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Use of dynamic and rewarding environmental enrichment to alleviate feather pecking in non-cage laying hens

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ABSTRACT

Feather pecking (FP) can cause feather loss, resulting in physical injuries, which may lead to cannibalism. FP appears to be a redirection of foraging behavior, which intensifies when hens have difficulty coping with stress and fear. Dynamic environmental enrichment (EE) may allow expression of natural foraging behavior thus reducing conspecific pecking behavior and alleviating hen injury. Three treatments (plastic box: BOX; hay bale: HAY; and no enrichment: CON) were randomly applied to 30 identical floor pens (10 hens/pen; 10 pens/trt). At the pen level, hen behavior, and the number of severe FP (SFP), gentle FP (GFP), aggressive pecks (AP), and enrichment pecks (EP) were recorded from video prior to (21 wk) and after (24 wk) treatment implementation, and when hens were 27, 32, and 37 wk of age. A manual restraint test (MR) was performed immediately after behavioral observations and levels of blood serotonin (5-HT) and glucocorticoids (GC) measured. Short-term (ST) and long-term (LT) analyses identified the impact of EE over the ST (21 vs. 24 wk of age) and LT (21 vs. all other ages) at the pen level. At the pen level, HAY (3.18 ± 0.33) tended to reduce GFP compared to CON (4.10 ± 0.34) over the ST ($P = 0.15$) and LT ($P = 0.09$), but did not impact the number of SFP, or AP over the ST or LT. More EP was observed in HAY (3.56 ± 0.14) than BOX (1.61 ± 0.18) throughout the study ($P < 0.0001$). More HAY hens perched ($P = 0.05$) at 24 wk (0.28 ± 0.12) compared to 21 wk (0.19 ± 0.11), and more HAY hens (3.69 ± 0.25) performed dust bathing compared to CON (4.14 ± 0.22, $P = 0.05$) throughout the study. CON performed more struggles (1.13 ± 0.04, $P = 0.04$) and were quicker to vocalize (4.87 ± 0.07 s, $P = 0.05$) during MR than HAY (latency to vocalize(s): 5.16 ± 0.05; number of struggles: 0.96 ± 0.05), counter-intuitively suggesting CON were less fearful. Treatment did not affect 5-HT or GC. HAY appears to be a promising EE for mitigating GFP in non-cage laying hens. Future studies should examine the impact of EE on individual, rather than group-level responses. These results suggest that the presence of a hay bale is stimulating and may reduce GFP while encouraging hens to redirect pecking towards a dynamic and manipulable EE.

1. Introduction

Feather pecking (FP) is a common and serious problem for laying hens that can be influenced by multiple factors (e.g., genetics, environment, and rearing experiences). Nicol et al. (2013) indicates that FP can develop as early

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as one day of age, and gentle feather pecking (GFP) and severe feather pecking (SFP) have been observed in up to 94% and 65% of flocks, respectively, at 35 wk. Hens with feather damage have less insulation, and reduced plumage cover has been linked to poor food conversion ratios as bald chickens may need up to 40% more feed to maintain their body temperature (Blokhuis et al., 2007). Since research efforts and genetic selection take time to address problematic FP from an ultimate, internally-driven state, there is a need to identify proximal, effective management practices to alleviate the damage caused by FP in the interim.

Feather pecking appears to be redirected foraging behavior that may be intensified by fear and stress (Rodenburg et al., 2013), and FP possesses characteristics similar to obsessive-compulsive disorders seen in humans and mice (van Zeeland et al., 2009). Different genetic lines of hens have different propensities for developing FP and express different levels of fearfulness and whole blood serotonin (5-HT). Hens selected for divergent levels of mortality due to injurious pecking and tendency to develop FP (Bolhuis et al., 2009; Uitdehaag et al., 2011), have different peripheral levels of 5-HT and behave differently during manual restraint tests (MR). These observations suggest that these differences in FP behavior are mirrored by differences in physiological responses.

