A review of poultry welfare in conventional production system

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Summary

The conventional production systems have the potential to influence poultry welfare in both positive and negative ways. The battery cage for egg-laying hens is perhaps the oldest of the intensive animal farming systems still in widespread use today. However, the concern regarding conventional cages is that behavioral restriction is inherent to the system and hens are prevented from expressing highly motivated behaviors for their entire laying lifespan. Non-cage systems enable the expression of a more diverse array of ancestral behavior patterns, with the greatest behavioral diversity occurring in free-range systems. Moreover, osteoporosis and bone fracture due to genetic improvement for high egg production has serious animal welfare implications in commercial layer flocks. Increasing the stocking density of broiler operations is a way in which producers can increase their return on investment. They do increase their risk levels as well, as the consequences of high stocking density may lead to increasing health problems and reduced livability. Due in part to genetic selection for unnaturally fast growth, muscle outpaces bone development during the early life of poultry, leading to problems with skeletal weakness. As a result, broilers often suffer from leg deformities and lameness. Leg disorders, besides being a matter of great concern from the welfare standpoint, also cause poor feed conversion, culling and high mortality of the poultry resulting in direct financial loss for producers. The major diseases with welfare implications ascites and sudden death syndrome and these have been exacerbated by intense selection for fast growth rate and increased feed efficiency. There is an increased mortality associated with faster growth rates whereas slower growth rates have a lower mortality. Genetic progress creates management and nutritional challenges that confront producers because broilers and broiler breeder flocks are less tolerant to management and disease problems than they were years ago. A number of diseases which are related to undesirable changes in metabolism are also increasingly threatening the health and welfare of poultry. Progress can be made in reducing and eliminating poultry welfare by genetic means and also by alteration of husbandry practices.

Key words: *broilers, egg, growth, layer hens*

Introduction

The poultry sector is one of the most rapidly growing livestock sectors worldwide. The poultry industry consists of two major elements, the egg industry and the poultry meat industry. In the former, the majority of birds are reared in cages housed in large commercial units. However, there is an increasing interest of free-range and open-barn systems. In the poultry meat industry, the birds are raised entirely on deep litter in large sheds (Duncan 2001, Glatz et al 2009). Over the past several decades improved poultry production systems have contributed to significantly enhanced performance traits like egg production and growth rate and economical production of poultry products. However, the poultry industry is also increasingly being challenged to address consumer and general public concerns about animal welfare. The commercial applications in agriculture of new breeding technologies, as well as conventional breeding strategies, have the potential to influence animal welfare in both positive and negative ways (Clark et al 2006).

Animal welfare is a controversial topic in modern animal agriculture because of a discrepancy of opinions regarding how animals should be maintained and treated. Part of the controversy over farm animal welfare issues is related to an apparent conflict of interest, as some management practices that increase farm profitability may negatively impact welfare (e.g. increased stocking density, beak trimming, toe clipping) (Estevez 2002). Animal welfare in commercial poultry production is an important topic particularly in Europe. In other parts of the world too, there is an increasing focus on farm animal welfare. In some countries this interest is only driven by export opportunities for poultry meat, especially to Europe. At the same time, increasing requirements pose a possible threat to the market position of meat not produced under upgraded animal welfare standards or without the guarantee that it was produced under such standards. This could be protection by means of import tariffs or other instruments for border protection (Van Horne and Achterbosch 2008). To optimize poultry welfare, it is essential that important welfare problems in the poultry industry should be well defined. Therefore, the aim of this review paper is to describe poultry welfare problems and how they have arisen in conventional production system.

Welfare of poultry

Animal welfare is a “state” (Broom 1991) that encompasses many complex aspects of the animals and includes biological, psychological, and ethical components. The achievement of high standards of animal welfare requires awareness of animal needs and both caring and careful efforts on the part of all that are involved in the supervision of farmed animals. General guidelines as to what those who use animals should provide in order to avoid suffering and other harms are contained in the five freedoms (Gade 2002, Clark et al 2006):

- Freedom from hunger and thirst, by ready access to fresh water and a diet to maintain full health and vigour;
- Freedom from discomfort, by providing an appropriate environment including shelter and a comfortable resting area;
- Freedom from pain, injury and disease, by prevention or rapid diagnosis and treatment;
- Freedom to express normal behaviour, by providing sufficient space, proper facilities and company of the animal’s own kind and;
- Freedom from fear and distress, by ensuring conditions and treatment which avoid mental suffering.
- Welfare of Layer Hens in Conventional Production System

Conventional battery cages

The conventional cage production system is still the predominant system worldwide for housing laying hens. Laying hens are typically kept to about 72 weeks of age, producing approximately 300 eggs per hen. The use of battery cages to house layer hens has stimulated considerable controversy. The cages promote hygiene, facilitate management and limit group size, thereby reducing aggressive and cannibalistic behaviour (Abrahammson and Tauson 1995) and therefore it is widely acknowledged that housing layer hens in battery cages positively impacts hen welfare. Despite the fact that there are some advantages of conventional cages in terms of health and welfare, these are now generally considered to be outweighed by the disadvantages, principally the barren environment, lack of a separate nesting area and substrate, restrictions on behaviour, and production syndromes such as osteoporosis, leading to poor bone strength and possible fractures (Duncan 2001, FAWC 2007).

