Strategies to reduce the risk of feather pecking in laying hens

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Introduction

Feather pecking (FP) is defined as the pecking at and pulling out of feathers of conspecifics. It can range from gentle feather pecking (GFP) to severe feather pecking (SFP) (Savory, 1995; Rodenburg *et al.*, 2013). SFP is the main concern, as this behaviour can lead to serious feather damage and the development of bald patches. These bald patches can attract tissue pecking and birds can be wounded by this behaviour. When birds are wounded, cannibalistic behaviour can develop and the victims can be pecked to death. FP is a problem in all housing systems, but is most difficult to control in non-cage systems, because of the large flock size in those systems. The main method used to control FP in commercial flocks is the use of beak trimming. By removing the tip of the birds' upper beak, the potential damage the birds can cause each other by pecking is reduced. However, as the practice of beak trimming is invasive in itself and does not offer a real solution to the underlying problem of FP, pressure is increasing in many countries to prohibit beak trimming. Therefore, strategies are needed to reduce the risk of FP in laying hens. In this paper, I will outline the background of FP behaviour and explain the major strategies in laying hen breeding and in parent stock, rearing flock and laying flock management, to control FP.

Causes of feather pecking

It is known that FP is closely related to exploratory and foraging behaviour. Chickens are omnivores and in the wild they spend up to 60% of their active time on foraging behaviour. They do this by moving around and by pecking and scratching at the soil (Dawkins, 1989). Blokhuis (1986) showed that when hens are restricted in their foraging behaviour, by preventing access to litter, they redirect their pecking behaviour towards the plumage of flock mates. In that sense, FP shows great similarity to tail biting in pigs – which is also related to lack of environmental stimulation (Brunberg *et al.*, 2016). Indeed, Newberry *et al.* (2007) showed that birds that were very active foragers when young, were more at risk to develop SFP when adult. Apart from foraging motivation, also the ability to cope with fear and stress seems to play a central role. Outbreaks of FP on commercial farms often coincide with stressful events happening at the farm, such as feed changes, disease outbreaks, etcetera. Some flocks and some animals seem more sensitive to stressors than others. In research, also relationships have been found between the ability to cope with fear and stress and FP. Birds that were very fearful in an open field test as a chick were more likely to develop FP later in life (Rodenburg *et al.*, 2004). Similarly, birds from a line characterized as a high FP line showed more freezing in the open field than their low FP counterparts. If laying hens' ability to cope with fear and stress could be improved by breeding and management, this may reduce the risk of FP outbreaks.

Genetics and breeding approaches

The fact that there is variation in FP between different hybrids and genetic lines illustrates that FP has a genetic background. Kjaer and Sørensen (1997) illustrated this by conducting a selection experiment and creating a high FP line, a low FP line and an unselected control line. These selection lines are still used in research today and have been very helpful in unravelling the causes of FP. Coming back to the relationship of feather pecking and high pecking activity, Kjaer (2009) demonstrated that birds from the high FP line were indeed much more active than birds from the low FP line, and that they could even be characterized as hyperactive. This has also been found in other studies using these same lines (de Haas *et al.*, 2010; van der Eijk *et al.*, 2018). To reduce the risk of feather pecking a breeding strategy is needed. The challenge there is that breeding normally focuses on individual characteristics of an animal, such as egg production and egg quality, and not on social traits. Muir (1996) proposed a creative way around this and suggested to select on group productivity, rather than individual productivity. By focusing on the group level, he selected groups that had an appropriate egg production combined with a high group survival. This approach was successful in strongly reducing mortality due to cannibalism. This approach has been taken forward in later years, proposing a method that combined individual and group performance (Ellen *et al.*, 2007). This selection scheme focused on reducing mortality in group-housed layers and also led to decreased fearfulness, decreased stress sensitivity and a reduction in damaging behaviour (Rodenburg *et al.*, 2009; Ellen *et al.*, 2014). Our tools to automatically record behavioural traits at an individual level for use in breeding programs is also increasing (Ellen *et al.*, 2019). At the same time, breeding is only part of the story and it not realistic to belief that FP can be addressed by breeding alone. A balanced approach is needed, creating an optimal match between animal and environment (Nicol *et al.*, 2013).

