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Poultry Welfare: Future Directions and Challenges

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Abstract: The emphasis on poultry welfare has changed dramatically over the past 2 to 3 decades, and as a result, the quality of life of broilers, laying hens, and turkeys has improved. However, some changes may come with unintended consequences. This paper is meant to review two such areas—one in which the direction of the consumer push for a specific change is not completely supported by the scientific literature, and the second in which environmental and economic factors may suffer as a result of the changes. Such areas of change may arise in industry challenges in the future. Perhaps using a balanced approach when considering factors where bird welfare and environmental costs collide—in conjunction with allowing consumers choice over the products they purchase—could offer the industry a more sustainable direction for the future.

Key words: well-being, housing system, slow, growth, sustainability
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Introduction

Consumer concerns and marketplace decisions surrounding poultry management systems have resulted in significant changes, or suggestions of changes, in a number of production practices. Examples include housing systems of laying hens, growth rates of broilers, and many others. The scientific community has rallied around this pressure, providing evidence of the impacts of these changes (positive and/or negative) and attempting to develop improved management skills that will aid in make these changes successful. A quick look at recent scientific literature confirms the significant level of research dollars being directed toward these areas.

In some cases, adoption of these new practices comes with unintended consequences. For example, a large proportion of the scientific evidence examining the welfare impacts of extensive housing systems for hens does not support the conclusion that free-run systems outperform furnished cages in all aspects. Additionally, there may be social responsibilities that should be considered—for example, the impact of alternative practices on environmental consequences. This paper will serve as a literature review in these two particular areas.

Welfare of hens housed in free-run versus furnished systems

Table egg producers in many areas of the world have experienced pressure from the public, commercial retailers, restaurants, and state legislation for the eradication of cage housing systems due to the perceived reduced welfare of caged hens compared to those housed in free-run housing systems. All laying hen housing systems provide feed and water ad libitum, but differences arise in their allowance for the expression of normal behaviors as well as in their ability to provide freedom from discomfort, pain, injury, and disease and freedom from fear and distress (Brambell et al., 1965). Thus, key areas to include in the evaluation of the best housing system for laying hens in terms of welfare are affect and behavior (including aggression), feather pecking and cannibalism, health, and mortality.

Nesting, perching, dustbathing, and foraging have been defined as the 4 behavioral priorities for laying hens (Weeks and Nicol, 2006), and the lack of materials or equipment to allow performance of these can decrease hen welfare due to emotional distress or the emergence of unwanted behaviors, which may at least partially occur in response to this absence. Nesting and perching behaviors are well supported in both furnished cages and free-run systems by the provision of enclosed nest areas and perches (Lay et al., 2011). Furnished cages (which can vary according to manufacturer) generally offer provisions for dustbathing and foraging within the cage system, either through a set space (dustbathing areas) or in the form of small amounts of feed or litter material scattered once to a few times per day on a scratching mat (Hartcher and Jones, 2017). Given the small quantities of material and hens' propensity to forage, the dustbathing/foraging material is often rapidly depleted. Despite this, dustbathing is a common occurrence in furnished cages as hens will sham dustbathe in the wire floor using the dust arising from the feeder as dustbathing material (Olsson and Keeling, 2005). Nonetheless, the incidence of dustbathing tends to be higher and with fewer interruptions in flocks housed in free-run systems (Hartcher and Jones, 2017).

The prevalence of aggressive interactions tends to be maximized at intermediate group sizes and space allowances because of the continuous agonistic interactions to establish a peck order and the requirements for physical space (Al-Rawi and Craig, 1975; Widowski et al., 2016). In groups over 100 hens, in which social discrimination is impossible, aggression typically arises around resources (D'Eath and Keeling, 2003). Feather damage remains low in furnished cage systems, indicating that gentle feather pecking rather than severe feather pecking develops in flocks housed in furnished cages (Sherwin et al., 2010). On the other hand, feather damage caused by feather pecking is greater in cage-free systems (Sherwin et al., 2010), and because the behavior can be learned, in addition to the large group sizes more commonly found in cage-free systems, the prevalence of severe feather pecking can remain high and develop more easily into cannibalism (Hartcher and Jones, 2017). Therefore, mortality due to cannibalism is generally higher in cage-free systems. Similarly, another problematic behavior associated with group size is smothering, which is the suffocation of birds due to the unpredictable crowding of hens in the corner of the housing system (Bright and Johnson, 2011). An assessment of farmers representing 35% of UK free-range egg producers revealed that 56% of the flocks experience smothering, with a resulting average loss of 25.5 birds per incident (Barrett et al., 2014).