The welfare of laying hens raised in standard commercial cages has been placed under intense scrutiny. However, ethical concern about the degree of restriction of the hens’ behavior and movement in conventional cages has led to an increasing movement towards alternative systems. Some of this is driven by consumer purchasing preferences, and some by legislation (Mench et al 2009, Tactacan et al 2009). With the impending ban of battery cages in Europe in 2012, substantial effort has been expended to find an alternative housing system for laying hens. As a result, in Europe a greater proportion of laying hens are housed in non-cage systems compared to the rest of the world (Janczak and Riber 2015). However, conventional cages in most parts of United States and Canada are still legal, efforts have been made to find a better system for housing hens (Tactacan et al 2009).

Lack of exercise

Many of the welfare problems in cages are inherent in the system. Standard battery cages are usually so small that a caged hen is physically unable to stretch her wings fully. The highly restrictive and barren nature of the battery cage prevents hens from exhibiting most normal patterns of behaviour, such as foraging, dust-bathing, nesting and exercising. This has a detrimental impact on their welfare and can lead to abnormal behaviour (Lymbery 1997, Pickett 2007).

In addition, inhibiting exercise leads to the development of bone weakness in caged hens. A recent study found bone fragility to the point where birds were experiencing bone breakages whilst still in their cages. This condition was responsible for more than a third of all mortalities in the caged layers studied (McCoy et al 1996). Denying hens exercise can also lead to a disease known as Fatty Liver Haemorrhagic Syndrome, in which hens die from a ruptured liver (SVC 1996).

Feather pecking and beak trimming

Feather pecking can be a major welfare problem in laying hens and can occur both in cages and non-cage systems. Feather pecking can be gentle or severe. Severe feather pecking can cause feather damage and result in denuded areas; if pecking of these denuded areas continues it can lead to wounding and the development of cannibalism. Cannibalism can also result from vent pecking. Hens are often beak trimmed to reduce the risk of welfare problems caused by feather pecking and cannibalism.

Beak trimming is a serious mutilation of poultry, which involves using a red-hot blade or an infra-red beam to amputate up to a third of the birds’ beak. Laying hens are often beak trimmed to reduce the risk of welfare problems caused by feather pecking and cannibalism. This might cause both acute and

chronic pain due to tissue damage and nerve injury, loss of normal function due to reduced ability to sense materials with the beak and loss of integrity of a living animal (Pickett 2007, Pickett 2008, Janczak and Riber 2015).

Scientific evidence and practical experience demonstrate that feather pecking and cannibalism can be controlled without beak trimming through the use of appropriate strains to reduce the hens' propensity to feather peck and good farm system design and management (CIWF 2010). Hens have a strong preference for a littered floor for pecking, scratching and dust bathing. When litter is provided it should be maintained in a friable condition. The provision of litter can reduce the risk of feather pecking (Huber-Eicher and Sebö 2001).

High rate of egg production

All laying hens are also at high risk from sustaining fractures both during the laying period and at depopulation. There is evidence that both these problems are associated with genetic selection for high productivity (Ferrante 2009).

Osteoporesis and bone fractures

The high rate of egg production in modern laying hens puts enormous demands on the birds' calcium reserves, leading to osteoporosis and a high risk of bone fractures (Pickett 2007). It is clear that commercial laying hens are susceptible to structural bone osteoporosis due to their high sustained rates of egg production. It is also clear that osteoporosis can be made worse by insufficient intake of minerals essential for bone or eggshell formation or of nutrients essential for bone metabolism (Webster 2004). Bone weakness in laying hens mainly results from osteoporosis. This is a pathological condition, which is associated with progressive loss of structural bone throughout lay, thereby rendering bones fragile and susceptible to fracture. In severe cases, it can lead to collapse of spinal bone and paralysis (Webster 2004, FAWC 2010).

Hens producing eggs at a high rate were most susceptible to the disease. Cage layer fatigue was associated with osteoporosis and bone brittleness. Severe osteoporosis leads to spontaneous bone fractures commonly in the costochondral junctions of the ribs, the keel, and the thoracic vertebrae. Vertebral fracture may damage the spinal cord and cause paralysis. Osteoporosis appears to be inevitable in highly productive caged laying hens. The condition can be made worse by metabolic deficiency of calcium, phosphorus, or vitamin D (Webster 2004).

