Ecosystem Health and Sustainable Agriculture

Sustainable Agriculture

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Introduction

The world is populated with vast numbers of domesticated birds collectively known as poultry including, at any one time, over 16 billion broiler chickens raised for meat, 5 billion laying hens raised for egg production, a quarter of a billion turkeys, and lesser numbers of ducks, geese, quail, pheasants, guinea fowl, and various species of ratte. The world market for poultry is growing, with the highest production currently occurring in the USA, China and Brazil. From an evolutionary perspective, close association with humans has made the domestic fowl *Gallus gallus domesticus* (comprising broiler chickens and laying hens), the most abundant and thus most successful of all birds.

Human survival depends upon consumption of nutrients obtained from other species, be they from poultry or other animal or plant prey. Due to intense genetic selection, housing and management, poultry products are relatively cheap, plentiful and appetising sources of nutrients to meet our needs. Nevertheless, there are some externalities associated with this massive success in human-poultry mutualism that are difficult to condense into numbers in an economic analysis but nevertheless need to be considered in evaluating the sustainability of poultry production practices. These include:

- Environmental pollutants emanating from poultry facilities, such as ammonia
- Carbon footprint for poultry production
- Use of land and energy/protein sources to produce poultry rather than other crops, or as a bioreserve
- Poultry acting as vectors of diseases (e.g. avian influenza) to humans and other animals, including endangered species
- Occupational hazards related to working at poultry farms, hatcheries and poultry processing plants
- Use of antibiotics to enhance poultry production, contributing to the development of antibiotic resistance
- Human obesity and associated health problems, as a consequence of over-consumption of readily available, low-cost food products including poultry
- Impacts on poultry well-being – the focus of the current article.

The ethic of animal care leads us to strive to keep animals in a manner that minimises suffering and contributes to a positive sense of well-being. Although it may be easier for us to care about sheep and cows than chickens and turkeys, we should remember that birds have a highly developed nervous system that is, essentially, homologous to that of mammals. Their small brains and seemingly expressionless faces should not be construed as evidence of a lack of thoughts and feelings.
Evolution has prepared birds to cope with the vagaries of the natural environment in a flexible manner through learning and subsequent recall; learning that is made salient by association of events with sensations such as pain, fear and separation distress. Based on evidence from brain and behaviour research, we can infer that birds have the ability to experience both positive and negative feelings, and to use memories of specific sensations occurring in specific situations as a foundation for future behaviour. Although domestication has altered the thresholds for expression of some behaviours, poultry species still retain the same basic behavioural repertoires of their wild relatives.

This knowledge leads us to reflect upon the impact of current commercial production systems on poultry well-being. The following discussion identifies the issues surrounding some controversial housing and management practices. As we shall see, scientific knowledge can inform decisions but value judgements are also involved when weighing up the relative merits of different options.

**Induced Moulting**

Let us start by considering the controversial practice of induced (forced) moulting of laying hens, whereby moulting is induced through feed withdrawal for up to two weeks. Egg producers have argued that this is an appropriate practice since birds moult in nature. Induced moulting is conducted after hens have been laying eggs at a high rate for approximately one year, and has the benefit of rapidly rejuvenating the bird, leading to improved hen survival rates, egg production and egg shell quality during a subsequent laying period. These benefits to subsequent health depend upon the hen losing abdominal fat that has accumulated over the lying cycle.

On the other hand, research assessing the level of motivation to eat during moulting indicates that these benefits come at a cost to the birds of strong hunger during the initial period of feed withdrawal, followed by fatigue and depressed behaviour. If weight loss is too great, feed withdrawal can lead to anorexia and death. Under commercial conditions, where the ratio of birds to caretakers is high, weight loss is monitored based on sampling of a proportion of birds rather than close monitoring of each individual bird. As a consequence, birds that are lighter than average at the start of moulting have an elevated risk of dying during the feed withdrawal period.

One can, therefore, contemplate whether it would be better from an animal welfare perspective to terminate the lives of the hens at the end of the first production cycle, when their egg production rate and egg shell quality have declined to uneconomic levels, than to subject them to a moult. Fortunately, research has shown that it is economically feasible to moult hens under commercial conditions by feeding them low nutrient feedstuffs such as wheat middlings or low sodium diets instead of withdrawing feed completely for 14 days. Producers can thus obtain the benefits of moulting on post-moult health and productivity without severe adverse consequences for the birds during the moulting process.