Cage-free systems result in an improvement in skeletomuscular strength, which can reduce the incidence of osteoporosis because of the increased level of environmental complexity and hen activity (Hartcher and Jones, 2017). However, due to the lower risk of falls and collisions, hens housed in furnished cages exhibit the lowest number of bone fractures. Due to its anatomical location and the high demand for calcium for egg production, the keel bone of laying hens is prone to injuries (Scholz et al., 2008). A summary of the literature indicates that the incidence of keel bone damage is as high as 90% of the hens (48%–90%) in free-run systems compared to 54% of the hens in cages (25%–54%; Sherwin et al., 2010; Wilkins et al., 2011; Saraiva et al., 2019). Additionally, while hens housed in furnished cages suffer primarily from compression lesions that are less likely to produce pain, the incidence of moderate and severe deviations that are more likely to produce acute and chronic pain increases in free-run systems (Saraiva et al., 2019).

Because of the increased level of contact with feces, hens in free-run systems suffer more from foot pad dermatitis and bumble foot, painful conditions that can impair a hen's ability to walk. On the other hand, hyperkeratosis, which is skin irritation due to the contact with hard floors, is worse in cage-type systems (Blatchford et al., 2016; Yilmaz Dikmen et al., 2016). Eye irritation, inflammation of the mucosa, and infection due to poor air quality are more common in free-run systems (David et al., 2015a; David et al., 2015b). A summary of all the dust levels reported in different laying hen housing systems shows that respirable dust particles (less than 5 μm in diameter) in an aviary system are at least 6 times higher than those found in a furnished cage system (David et al., 2015b). In addition to airborne microorganisms that can cause infection in the respiratory tract (Madelin and Wathes, 1989; David et al., 2015b), many organic dust particles can cause allergic reactions that result in inflammation (Douwes et al., 2003). Another air quality issue frequently found in poultry houses is ammonia (Zhao et al., 2015), which is aversive to chickens particularly at concentrations 25 parts per million (ppm) and over (Anderson et al., 1966; Miles et al., 2006) and can damage villi in the respiratory tract, compounding the negative effects of factors such as dust. David et al. (2015a) summarized ammonia level reports in different laying hen systems. Levels ranged from 0.4 to 47.8 ppm, with free-run systems having on average 7.7 times higher ammonia concentrations than furnished cage systems. Even in well-managed systems (manure removal twice a week) in which ammonia levels were kept low (under 7 ppm), free-run systems had more than double the concentration of ammonia than cage systems (Zhao et al., 2015). Finally, mortality is generally highest for hens housed in free-run systems compared to furnished cages according to a meta-analysis of 10 studies comprising over 3,800 flocks (Weeks et al., 2016). Also, disease caused by bacteria, viruses, and red mites are more commonly found in litter-based systems (Hartcher and Jones, 2017).

In summary, in terms of welfare, a review of the scientific literature has revealed that free-run housing systems offer laying hens the opportunity to express more natural behaviors, resulting in stronger bones. However, they also provide more opportunities for severe feather pecking, cannibalism, and smothering of hens. Similarly, hens housed in free-run systems are more prone to higher incidences of broken bones, foot pad dermatitis, and bumble foot as well as higher mortality and disease levels and lower air quality compared with hens housed in furnished cages, suggesting that in—many respects—furnished cages are superior to free-run housing systems for hen welfare.

Slow-growth versus conventional-growth broilers

The modern conventional broiler grows rapidly with an impressive feed conversion ratio, which has provided food sources for a large portion of the world's population. Whether this rapid growth results in reductions in bird welfare has been a focus of consumers and retailers. By altering growth rate (hence slow-growth broilers), it is thought that birds will have a reduction in leg issues, improved immune function, and a widened and increased behavioral expression compared to faster growing birds, all factors that improve bird well-being. Defining slow growth is difficult, because many welfare assurance programs have their own definitions. For example, Global Animal Partnership differs in maximum growth rate and defines these as a maximum of 68 g per day for Step level 1, 2, and 3 and a maximum of 35 g per day for Step level 5+ (https://globalanimalpartnership.org/wp-content/uploads/2018/04/GAP-Standard-for-Meat-Chickens-v3.1-20180403.pdf).

