PhD Project Advertisement

Project title: Healthy hen or happy hen? Disease-welfare trade-offs in extensive poultry systems
Project No: FBS2022-49-Morgan-qa

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Project description:

Change in poultry production systems from highly intensive, e.g. caged laying hens and mass indoor broiler rearing, towards more extensive or free-range systems is accelerating, driven by consumer concerns over animal welfare. Consumers, however, are generally unaware that intensification brought significant benefits for disease control through biosecurity and breaking transmission cycles. Moving to extensive systems risks reversing those benefits, leading to different welfare problems including from disease and increased antimicrobial use. While possible in principle to optimize such health-welfare trade-offs, this is not currently feasible because the link between extensification and disease risk is poorly characterized, and because optimization implies a common currency that does not yet exist. Welfare indicators based on behavioral freedoms or a 'life worth living', including freedom from pain, have diverged from the widely acknowledged but poorly measured welfare consequences of poor health due to infectious diseases. This dissonance must be reconciled to design systems that deliver good health and good welfare together. Moreover, the abatement of disease in extensive systems by means other than increased antimicrobial use requires creative new solutions, which if successful could simultaneously support health and welfare.

We hypothesise that:

- Birds in extensive poultry systems experience higher levels of infection with environmentally transmitted parasites;
- These parasites are associated with poor health and production outcomes;
- Health and other welfare indicators can be combined into a meaningful single currency for optimization across dimensions;
- Modification of extensive systems can achieve improved health without compromising on other welfare, maximizing benefits of extensification.

Work plan:

Sample parasite infections and host status across intensive-extensive gradient

Laying hen and broiler farmers will be recruited spanning intensive, commercial extensive and smallholder flocks with a variety of housing systems. Details of housing system, antimicrobial (including anticoccidial and anthelmintic) usage and health problems will be collected by questionnaire and semi-structured interview. The student will visit a subset of farms chosen along an intensive-extensive gradient to sample faeces and, where available under normal farm management (slaughter or culling), carcases for post mortem assessment of parasite and pathogen burdens. Next generation sequencing will be used to measure pathogen diversity from faeces. Performance metrics including growth rates and egg yield and quality will be collected at flock and, where possible, individual bird levels; with welfare benchmark indicators. Data will be analysed using generalized linear mixed models, to characterize correlations between housing system and the load and diversity of parasites and pathogens, to address the first hypotheses.

Develop and apply precision interventions to attenuate infection risk in extensive settings

Population dynamic models will be developed for the major macro and microparasite species found, to include ascarid worms, coccidia and key bacterial species, using established SIR mathematical frameworks but using Netlogo software to add explicit consideration of housing space (indoor and outdoor) and hence variation in host density and contact rates through spatial clustering. The models will be used to evaluate the impact of refinements to housing on parasite transmission. Selected interventions will be trialed in participating extensive flocks experiencing disease problems and impact on infection, performance and welfare measured.

Combine welfare metrics and evaluate consequences of system change and interventions

Individual welfare indicators will be compared across production systems and interviews (of producers, health advisors and the public) on perceptions of welfare and disease impacts used to derive a novel 'disease welfare' indicator. Metrics will be applied across farms to determine whether outcomes might be optimized differently using different index combinations, and how precision disease interventions can support greater improvements in overall welfare in extensive systems.

Training opportunities:

The student will receive training in:

- Epidemiological study design and data analysis
- Parasitological sampling and laboratory methods including from faeces and post mortem
- Parasite and pathogen identification, including using next generation sequencing
- Bioinformatics and data reduction techniques for capturing pathogen diversity
- Animal welfare assessment indicators
- On-farm evaluation of health and welfare
- Mechanistic computer modelling of parasite transmission and associated software
- Intervention design and trialing
- Farmer and stakeholder communication

These training opportunities will be delivered mainly at QUB, in the new Biological Sciences building that houses state-of-the-art parasitology laboratories and a strong and vibrant research group comprising 8xPhD, 1x technician and 4x PDRA. Additional connections to co-supervisors afford opportunities for deepening knowledge in welfare science and next-generation sequencing and its applications both within the project and more broadly.

High level of industry relevance and the fundamental place of the on-farm sampling, contact with stakeholders is inherent to the project. The student will be encouraged from the start to co-produce details of the work with both producers and consumers. This initial contact will form the basis for formal involvement of stakeholders at key decision points throughout the project, and to secure a placement that showcases opportunities for industry employment outside academia.

Student profile:

Interest in animal health and welfare and FoodBioSystems aims and challenges, some background in biological sciences.

References:

[1] DalBosco 2021,Animals,11,1281,doi10.3390/ani11051281;

[2] Saraiva 2021,BrazilianJ.PoultrySci.23,1337,doi10.1590/1806-9061-2020-1337;

[3] Widowski 2016,PoultrySci.J.72,doi10.1017/S0043933916000027;

[4] Rawson 2020,FrontiersMicrobiol.11,576646,doi10.3389/fmicb.2020.576646

Funding particulars:

For up to date information on funding eligibility, studentship rates and part time registration, please visit the FoodBioSystems website.