The complete feed withdrawal moulting procedure has therefore been outlawed in the European Union and, more recently, abandoned in the US through industry adoption of voluntary animal care standards. This approach to solving the animal welfare concerns surrounding induced moulting means that the same number of eggs can be produced with fewer hens than would be needed if flocks were terminated after a single laying cycle and extra pullets had to be raised to replace the flock every year. It also avoids the environmental impact associated with housing, feeding and disposing of manure from additional pullets.

The story does not end here, however. We always face the difficulty of deciding how far we should go towards accommodating poultry well-being. Although the use of low nutrient moulting diets enables birds to fill their gut and provides birds with an outlet for foraging behaviour, these diets do not appear to create a pleasant feeling of satiety, and may promote increased aggression in lines of poultry predisposed towards aggressive behaviour. Use of certain pharmacological appetite suppressants may be more humane than feeding low nutrient feedstuffs, thereby reducing feed inputs and manure outputs, but this approach would not be acceptable to consumers concerned about the naturalness of their food. For increased sustainability, we should also be considering increasing the longevity of hens beyond two laying cycles, even if this can only be achieved by reducing the hens’ rate of egg production per cycle.
Problems Associated with Rapid Growth

Weight control is also relevant to the production of broiler chickens and turkeys being raised for breeding purposes rather than for meat production. Genetic selection and management of broilers and turkeys for rapid growth comes at a cost of increased risk for heart attacks and leg deformities that make walking painful, while the prodigious appetite of these birds necessitates continual feed restriction of parent breeding stock to facilitate survival and reproduction. This long-term feed restriction results in hunger and can lead over time to the development of oral stereotypies such as spot pecking. Poultry breeding companies are now applying increased selection pressure against cardiovascular and skeletomuscular problems in these birds, primarily by selecting for somewhat slower growth during early development. The health of broilers and turkeys can also be improved by using short daylengths to limit early growth rate, and hunger in feed restricted breeders can be alleviated to some extent by feeding high-fibre diets.

Bone Fractures

Genetic selection of laying hens for high egg production can also create welfare concerns if insufficient emphasis is placed on concurrent selection for bone strength. The consequence is hens that tend to have fragile bones at the end of lay. This is a problem when hens are caught for transport to a processing plant because they can acquire painful bone fractures when handled. A related problem is that few poultry plants are interested in processing meat from hens, due in part to concerns about food safety created by bone fragments in meat as a result of bone fractures. As a result, hens may face long transportation distances to slaughter, facing an elevated risk of dying in transit.

Due to difficulties in marketing end-of-lay hens in the US, they are increasingly killed on the farm using carbon dioxide gas. Because the hens are killed almost immediately following catching, the duration of suffering from any bone fractures sustained during catching is brief. However, the carcasses must then be disposed of by rendering, incineration or composting, which is wasteful of a potential human food source.

Hen bones are more fragile when hens get little exercise due to confinement in cages. However, the risk of bone breakage in caged hens is low until they are handled at the end of lay. By contrast, although uncaged hens in avaries and free range systems have stronger bones, they nevertheless can have high rates of keel bone fracture during the laying cycle, possibly due to crash landings and collisions. In either case, broken bones represent a serious animal welfare concern. Fortunately, it is possible to reduce the risk of fractures through improved housing design and gentler handling methods, and to increase bone strength through increased selection pressure for this trait (Figure 46.1). A question is how much to favour bone strength through genetic selection if this benefit comes at a cost of reduced egg production, thereby increasing the number of hens that must be kept to obtain the same number of eggs.

Figure 46.1. (a) Laying hens must be handled carefully to avoid bone fractures; (b) Fractured keel bone; (c) Housing must be designed to minimise the risk of bone fractures when hens move between locations. Photo: R. Newberry.
Cannibalism
Cannibalism and feather pecking are pervasive welfare problems in poultry (Figure 46.2). The incidence is sometimes very high in hens with intact beaks, especially when hens are kept in large groups and even a single cannibalistic bird has access to many potential victims. In addition to causing welfare problems, feather pecking results in denuded birds that need to eat more feed to stay warm. Beak trimming is a minor surgical procedure used to control these behaviours. Beak trimming also makes manipulation of feed more difficult, resulting in less feed being thrown on the floor and wasted. Beak trimming is, however, a painful procedure and may reduce the ability of hens to remove parasitic mites through preening.

