Beak Trimming Reduces Feeding Efficiency of Hens

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Primary Audience: Poultry Farm Managers, Poultry Scientists, Veterinarians, Legislators

SUMMARY

The ability of beak-trimmed and intact laying hens to ingest feed pellets was examined by high-speed video filming of feeding birds. The birds were exposed to either a deep layer of pellets or a single layer of pellets. In the single layer treatment, there was a negative correlation between mandible asymmetry and feeding success. These data have important implications for poultry welfare, since the degree of bill asymmetry caused by beak trimming may, under certain circumstances, result in inadvertent feed deprivation.

Key words: hen, beak trimming, feeding, welfare

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DESCRIPTION OF PROBLEM

Beak trimming is a procedure carried out by poultry producers to prevent injurious feather pecking and cannibalism [1, 2]. Beak trimming reduces feed intake, BW, mortality, and affects some production parameters, such as feed conversion efficiency, the net effect of which is usually positive on profitability [2, 3, 4]. Despite considerable research, there is no acceptable alternative to beak trimming as a means of preventing pecking damage that is not also contentious, for example the use of dim lighting. Although some European countries (Sweden, Finland, Norway, and Iceland) have outlawed the practice, it will remain legal elsewhere.

If improperly trimmed, neuromas may form on the cut surface of the bill [5], and it has been suggested that the lack of a complete upper mandible may alter a bird's interaction with its environment and its ability to preen [6, 7]. These changes in beak use might be due to either pain or lack of sensory input from the bill tip [6]. Beak tipping is an alternative to trimming and removes the hook of the upper beak. The relative proportions of hens left intact, beak tipped, or fully trimmed by either method is difficult to discover given the sensitivity of the beak-trimming debate.

In this paper, we describe how beak trimming detrimentally affects feed pellet manipulation by laying hens. We propose 2 hypotheses; first, hens that have their top mandible shortened by beak trimming will be less successful when picking up isolated feed pellets and, second, that a deep layer of feed will improve their success rate.

MATERIALS AND METHODS

Ten ISA Brown layer hens were obtained from a commercial supplier. Five hens had intact beaks, and 5 hens were beak-trimmed following standard practices with between 30 and 50% of their upper mandible removed at age 5 d. All 10 hens were reared until 8 mo old under standard

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TABLE 1. Effect of beak trimming and feed presentation type on pecking success

Beak form	Feed presentation	Success, % (SD)	Failure, % (SD)	Mishandled, % (SD)
Beak trimmed	Monolayer	16.4 (11.8)	80.6 (16.2)	3 (2.7)
	Multilayer	68.2 (10.2)	21.2 (5.9)	10.6 (5.9)
Intact	Monolayer	84 (3.2)	14 (3.8)	2 (1.2)
	Multilayer	89.8 (4.5)	8.8 (4.1)	1.4 (0.5)

husbandry conditions. The asymmetry (under- or overlap) of the hens' mandibles was measured using digital vernier callipers [8] to an accuracy of ±0.01 mm. Three measurements were made on each bird so that the statistical repeatability of the measurements could be assessed.

The hens were accustomed to feed on commercially available feed pellets [9] either from a shallow tray where the feed was presented as a single layer (monolayer) or in a bowl as a deep layer (multilayer). Similar feed had been fed to the hens since they were 14 d old. The lengths and diameters of 20 randomly selected pellets were also measured to assess overall pellet size. A high-speed video camera [10] recorded a succession of pecks at a rate of 250 frames/s for each hen, which were then edited, digitized, and stored on a personal computer. Birds were filmed side-on and were accustomed to feeding in the presence of the camera and the camera operator. The camera was positioned approximately 1 m, and the experimenter 2 m, from the bird. Tests were conducted between 1400 and 1700 h and were appropriately randomized between intact and trimmed and for pellet depths. The birds were filmed for 1 min, and the percentage of pecks in which a pellet was grasped and ingested (success), instances in which no pellet was lifted from the supply (failure), and occasions when the pellet was lifted from the supply but dropped before ingestion (mishandled) were calculated from the video records.