Environmental enrichment (EE) has been widely utilized by zoos to provide stimulation to animals unable to fulfill inherent drives due to environmental limitations (Shepherdson et al., 1998). Furthermore, considerable effort has been made to recreate the animal's natural habitat in captive settings that provides a pleasurable aesthetic for visitors while complementing the animal's natural history. This same approach should be made for agricultural animals where environments are not only efficient, but are designed around the animal's biology, including EE (Newberry, 1995; Swaisgood and Shepherdson, 2005). Furthermore, EE should continue to stimulate the performance of natural behaviors over time as animals can quickly become habituated to their presence (Tarou and Bashaw, 2007).

For laying hens in caged environments, EE has been employed to reduce fear and trauma during depopulation of caged hens (Reed et al., 1993), decrease aggressive pecking (Gvaryahu et al., 1994), and increase feeder use (Sherwin, 1995). Even though non-cage hens are provided with more opportunities, they face different challenges than their caged counterparts, and subsequently will need different EE. Successful EE must be both beneficial for the animal and practical for the producer. String has shown to be effective in reducing feather pecking in pen housed hens (Jones et al., 2002). However, these devices require manufacturing and installation by the producer, which could impact profit margins, and is impractical to implement on a commercial scale.

Litter material is an important resource for hens, and litter availability is an important component of basic hen husbandry. Commercial rearing flocks that experienced a lapse in litter availability exhibited an increase in FP and a change 5-HT levels (de Haas et al., 2014) illustrating that hens responded strongly and negatively to litter removal. Non-cage hens housed with access to cut straw or a polystyrene block were observed to perform fewer FP than hens housed with polystyrene pellets or chopped straw (Huber-Eicher and Wechsler, 1998). This highlights the importance of providing an interactive environment in which hens can engage pecking. Such EE would allow them to perform behaviors they are strongly motivated to perform, without harming conspecifics.

Many EE devices have been passive, meaning the bird was responsible for making the EE move or change, and these devices did not change the physical configuration of the room, These EE have included suet holders filled with peanut butter, seeds or cabbage (Dixon et al., 2010), wooden beads, and chrome chain (Jones et al., 2000), or plastic rings with spinning objects hung from the top of the cage (Bell and Adams, 1998). These EE have been unsuccessful in reducing FP, and in one case, unintentionally stimulated the development of FP (Lindberg and Nicol, 1994).

Environmental enrichment can also change the spatial configuration of the room. Changing the hen's space can impact hen perception, alter how they use the space, and may influence the social dynamics. Chickens will use a larger proportion of the pen when provided with vertical barriers (Cornetto and Estevez, 2001), and hens are more likely to use and perform comfort behaviors in areas with cover (Newberry and Shackleton, 1997). Hens are evolved to perch in the branches of a bush, and increasing vertical space by providing a hay bale could stimulate a sense of comfort for the hens similar to what they would seek in the wild.

Our objective was to identify whether the a dynamic and rewarding (meaning the hen received a physical reward for her pecking efforts – in this case a piece of hay) EE (HAY) would reduce conspecific-directed pecking and exhibit a reduces stress response during manual restraint test via corticosterone, 5-HT, and behavior, compared to a plastic box (BOX, similar in size to HAY but static and non-rewarding) or to a negative control (CON). Specifically, we hypothesized that HAY hens would have reduced SFP and GFP, lower stress-induced corticosterone levels, higher 5-HT levels, and would be less fearful during MR than BOX or CON hens. Furthermore, we anticipated that HAY hens would have better feather cover scores than BOX or CON hens. We anticipated that BOX and HAY would have a positive short-term effect on behavior, but only HAY would be long-lasting.

2. Materials and methods

All procedures were approved by the Michigan State University Institutional Animal Care and Use Committee (AUF 04/12-068-00).

2.1. Animals and housing

Thirty identical pens (1.5×2.7 m) were constructed at the Michigan State University Poultry Teaching and Research Center. Pens were separated by floor to ceiling wire mesh, and temperature was regulated with forced heating and fan ventilation. Each pen was furnished with a commercial tube feeder, a water line containing three