A significant proportion of the available literature supports these claims, particularly surrounding the behavioral expression component. Bizeray et al. (2000) compared conventional versus slow-growth broilers at 1, 8, 15, and 17 d of age. Their research indicated that activity levels differed as early as 15 d of age, when conventional birds stood less and spent more time lying than slow-growth birds. Bokkers and Koene (2003) also compared conventional versus slow-growth birds at various ages. These authors found a reduction in activity time budgets in the conventional birds, but no differences in resting, dustbathing, preening, stretching, or ground-pecking behavior. These same authors then focused on determining motivational factors in conventional versus slow-growth birds (Bokkers and Koene, 2004). Using feed restriction followed by determining latency to walk and walking bouts to access feed, it was concluded that low-weight broilers walked because they were motivated to do so but that body weight itself of conventional birds limited walking ability. Wallenbeck et al. (2017) also compared behavior of broilers at 2, 6, and 9 wk of age and found that age itself significantly reduced activity levels but that conventional broilers were less active than their same-age slow-growth comparisons. Wilhelmsson et al. (2019) also performed welfare assessments comparing conventional versus slow-growth broilers at 2, 6, and 9 wk of age and reported that the most significant differences occurred after 6 wk of age. Torrey et. al. (2019) compared a conventional broiler strain to 3 slow-growth strains. At days 27, 44, and 56, compared to the conventional breed, the slow-growth birds were more active, with less sitting behavior (63.07% vs. 70.35% of time) and more standing (10.85% vs. 4.63% of time) and walking (4.23% vs. 2.19% of time).

Research has also reported differences in health parameters between conventional versus slow-growth broilers. Julian and Mirsalimi (1992) compared oxygen saturation in light (2,285 g) versus heavy (3,481 g) chickens at 6 wk of age. They reported that saturation levels were higher in light birds. Bokkers and Koene (2003) compared these bird types at 12 wk of age, finding more heart defects, tendon regeneration, scoliosis, and rotated tibia in the conventional birds but more deviated keel bones in the slow-growth birds.

Many of these comparisons have been made with birds of the same age rather than with those at similar body weights. This may confound data and lead to conclusions based on factors other than growth rate, as body weight itself has an impact on behavioral expression regardless of the growth trajectory. However, a currently ongoing study has made comparisons at similar body weights (Torrey et al., 2019) and reported in an abstract that behavioral expression is reduced in the conventional birds compared to slow-growth birds at similar body weights, particularly with respect to the amount of time spent sitting and standing. Fanatico et al. (2008) compared birds at similar body weights and reported improved mobility and reduced mortality levels in slow-growth birds. This information does support the improvement in well-being when growth trajectories are altered, although further studies comparing broilers at the same body weight would be welcomed.

Changing the production schemes fully to slow-growth broilers, however, comes with significant economic cost and environmental consequences, and although these are not always part of the discussion, they likely will be as more emphasis is placed on climate change. Regarding economic consequences, a longer barn turnover time, reduced feed conversion ratio, and increased financial costs for trucking of feedstuffs contribute to a more expensive product for consumers. With respect to environmental costs, contributing factors include the disposal of a larger number of bird mortalities per year; significant increases in feed requirements (which increases land use to provide the feed as well as the carbon footprint to harvest and move feed to mill and to farm), water requirements, and land base requirements; increase in mass of manure to dispose of; etc.; all of which will surely conflict with the pressure to alter climate change—this discussion will likely occur in the near future.

Conclusions

These are examples of directions of change that are occurring in the management of commercial broilers, turkeys, or laying hens and represent where the immediate future of poultry welfare is.

With respect to laying hen housing, science has confirmed that welfare in conventional cage systems is compromised, but the decision for the direction of alternative housing systems is not clear. In Canada, the development of the Codes of Practice for the Care and Handling of Pullets and Laying Hens (National Farm Animal Care Council, 2017), along with the Egg Farmers of Canada, requires producers to switch to either a furnished cage system or a cage-free system for all commercial production. This document is a “science-informed” document and will provide consumers a choice when purchasing eggs. This certainly could be considered to be a balanced approach to improvements in hen welfare.

With respect to altering growth rates in broilers, the challenge with moving forward differs from the hen example. The threat of climate change frightens a significant proportion of the world, and undoubtedly, a move to slow-growth broilers requires more resources and will create a dramatic increase in carbon footprint compared to conventional broiler production. Perhaps a balanced approach here, then, is to once again allow choice for consumers, as well as allow market differentiation for companies wishing to provide one or the other.

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