flocks of rearing hens were monitored. These flocks split into 51 flocks of laying hens. Flocks were scored for signs of feather damage during rearing at the ages of 7, 12, and 16 weeks and on the laying farms at 30 weeks. On the rearing as well as the laying farm, data were collected on the housing system. Logistic regression was used to analyse our data. Feather damage was seen in 13 out of 24 (54%) of rearing flocks. Logistic regression showed that a higher number of pullets being kept per square meter in the first 4 weeks of life were associated with feather damage during the rearing period (Chi square = 8.49, df = 1, p = 0.004). Moreover, the combination of not having litter at the age of 1-4 weeks and the absence of daylight at the age of 7-17 weeks was a significant predictor of feather damage during the laying period (Chi square = 13.89, df = 4, p = 0.008). In 71% of the cases that pullets did not show feather pecking damage during rearing, they did not show feather pecking damage in the laying period either. When flocks of pullets did show feather damage, in 90% of the cases they did so during adult life. These results lead to suggestions on how to improve the rearing conditions of laying hens and increase their welfare not only during rearing but also during later life. Although the observations were done on organic farms, the results can be applied for other non-cage systems too. (C) 2009 Elsevier B.V. All rights reserved.

Chow, A. and J. A. Hogan (2005). "The development of feather pecking in Burmese red junglefowl: the influence of early experience with exploratory-rich environments." Applied Animal Behaviour Science **93**(3-4): 283-294.

This study examines the development of feather pecking and its relationship to exploration in Burmese red junglefowl (*Gallus gallus spadiceus*). Ten groups of four chicks each were raised from hatching on wire mesh floors (home pen). Two of the four chicks in each group received experience in exploratory-rich environments four times a week for 5 weeks, and the other two chicks remained in the home pen. Observations conducted in the home pen revealed that chicks deprived of experience in exploratory-rich environments performed significantly more gentle feather pecking, and tended to show more severe feather pecking than the experienced birds. Experience in the exploratory-rich environments did not affect the frequency of environmental pecking or food pecking. These results suggest that chicks deprived of exploratory-rich environments may come to perceive pen mates as appropriate exploratory stimuli and subsequently direct exploratory behavior toward conspecifics. This tendency to peck pen mates may lead to the development of feather pecking. We suggest that forceful pecks may be reinforcing, and that the more likely pecks are directed to a conspecific, the more likely feather pecking will develop. (c) 2005 Elsevier B.V. All rights reserved.

de Haas, E. N., et al. (2014). "Predicting feather damage in laying hens during the laying period. Is it the past or is it the present?" Applied Animal Behaviour Science **160**(0): 75-85.

Abstract Feather damage due to severe feather pecking (SFP) in laying hens is most severe during the laying period. However, SFP can develop at an early age and is influenced by early rearing conditions. In this study we assessed the risk factors during the rearing and laying period for feather damage at 40 weeks of age, in ISA brown and Dekalb White laying hens. Variables related to housing conditions during the rearing and laying period, and variables related to fearfulness (response to novel object, stationary person, and social isolation) and feather pecking (SFP, feather damage and feather eating) were tested to affect feather damage at 40 weeks of age. Feather damage on the neck, back and belly region was assessed on 50 hens, resulting in a total body score, and averaged per flock (based on Welfare Quality®, 2009). First, analysis was conducted by a two-way ANOVA to assess separate factors to influence feather damage at 40 weeks of age. Hereafter, the final GLM for predicting feather damage at 40 weeks of age included only variables which had $P < 0.1$ in the two-way ANOVA. Risk factors during the rearing period were high levels of SFP at five weeks of age and elevated fear of humans (explained variance 29% and 5.3%, resp.). Risk factors during the laying period were a large group size (explained variance: 1%), distance to stationary person (explained variance: 16%), floor housing compared to aviary housing (1.27 ± 0.18 vs. 0.75 ± 0.07 , explained variance: 21%) and a standard management compared to adjusted management such as a radio, pecking blocks, round drinkers and/or roosters (0.98 ± 0.31 vs. 0.51 ± 0.04 , explained variance: 26%). Approximately 49% of the laying flocks and 60% of the rearing flocks in this study showed high SFP or severe feather damage. This high incidence emphasizes the severity of the problem and the importance of finding a

solution. The results of this study may aid in providing practical solutions to this serious animal welfare problem.

de Haas, E. N., et al. (2014). "Parents and Early Life Environment Affect Behavioral Development of Laying Hen Chickens." *Plos One* **9**(3): e90577. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3948370/>.