Beak trimming has been banned in Sweden, and some other countries are considering a similar ban. As a result, producers must use management techniques that reduce the risk of cannibalism such as rearing pullets with perches, which increases the likelihood that they will use the nest boxes for egg laying as adults. There is also increased demand for hens of genetic lines in which strong selection pressure has been applied to reduce cannibalistic tendencies. Nevertheless, the debate about beak trimming continues because, if properly done, it is reliably effective in minimising the risk of cannibalism, whereas cannibalism can otherwise emerge unpredictably. An alternative approach might be to permit beak trimming but find effective methods for controlling the pain from the procedure.

Behavioural Restriction
Probably the most hotly debated issue concerning the welfare of poultry is the behavioural restriction that results from the housing of laying hens in unfurnished cages. The European Union is phasing out the use of conventional cage housing systems for laying hens by 2012 by requiring that hens be provided with a nest, perch and foraging/dust bathing substrate. The intention is that these enrichments, whether provided in furnished cages or in aviaries, pens with litter and slatted areas, or free range systems, allow hens to perform more natural behaviour (Figure 46.3). In the US, animal advocacy groups are pressing for legislation to ban the use of cage housing systems where hens are unable to spread their wings without touching cage walls or other birds. In addition, there is increasing consumer demand for eggs from non-cage systems and especially free range systems, and consumers are showing a willingness to pay more for poultry products with some form of humane certification. Although increased behavioural freedom is a laudable goal, it is not a simple matter to define and implement welfare standards for non-cage housing that produce an overall net benefit for poultry welfare while at the same time being sustainable in other ways.

For example, what constitutes an adequate perch for a hen (Figure 46.4)? Should a rod a few centimetres off the cage floor count as a perch? It would help to increase leg bone strength but do hens feel safer as a result of sitting on such perches? This may be the case at night when it is dark but not in the daytime when there is an increased risk of being cannibalised while sitting on low perches. What
if higher perches are required, resulting in birds that are calmer and safer from cannibalism but with an increased incidence of keel bone fractures as a result of crash landings when jumping off perches? If a slatted floor allows birds to wrap their feet around the slats, should the slatted area be counted as perch space? What if birds do not use the perches that are provided to meet an auditing requirement? This may occur if perches are specified in legal requirements for the housing of adults only and the birds are not given the opportunity to obtain early experience in the use of perches. Genetic background and body weight can also influence propensity to use perches. Furthermore, depending on their design and placement, perches can affect the use of nest boxes, the frequency of cracked eggs, the ease of keeping the facilities clean, the likelihood of faeces falling on birds below, the risk of foot lesions, and a host of other interrelated factors. As a consequence, a simple decision to require that hens be provided with perches to enable natural behaviour turns out to have many implications, depending upon how the requirement is implemented and audited.

Similar questions can be asked about appropriate substrates for promoting foraging, exploration and dust bathing behaviour, the amount of space that should be covered with these substrates, and the amount of time that they should be available to the birds. Porous floors allow faeces to fall through and be separated from the birds, thereby reducing the risk of faeces-born pathogens.
and parasites. When a particulate substrate is provided, it must be managed carefully to avoid problems with ammonia, dust and painful foot pad dermatitis.

Access to free range can potentially provide the greatest degree of environmental enrichment for the birds, especially when there is woodland cover that provides a sense of security relative to open space. However, it also comes with risks such as predators, soil-borne parasites, and exposure to wildlife providing potential for disease transmission. In addition, manure must be managed to avoid environmental pollution. Products from such systems are more expensive due to greater land use, higher feed consumption, and sometimes higher mortality. Nevertheless, it is likely that the future will bring increased consumer demand for pasture-based production systems and use of less productive but more robust breeds of poultry.

**Conclusions**

The health and well-being of poultry in different housing and management systems can range from good to poor depending on the genetic stock used, previous rearing conditions of the birds, specifics of the housing design and management, and husbandry skills and empathy of poultry caretakers. Sustainable solutions are needed that promote poultry health and well-being while at the same time maintaining the affordability and safety of poultry products, ensuring worker safety, and avoiding wastefulness and damage to the environment. Ethical review of poultry production practices incorporating the latest scientific knowledge and taking into account the hierarchy of public values can help to identify improvements and avoid unanticipated adverse consequences for both people and poultry.
References

Chapter 47


Further reading


Recommended Reading


Humane Slaughter Association, website: http://www.hsa.org.uk
