Research summary

Impact of alternative housing systems on layer health and egg production

About the study

As Canadian egg farmers undertake a sector-wide transition to phase out conventional housing systems, a number of questions have emerged. Dr. Martine Boulianne, Chair in Poultry Research at Université de Montréal, teamed up with Dr. Stéphane Godbout from the Institut de recherche et de développement en agro-environnement (IRDA) and Dr. Caroline Duchaine from Université Laval to assess the trade-offs between enriched colony housing and free run aviary systems. The research team specifically sought to assess outcomes in the areas of bird health and egg production.

In enriched colony housing, sometimes referred to as furnished or colony housing, hens live in small to medium groups (approximately 20 to 60 birds) in systems that feature amenities like nest boxes and more square footage per bird, giving them extra space to stretch, perch and spread their wings. In aviary systems (a free run operating system with multi-tiers), hens live in a large group, roaming inside the barn where they can also perch, scratch and lay eggs in nest boxes. Hens in aviary systems have additional square footage per bird and the ability to dustbathe and move vertically.

Methods

Birds from 12 commercial aviaries and 12 commercial enriched colony houses from Ontario and Quebec were selected for this study which spanned a four-year period (2017 to 2021). Weekly laying rate, cumulative mortality, feed consumption and hen weight were assessed between 19 and 65 weeks of age while egg quality was measured during four time periods set at 35, 45, 55 and 65 weeks of age during the laying cycle. A sample of birds were individually examined and scored for health and welfare parameters every four weeks from 19 to 35 weeks and then at weeks 45, 55 and 65. Fecal samples collected on a weekly basis and 10 mortalities were submitted every month for the research team to determine the causes of death and test for the presence of pathogens such as *Escherichia coli*, coccidia and *Clostridium perfringens* in feces.

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Indicators such as airborne dust and bioaerosol concentrations, gas concentrations, air flow, temperature, humidity were also measured at all 24 operations at every visit to determine the influence of each housing system on air quality.

Findings

The two housing types considered in this study demonstrated similar hen performance and egg quality parameters. However, the researchers noted that the age of hens influenced all parameters studied except for prevalence of dirty eggs. In both housing types, the Haugh unit (a measure of the egg protein quality) and shell strength were highest at early in lay and decreased as the hens aged. Similarly, shell strength and yolk color intensity also gradually decreased with hens' age after the second sampling period. The opposite was seen for egg weight, laying rate, feed consumption and body weight, all of which increased as the hens aged. While these differences related to age are not new findings, they indicate that both housing systems can perform equally when it comes to egg production. It should also be noted that, in addition to age, factors such as genetics, nutrition, health or management have been identified by literature as other factors with influence on egg production.

It is of interest to note that the cumulative mortality in aviaries increased faster with hens' age compared to enriched systems. Mortality was mostly caused by *E. coli* infections. Surprisingly, the majority of the *E. coli* strains isolated from the lesions were non-pathogenic according to current classification schemes. Researchers partially attributed higher mortality in aviaries to necrotic enteritis (caused by *Clostridium perfringens*) shortly after placement. However, as hens aged, they appeared to have developed an immunity to *Eimeria*, the agent causing coccidiosis, indicated by decreased oocysts counts with age. Preventing coccidiosis is critical to preventing necrotic enteritis. Researchers recommend use of vaccines for both coccidiosis and necrotic enteritis to prevent these diseases in pullets to be placed in aviaries. It is important to note that vaccination might be warranted in enriched colonies as well since *Eimeria* was also found in these systems.

Hens housed in aviaries displayed more keel bone fractures likely due to falls and collisions with housing structures that occur as birds move between tiers or perches and more footpad dermatitis due to litter quality. Feather coverage was similar between the two systems.

In contrast to other parameters assessed during this study, environmental conditions varied between the two housing types. Aviaries presented higher dust, airborne bacteria and endotoxin concentrations, as well as higher ammonia levels compared to enriched colony housing. Researchers attributed these differences to the presence of litter on the ground of aviary systems and access to litter and birds scratching it. More than 50% of visits carried out in aviaries between October and April exceeded 25 ppm of ammonia (Occupational Safety and Health Administration recommended limit). The researchers also found, in the winter months, certain greenhouse gas concentrations (carbon dioxide and methane) to be higher compared to warmer months in both enriched and aviary systems. These findings stress the importance of developing and implementing mitigation strategies to improve air quality especially in aviaries but also for all housing systems during the cold season for both the hens and the workers' health.

Conclusions

The findings from this study add to an extensive body of evidence that demonstrate each housing system offers advantages and trade-offs for hens' health and welfare, and the quality of the barn environment. As Canadian egg farmers are in the midst of transitioning to alternative housing systems, this study provides them with information to help assess which housing system is best suited for their operation and highlights that further research can identify mitigation measures and practices that help optimize both systems.

About the researchers

Dr. Martine Boulianne is a professor and holds the Chair in Poultry Research at Université de Montréal.

Dr. Stéphane Godbout is a research engineer at IRDA and an associate professor at Université Laval's Department of Soils and Agri-Food Engineering.

Dr. Caroline Duchaine is a professor at Université Laval in the Department of Biochemistry, Microbiology and Bioinformatics.

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