Severe feather pecking (SFP) in commercial laying hens is a maladaptive behavior which is associated with anxiety traits. Many experimental studies have shown that stress in the parents can affect anxiety in the offspring, but until now these effects have been neglected in addressing the problem of SFP in commercially kept laying hens. We therefore studied whether parental stock (PS) affected the development of SFP and anxiety in their offspring. We used flocks from a brown and white genetic hybrid because genetic background can affect SFP and anxiety. As SFP can also be influenced by housing conditions on the rearing farm, we included effects of housing system and litter availability in the analysis. Forty-seven rearing flocks, originating from ten PS flocks were followed. Behavioral and physiological parameters related to anxiety and SFP were studied in the PS at 40 weeks of age and in the rearing flocks at one, five, ten and fifteen weeks of age. We found that PS had an effect on SFP at one week of age and on anxiety at one and five weeks of age. In the white hybrid, but not in the brown hybrid, high levels of maternal corticosterone, maternal feather damage and maternal whole-blood serotonin levels showed positive relations with offsprings' SFP at one week and offsprings' anxiety at one and five weeks of age. Disruption and limitation of litter supply at an early age on the rearing farms increased SFP, feather damage and fearfulness. These effects were most prominent in the brown hybrid. It appeared that hens from a brown hybrid are more affected by environmental conditions, while hens from a white hybrid were more strongly affected by parental effects. These results are important for designing measures to prevent the development of SFP, which may require a different approach in brown and white flocks.

de Jong, I. C., et al. (2013). "Can substrate in early rearing prevent feather pecking in adult laying hens?" *Animal Welfare* **22**(3): 305-314.

In The Netherlands, laying hen chicks are often reared without litter on the raised slatted area of a barn system or confined in the aviary system during the first two to five weeks after hatching, with chick paper or chicken wire on the floor. In the absence of a suitable pecking substrate, chicks may redirect their pecking behaviour to other birds, which possibly increases the risk of developing feather-pecking behaviour. The aim of this study was to determine whether housing on wood-shavings (WS treatment; n = 15 groups) as compared to housing on chicken wire (CW treatment; n = 15 groups) between day 1–20 could reduce feather pecking in adult birds. After day 20, all chickens were allowed wood-shavings as litter. Behavioural observations showed that CW chicks performed significantly less ground-pecking behaviour compared with WS chicks up to day 20. More CW chicks showed gentle feather pecking at day 7 and 14 as compared to WS chicks, and more CW chicks pecked at the feeder or drinker than WS chicks up to day 20. CW chicks showed rebound behaviour: the day after they were introduced to wood-shavings they displayed more ground-pecking behaviour compared to the WS chicks. Later on in the rearing period no noticeable differences between treatments were found in frequency of gentle and severe feather-pecking bouts. During laying, more gentle feather-pecking bouts were observed in CW than in WS groups but no differences in severe feather-pecking bouts were observed, nor in feather damage at the end of the trial. The results indicate that hens can display substantial flexibility in their pecking behaviour and that, despite more gentle feather pecking in CW hens in laying, the absence of substrate in early rearing does not increase the risk of developing severe feather-pecking behaviour when adult.

Dixon, L. M. and I. J. H. Duncan (2010). "Changes in Substrate Access Did Not Affect Early Feather-Pecking Behavior in Two Strains of Laying Hen Chicks." *Journal of Applied Animal Welfare Science* **13**(1): 1-14.

Feather pecking, commonly found in flocks of laying hens (*Gallus gallus*), is detrimental to bird welfare. Thought to cause this problem is the normal housing of layers without a floor substrate. Some evidence suggests that early substrate access decreases later feather pecking. However, there has been little research on the immediate effects of a change in substrate availability on bird welfare, although environmental modifications like this are often done when brooding and rearing laying hen chicks. To investigate this, the behavior of two strains of laying hen chicks was recorded for 4 weeks. The study kept the birds on either wire or peat moss for 14 days and then switched half the chicks to the other flooring. Early feather pecking was not significantly different for birds started on peat moss and switched to wire than for birds only on wire (p .05). Because moving chicks from peat moss to wire did not cause additional welfare problems, the study recommends that chicks be kept on a substrate when young as feather-pecking levels are lower and immediate welfare is improved compared with birds kept only on wire.

Gilani, A.-M., et al. (2012). "The effect of dark brooders on feather pecking on commercial farms." *Applied Animal Behaviour Science* **142**: 42-50.