Parent stock

Laying hen parent stock is often kept in quite traditional floor housing systems and at relatively high stocking densities. Little research has focused on the potential effects of parent stock housing and management on the risk of FP. However, we know that stress in the parent stock can be transferred to the offspring through epigenetic effects (Goerlich *et al.*, 2012; Rodenburg and de Haas, 2016; Guerrero-Bosagna *et al.*, 2018). De Haas *et al.* (2014b) studied the effect of stress in the parent stock on FP in the offspring. They visited five Dekalb White and five ISA Brown parent stock flocks and from each flock they also visited five rearing flocks and followed these until the laying period at 30 weeks of age (50 rearing flocks in total). Especially in the Dekalb White flocks, a relationship was found between parental stress and offspring SFP. Offspring from parent stock with poor plumage condition and high basal corticosterone levels already showed SFP during the first weeks of life. We know that once a flock develops SFP, it is very difficult to get rid of this behaviour – so this indicates that parental stress may be one of the major factors in the development of SFP in white layer flocks (Figure 1). This also underlines that it is worthwhile to invest in parent stock housing and management, with the aim to reduce stress in the parent stock (de Haas *et al.*, 2014a; de Haas *et al.*, 2014b).

Rearing flock

The rearing period is a very important period in laying hen development. Linking back to the introduction, one very important aspect to get right during rearing is litter supply. From day 1, layer chicks are highly motivated to explore their environment and to show foraging behaviour. Satisfying this need helps to reduce the risk of early outbreaks of FP. In conventional aviary rearing, frequently chick paper is used to prevent the chicks from getting stuck in the cage floor. An additional benefit of chick paper is that litter accumulates on the chick paper and allows the chicks to use this as foraging material. In the research of de Haas *et al.* (de Haas *et al.*, 2014a; de Haas *et al.*, 2014b), part of the farmers would leave the chick paper in until the aviary system was opened, while others would remove it and keep the birds for one to two weeks in the barren cage floor before opening the system. Similarly, part of the farmers would supply extra litter on the floor of the system, when the system was opened around 5 weeks of age, while other farmers would not do this. It was found that removing chick paper and not supplying litter when opening the system both increased the risk of SFP during the rearing period. Especially the combination of paper removal and no extra litter supply led to the most FP. Interestingly, this was mainly the case in the ISA Brown flocks, indicating that brown flocks may be more sensitive to lack of environmental stimulation than white flocks (Figure 1). Risk factors during the rearing period for high feather damage during the laying period were high levels of SFP at five weeks of age and high fear of humans. Interestingly, a peak in both GFP and SFP was observed at five weeks of age. This is also the age around which most flocks were released from the rearing cage into the aviary system.