RESULTS

For beak-trimmed hens, the protrusion of the lower mandible beyond the upper mandible ranged between 4.73 and 1.87 mm (mean 2.83 mm, SEM 0.27). For the intact hens, the upper mandible protruded over the end of the lower mandible between <0.01 and 1.92 mm (mean 1.05 mm, SEM 0.17). The repeatability [11] of the measurements of bill asymmetries was very high at 95.9 and 97.8% (intraclass correlation coefficient) for intact and beak-trimmed hens, respectively. The mean diameter of the pellets was 3.4 mm (SD = 0.06), and the mean length was 7.4 mm (SD = 2.00).

The hens in different treatment groups showed contrasting abilities to ingest feed pellets successfully (Table 1). From this, it is clear that the beak-trimmed hens were less successful when eating from the mono- and the multilayer than the intact hens (Mann-Whitney *U*-test, $U_{5,5} = 0$, $P < 0.01$). One of the trimmed hens failed to ingest any feed pellets from the monolayer (success rate = 0%). The beak-trimmed hens were more successful at eating feed from a multilayer than a monolayer (Wilcoxon matched pairs test, $W_5 = 15$, $P < 0.05$), although the intact hens were equally successful for both forms of feed presentation ($W_5 = 3.5$, $P > 0.05$).

One-tailed Spearman's rank correlation coefficients revealed that for beak-trimmed hens, the level of asymmetry was highly and negatively correlated with success rate for the monolayer ($r_s = 1$, $P < 0.01$) but not the multilayer ($r_s = 0.6$, $P > 0.05$) treatment. No such relationship for the intact hens for either the mono- ($r_s = -0.8$, $P > 0.05$) or multilayer ($r_s = -0.8$, $P > 0.05$) treatments occurred, although the trend for these data is for increasing upper mandible overlap to reduce success rate (Figure 1).

Detailed examination of high-speed video filming explained why beak-trimmed hens so frequently failed to grasp feed pellets. Figure 2 shows the beak gaping and closing around a feed pellet for both an intact and trimmed hen. For the beak-trimmed hens (Figure 2, a and b), because the lower mandible protrusion beyond the cut end of the upper mandible is greater than the diameter of the pellet, the hen is unable to trap the pellet between her mandibles and lift it from the monolayer. For 4 hens, the lower mandible protrusion was less than 3.4 mm (the diameter of the feed

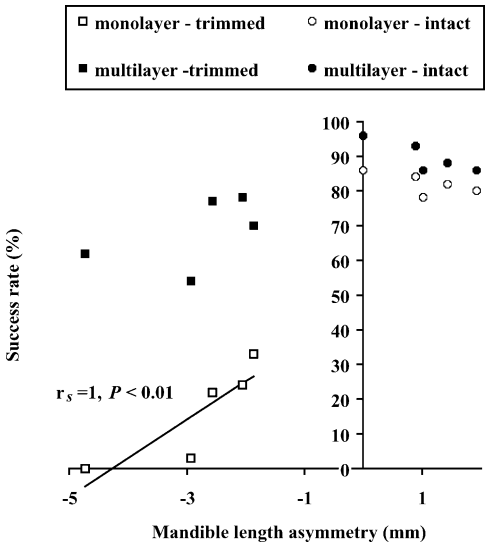

FIGURE 1. Success rate of ingesting feed pellets vs. degree of mandible asymmetry (positive values represent the upper mandible overlapping the lower (intact) and vice versa for negative values (trimmed)). Best-fit line is indicated for the only significant trend and includes the associated Spearman's rank correlation coefficient, r_s.

pellets), and each managed to pick at least a few pellets from the monolayer. For 1 hen, however, the protrusion was greater than 3.4 mm, and this hen failed to pick any pellets from the monolayer. Figure 2 (c and d) shows how an intact hen efficiently performs a similar task.