Commercial laying hen chicks experience continuous light for up to 24 h/day in the first week of life. Under these conditions, active chicks disturb, and may direct feather pecks towards resting ones. Previous experimental work with small groups showed that both problems were reduced in chicks brooded by dark brooders (heaters). The current study aimed to extend these small-scale trials by examining the use of dark brooders on two commercial rearing farms. Each farm contributed two identical houses, one of them equipped with dark brooders and the other with regular brooders. The experiment comprised five replicates, each consisting of one dark brooder flock and one control flock (total of 10 flocks). Each flock contained 2000 Columbian Blacktail chicks with intact beaks, which

were reared to organic standards. Observations took place three times during the rearing period at 1, 8 and 16 weeks and three of the five replicates were also followed into lay, with observations at 25 and 35 weeks. Bird weights, the evenness of body weight, mortality at the end of rear, feather pecking, the percentage of the flock with missing feathers and individual feather scores were measured, as well as the flock's reaction to a novel object and an approaching human in selected areas of the house. Apart from mortality, which was analysed as a paired t-test in PASW Statistics 18, data were ordered in three (or four) levels (visits within (flock within) replicate within farm) and were analysed using the multilevel statistical software MLwiN 2.25. Treatment and age were entered in the model as explanatory variables. On average, across observations taken at all ages, dark brooder flocks performed significantly less severe feather pecking than control flocks ($\chi^2 = 12.215$, $df = 1$, $P = 0.0005$) and had a significantly lower percentage of birds with missing feathers ($\chi^2 = 7.380$, $df = 1$, $P = 0.007$). Individual feather condition deteriorated faster in the control treatment (treatment \times age²: $\chi^2 = 12.148$, $df = 1$, $P = 0.0005$). There was also an interaction between treatment \times age for weight ($\chi^2 = 11.087$, $df = 1$, $P = 0.0009$) which meant that dark brooded birds ended up slightly heavier than birds from the control treatment. Mortality at the end of rear, gentle feather pecking and evenness of the weight were not measurably affected by treatment. The novel object and human approach test gave mixed results. In conclusion we found no detrimental effects of dark brooding on commercial farms and suggest this is a promising approach to reducing problems with feather pecking and generally improving the welfare of commercial pullets.

Gilani, A.-M., et al. (2013). "The effect of rearing environment on feather pecking in young and adult laying hens." Applied Animal Behaviour Science **148**(1–2): 54-63.

Abstract Although the rearing period has an important influence on the development of feather pecking in laying hens, few studies have quantified the risk factors operating on commercial farms during this time and identified their long-term impact. Our aim was to conduct a longitudinal study to investigate the effect of rearing environment on feather pecking in young and adult laying hens. Thirty-four flocks from 29 rearing farms were recruited and visited at the beginning, middle and end of the rearing period and once at lay (35 weeks). Twelve flocks were beak trimmed. Information on rearing environment was used to create models predicting feather pecking and plumage damage during rear and lay, using the multilevel statistical software MLwiN 2.25. Across all flocks, gentle feather pecking (GFP) was observed during 94% of the visits at both rear and lay, at 1.3 and 1.0 bouts/bird/h respectively. Severe feather pecking (SFP) was observed during 27% of the visits during rear and during 65% of the visits at lay, with a mean rate of 0.4 pecks/bird/h during rear and 1.9 pecks/bird/h at lay, across all flocks. The mean percentage of the flock with missing feathers was 12% at 16 weeks and 49% at lay. The mean individual feather score at lay was 21 (range 6–24 (best)). The study confirmed that feather pecking and feather damage occur during the rearing period. Statistical modelling further showed that the percentage of the flock with missing feathers was significantly lower and individual feather scores significantly higher (better) at lay, in flocks where feather pecking had not started at the end of rear. The three models on the effect of rearing environment on GFP, SFP and the percentage of the flock with missing feathers during rear contained 21 significant variables. Approximately a third of those related to house climate (temperature, humidity, sound, light and dust levels), while another third related to foraging. Foraging itself appeared in all three models, confirming that good foraging is one of the major factors in reducing feather pecking. The four models on the effect of rearing environment on GFP, SFP, the percentage of the flock with missing feathers and individual feather scores at lay contained 17 significant variables and sound level was significant in three of the four. The analysis further indicated that experienced rearing staff was protective against feather pecking at both rear and lay and that feather pecking increased with an increasing number of diet changes during rear.