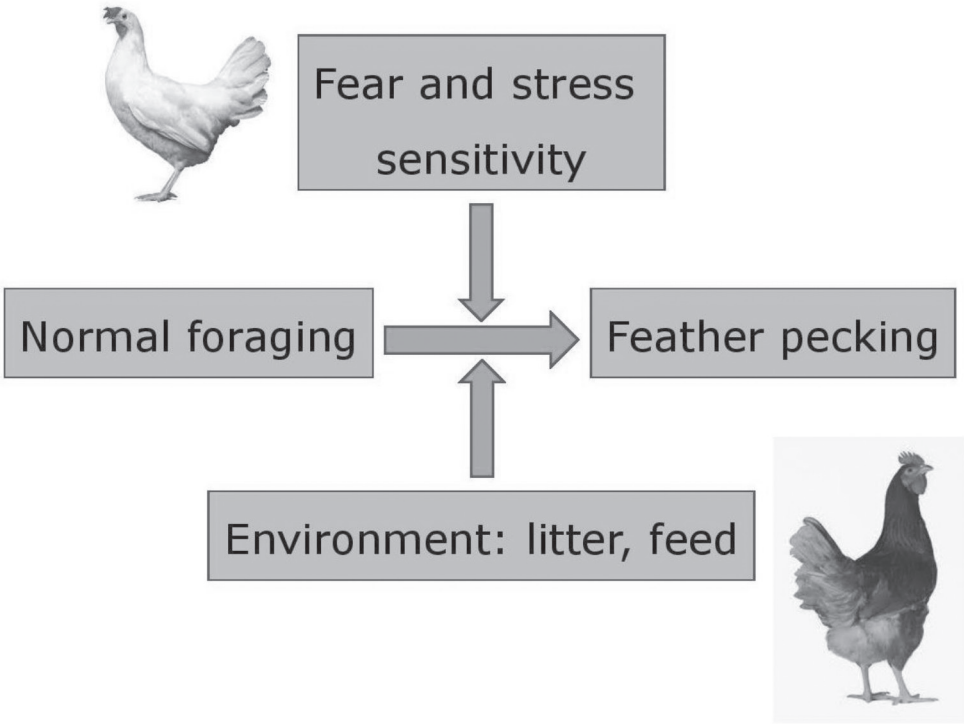

Figure 1. Model for the development of feather pecking in commercial flocks of laying hens, based on the project by de Haas et al. (2014): feather pecking will develop from normal foraging behaviour and is stimulated in conditions that are stressful for the birds (especially in white flocks) and when the environment is lacking in stimulation (especially in brown flocks).

Laying flock

Of course, the longest period of the laying hen's life is spent at the laying farm. Also during this phase, appropriate management is needed to prevent outbreaks of SFP. De Haas *et al.* (2014a) studied the risk factors for high feather damage at 30 weeks of age. Risk factors during the laying period were a large group size, high fear of humans, floor housing compared to aviary housing and a standard management compared to adjusted management such as a radio, pecking blocks, foraging materials, round drinkers and/or roosters. This illustrates that limiting group size, habituating the laying hens to human activities and environmental enrichment can be considered key strategies to control SFP during the laying period. To start with group size, in many cases flocks in aviary systems are subdivided in smaller subgroups (for instance five subgroups of 6,000 hens each). This subdivision may prevent problem behaviours to spread through the whole house and may also increase the chance of the farm manager being alerted to early signs of stress or SFP. Secondly, reducing fear in laying hens – both during rearing and lay, fear of humans came out as a major indicator of later feather damage. This underlines the importance of habituating a flock to human activities and noise. Flocks that are well habituated and more robust in this respect will be less likely to be affected by

stressful events. Finally, modified management was found to be a successful strategy to prevent SFP. By providing a radio in the house or pecking enrichments such as pecking blocks or alfalfa hay the risk of SFP outbreaks can be reduced. Approximately 49% of the laying flocks and 60% of the rearing flocks in of the flocks studied by de Haas *et al.* (2014a) showed high SFP or severe feather damage, indicating that this is a serious problem in laying hens.

Conclusion

In conclusion, feather pecking is a serious welfare problem. It can occur in all housing systems, but is most difficult to control in non-cage systems given the large flock size in those systems. Breeding companies can help to reduce the risk of feather pecking, through breeding for improved group performance, but success depends on active involvement of the whole production chain. More attention to parent stock housing and management is warranted, as high parental stress levels may result in increased SFP in the offspring, especially in white flocks. During rearing, attention should be given to litter supply and providing outlets for foraging and exploratory behaviour. Especially brown flocks proved sensitive to limitation of litter supply during rearing. During the laying period, it pays off to invest in birds that are habituated to varied human activities. Further, again a stimulating environment limits the risk of SFP outbreaks. The toolbox to successfully manage laying hen flocks and to prevent outbreaks of SFP is growing and experience with managing non-beak trimmed flocks is also increasing. This will the entire EU laying hen industry to further reduce problems with SFP and cannibalism and to increase the welfare of laying hens throughout Europe.

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