DISCUSSION

Qualitatively, the reduced efficiency of feed pecking for beak-trimmed hens is similar to that described in other studies [12] who found a 5-fold increase in the number of pecks required to ingest the same quantity of feed pellets presented in a multilayer approximately 12 d after beak trimming. Although they explored the ability of hens before and after trimming to ingest pelleted feeds, they presented only single pellets on a layer of sawdust, rather than the single and multiple layers we tested. Additionally, the birds in this study had not been allowed an opportunity to adapt their feeding technique after trimming. Quantitatively, however, we found a less marked response for the multilayer approximately 8 mo after trimming (68.2 vs. 89.8% of all pecks were successful). The effect of beak trimming on feeding efficiency may decrease with time, either because the trimmed upper mandible regrows [13], or other neurological changes occur, or the bird adapts its pecking behavior. The degree to which a hen can alter her pecking strategy, for example, to account for a damaged or markedly asymmetric beak, is limited by the range of postures allowed by the cervical column [14] and the fixated nature of some elements in the sequence of behaviors comprising a peck [15]. In the case of these hens, the cervical column would not permit a posture that would allow the hens successfully to grasp a feed pellet. The data presented in Figure 1 demonstrate that the degree of trimming has an effect on success rate and also suggests (though not significantly) that overgrown upper mandibles impose a similar constraint. The sequence of events comprising a peck are also similar to those described in an earlier study of feeding by beak-trimmed birds [12], and the pellet manipulation procedure is similar to that described as "glue-and-slide" for the pigeon [16]. Although we did not record handling time, it is likely that this too is affected by the degree of bill asymmetry. In a wild bird species, the starling, [17] handling times are positively correlated with the degree of beak overlap but starlings tune their beak shape depending on their current diet by bill-wiping actions.

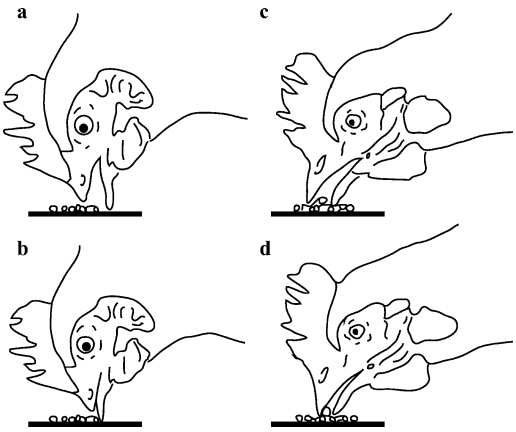

FIGURE 2. Line drawings of gaping and beak closure events for trimmed (a and b) and intact (c and d) hens.

Our findings are novel and useful for 2 main reasons. First, these findings quantify how beak trimming, carried out in a commercially realistic way, can dramatically disrupt feeding behavior and illustrate how this practice handicaps the hens during their interaction with their environment. Although previously published work [18] has

identified that birds of different beak length classes have different feed intakes, our data are the first to demonstrate a quantitative relationship between a beak's over- and underlap and its ability to handle feed items.

The practical consequence of our data is that some feeding systems may be incompatible with beak trimming, particularly those where feed is thinly spread over a hard surface. Producers should be aware that the presence of feed per se does not indicate that hens will have access to it, and feed pellets must be of a sufficient depth within a feed container so that a beak-trimmed hen can maintain an adequate feed intake. Second, in Figure 1 there is a direct relationship between the level of beak trimming and the consequences on feeding efficiency. The consequence of this is that either beak trimming should remove as little of the upper mandible as possible (e.g., by beak tipping). Alternatively and tentatively, the form of full beak trimming, which results in equal shortening of the upper and lower mandible, may have a previously unnoticed benefit on beak-manipulatory efficacy in comparison with the form, which we describe earlier, although practical experiences [19] suggest birds with symmetric beaks may continue to feather peck. It must be reiterated that although the effects presented here on eating efficiency and those described elsewhere may indicate a deleterious effect on the welfare of hens, beak trimming remains an effective solution to ameliorating the trauma of pecking damage. Alternative methods to beak trimming for controlling pecking damage, perhaps through genetic selection [20], are urgently required.

CONCLUSIONS AND APPLICATIONS

1. Beak-trimmed birds show a decreased ability to feed when presented with a thin layer of feed pellets. The effect shows a quantitative relationship with the degree of mandible asymmetry.
2. To minimize the impact of trimming on a bird's behavior and welfare, we suggest that the upper mandible should be trimmed as little as possible.
3. Producers should also be aware that birds with asymmetric bills might not have access to feed if it is presented as a thin layer.

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