Gunnarsson, S., et al. (1999). "Effect of rearing factors on the prevalence of floor eggs, cloacal cannibalism and feather pecking in commercial flocks of loose housed laying hens." British Poultry Science **40**(1): 12-18.

1. Effects of rearing conditions on behavioural problems were investigated in a cohort study of commercial flocks of laying hens housed in 2 different loose housing systems. The sample population was 120 385 laying hens from 59 flocks of various hybrids at 21 different farms. 2. Logistic regression modelling was used to test the effects of selected factors on floor eggs, cloacal cannibalism and feather pecking. In addition to early access to perches or litter, models included hybrid, stocking density group size, housing system, age at delivery, identical housing system at the rearing farm and at the production farm and, in models for floor eggs and cloacal cannibalism, nest area per hen. Odds ratios were calculated from the results of the models to allow risk assessment. 3. No significant correlations were found between the prevalence of floor eggs, cloacal cannibalism and feather pecking. 4. Access to perches from not later than the 4th week of age decreased the prevalence of floor eggs during the period from start-of-lay until 35 weeks of age, odds ratio 0.30 ($P < 0.001$). Furthermore, early access to perches decreased the prevalence of cloacal cannibalism during the production period, odds ratio 0.46 ($P = 0.03$). 5. No other factor had a significant effect in these models. Although it was not significant, early access to litter had a non-significant tendency to reduce the prevalence of feather pecking.

Janczak, A. M. and A. B. Riber (2015). "Review of rearing-related factors affecting the welfare of laying hens." Poultry Science.

Laying hens may face a number of welfare problems including: acute and chronic pain caused by beak trimming; exaggerated fearfulness that may cause stress and suffocation; difficulties in locating resources, resulting potentially in emaciation and dehydration; frustration and boredom, caused by an environment that is barren; feather pecking; cannibalism; foot lesions; and bone fractures. In Europe,

a greater proportion of laying hens are housed in non-cage systems compared to the rest of the world. The extent of the different welfare problems may therefore vary between countries as the type of housing system influences the risk of suffering. More generally, many of these welfare problems are influenced by the rearing environment of the pullets. This article therefore focuses on welfare problems in laying hens that can be traced back to rearing. Factors that have been studied in relation to their effects on bird welfare include beak trimming, housing type, furnishing, enrichment, feeding, stocking density, flock size, sound and light levels, concentration of gasses, age at transfer from rearing to production facilities, similarity between rearing and production facilities, competence of staff, and interactions between bird strain and environment. The present review aims to summarize rearing-related risk factors of poor welfare in adult laying hens housed according to European Union legislation. It aims to identify gaps in current knowledge, and suggests strategies for improving bird welfare by improving rearing conditions. Two main conclusions of this work are that attempts should be made to use appropriate genetic material and that beak trimming should be limited where possible. In addition to this, the rearing system should provide constant access to appropriate substrates, perches, and mashed feed, and should be as similar as possible to the housing system used for the adult birds. Finally, young birds (pullets) should be moved to the production facilities before 16 weeks of age. The measures outlined in this review may be useful for improving the welfare of pullets and adult laying hens.

Jensen, A. B., et al. (2006). "Effect of brooders on feather pecking and cannibalism in domestic fowl (*Gallus gallus domesticus*)."
Applied Animal Behaviour Science **99**(3-4): 287-300.

Several studies have shown that the tendency to feather peck is influenced by events early in life and preventive measures should therefore be introduced at hatching. Separating inactive chicks from active chicks by providing dark electrical brooders was predicted to reduce the risk of chicks developing pecking preferences for conspecifics. Twelve groups of 15 layer hen chicks (Lohmann Tradition) were reared in pens (2.55 m²); during the first 5 weeks after hatching six pens were provided with dark brooders and six pens with heating lamps. All pens were observed continuously for 30 min per pen once a week until the chickens were 23 weeks old, and each bout of severe feather pecks was recorded. The chickens were observed several times daily, and all injured individuals were removed from the experiment. Faecal samples were collected from the pens when the chicks were 16, 17 and 18 days old and analysed for corticosterone metabolites. At the end of the experiment, the plumage and skin damage were scored. Data were analysed using repeated measures ANOVA. The dark brooders completely prevented severe feather pecking in the dark brooder pens, whereas the frequency of severe feather pecking rose with age in the heating lamp pens (treatment x age: $P < 0.0001$). At the last observation (week 23), the frequency of severe feather pecking bouts in the dark brooder pens was 0.3 +/- 0.4 (mean S.E.) compared to 31.3 +/- 10.1 in the heating lamp pens. The frequency of gentle feather pecking was significantly higher in the heating lamp pens at all ages ($P < 0.0001$). Mortality followed the same pattern as severe feather pecking; it was almost nonexistent in the dark brooder pens, whereas from point of lay it continued to rise with age in the heating lamp pens (1 versus 24 casualties, treatment x age: $P < 0.0001$). The high level of severe feather pecking in the heating lamp pens was also reflected in the scores of plumage and skin damage as both were found to be significantly higher in the heating lamp pens (plumage: $P = 0.0004$; skin: $P = 0.0273$). There was no difference between treatments in concentrations of faecal corticosterone metabolites ($P = 0.8146$). The results suggest that the provision of dark brooders has a long-lasting reducing effect on the frequency of feather pecking and cannibalistic attacks, resulting in reduced mortality and an improved condition of both plumage and skin. (c) 2005 Elsevier B.V. All rights reserved.

Newberry, R. C., et al. (2007). "Behaviour when young as a predictor of severe feather pecking in adult laying hens: The redirected foraging hypothesis revisited."
Applied Animal Behaviour Science **107**(3-4): 262-274.

It has been suggested that feather pecking in poultry results when foraging behaviour is redirected to feathers in the absence of adequate foraging incentives and that gentle feather pecking is a precursor of severe feather pecking. Associations have also been proposed between feather pecking and other behaviours including dust bathing and preening. Here, we present the results of a longitudinal study on the development of severe feather pecking in individual domestic fowl. We hypothesised that behaviour, and especially foraging and gentle feather pecking behaviour, of individual birds when young predicts severe feather pecking behaviour by the same birds when adult. To test this hypothesis, we used behavioural data collected from 192 individual White Leghorn hens (12 focal birds/group) housed continuously from hatch in 16 floor pens. Data on 34 behaviour variables recorded when the birds were young (3-15 weeks of age) were subjected to factor analysis. The resulting factors were entered as independent variables in a generalised linear model to determine their relationship with severe feather pecking by the same birds as adults (1737 weeks of age). We found a positive association between a factor describing foraging when young and severe feather pecking when adult, and a negative association between a factor describing dust bathing when young and severe feather pecking when adult ($P < 0.05$). Levels of severe feather pecking increased following the onset of lay and we found no significant association between factors describing feather pecking when young and severe feather pecking by the same individuals when adult. Most of the birds were observed to perform exploratory gentle feather pecks when young. No evidence was found that exploratory or stereotyped gentle feather pecks consistently became more severe over time but factor analysis indicated that severe feather pecking by young birds was more closely correlated with exploratory, than stereotyped, gentle feather pecking, signalling utility in distinguishing between exploratory and stereotyped gentle feather pecking in future studies. We conclude that severe feather pecking did not substitute for foraging behaviour but, rather, was more likely to emerge in adult hens

that had performed relatively more foraging, and less resting and dust bathing, when young. However, none of the individual behaviour variables recorded when young could be used to identify precisely which individuals would exhibit severe feather pecking when adult. (C) 2006 Elsevier B.V. All rights reserved.

Rodenburg, T. B., et al. (2008a). "Selection method and early-life history affect behavioural development, feather pecking and cannibalism in laying hens: a review." Applied Animal Behaviour Science **110**(3/4): 217-228.

The aim of this review is to discuss the effects of selection method and early-life history on the behavioural development of laying hens. Especially in larger groups, laying hens often develop damaging behaviours, such as feather pecking and cannibalism, leading to impaired animal welfare. We hypothesise that the propensity to develop feather pecking and cannibalism is affected by a bird's genetic background and by its early-life history. The genetic background can be influenced by genetic selection. Laying hens are traditionally selected on individual performance, which may lead to co-selection of feather pecking and cannibalism. For hens kept in small groups, it has recently been demonstrated that a novel group selection method, focusing on group performance, can help to reduce cannibalism. However, the biological background behind the success of group selection is unknown. It is also not known whether these results from small groups can be translated to larger groups of laying hens. Regarding early-life history, laying, brooding and rearing conditions have been shown to have major effects on behavioural development and on feather pecking and cannibalism. The presence of a hen during rearing has been shown to improve foraging- and social behaviour, to decrease feather pecking and to decrease fearfulness in chicks. Applying group selection and rearing laying hens in a more natural environment may be key factors in solving the problems caused by feather pecking and cannibalism, especially if the promising results of group selection from small groups in experimental settings can be translated to large-group housing systems.