Osteoporosis and bone fractures were recognised as welfare concerns soon after cages were introduced over 50 years ago, but it was some time before it was established that osteoporosis was related to the restriction of movement and lack of exercise (FAWC 2010). Inactivity contributes to bone loss, so the severity of osteoporosis is increased if hens are kept in cage systems where their movement is restricted. Even with selection to improve bone strength, the limited space in cages means that birds are unable to exercise to maintain bone strength. Non-cage systems provide birds with much greater freedom of movement and opportunities for exercise (Pickett 2007). Hens in housing systems that promote physical activity tend to have less osteoporosis and rarely manifest cage layer fatigue. Genetic selection may also produce laying hens that are less prone to bone weakness (Webster 2004).

Welfare of broilers in conventional production system

Broilers are those reared for meat production. Historically, poultry were kept for a few years for egg production, and then eaten at the end of their useful laying life. However, from the mid twentieth century birds began to be selected either for laying high numbers of eggs, or for producing greater muscle mass (and thus meat) (Scheele 1997, Weeks et al 2000, Hall and Sandilands 2006, EFSA 2010). As global meat consumption continues to rise and consumers show ever more interest in the origin of their food, maintenance of the welfare of production animals has never before been so important (Decuypere et al 2010). Poultry raised for meat are the most numerous of any land animal farmed in the world. For instance, in a single year in the United States, more than 8.5 billion poultry, termed "broilers" by industry, are slaughtered for human consumption (USDA 2013).

Stocking density/Overcrowding

Stocking density, the number of birds per unit of floor space, indicates the level at which the animals are crowded together in a grow-out house. The domestic poultry, whether selected for meat (broilers) or egg production (layers) live in social groups organized in a hierarchical system. Within a dominance hierarchy, dominant individuals have priority of access to food, water and other valuable resources. Subordinates, on the contrary, give priority of access to dominants with minimum aggressive interactions (Estevez 2002). Lack of adequate space can have negative consequences on the health, behavior and physiology of broilers. High stocking density in broiler sheds restricts the broilers' behaviour and causes health problems. It leads to increases in lameness, breast blisters, foot-pad

dermatitis, hock burns and infections. Crowded broiler sheds lead to wet litter, increased air pollution from ammonia and dust particles and poor temperature and humidity control, all of which damage the broilers' health and welfare (Turner et al 2005).

Higher level of competition for essential resources such as food and water, as it might be at high rearing densities, it will become increasingly difficult for subordinates to reach the feeders and feed intake per bird will tent to decline. In extreme cases, competition may result in starvation and death of the weak individuals. This competition for resources is thought to be one of the main causes of the reduction in bird performance observed commonly at high stocking densities. To minimize these negative effects it is important to provide adequate feeding and drinking space per bird, particularly in situations of limited food availability (e.g. broiler breeders) so that all birds have adequate access to resources. This practice will result not only in best feed conversion per bird, but also will minimize flock size variability (Estevez 2002).

Faster growth rate

The growth rate of commercially produced broilers has been increased greatly, with standard broilers now reaching 1.5 kg body weight in 30 days whereas 120 days were needed in the 1950s. Simultaneously, the feed conversion ratio (the amount of feed eaten per kg of poultry growth) has been reduced from 4.4 to 1.47. It has been shown that this is largely the result of genetic selection and it is generally accepted that most of the welfare problems are caused by genetic factors (EFSA 2010). The commercial applications in agriculture of new breeding technologies, as well as conventional breeding strategies, have the potential to influence animal welfare in both positive and negative ways (Clark et al 2006).

Contemporary broiler breeders possess the genes for faster growth rate, better feed conversion, and increased meat yield in their broiler progeny. Selective breeding forever faster growth rate and feed conversion efficiency has caused most of the welfare problems broilers suffer from today (Rosales 1994, Turner et al 2005, EFSA 2010). Broilers have a mortality rate of 1% a week, seven times the rate of laying hens of the same age (Turner et al 2005). Some birds are culled for humane reasons and others are found dead, and there is an increased mortality associated with faster growth rates whereas slower growth rates have a lower mortality (EFSA 2010).

Skeletal disorder (Leg weakness)

Skeletal disorders are a major cause of poor welfare in broilers (SCAHAW 2000). It is also generally accepted that the main cause of leg problems is that modern broilers have been selectively bred (often referred to as "genetic selection") to grow extremely quickly. These accelerated growth rates have been achieved primarily by selective breeding, but also through the use of rich diets and growth-promoting antibiotics (Kestin et al 1992, Stevenson 2003). Because they grow too fast, millions and possibly tens of millions of European Union broilers a year suffer from painful lameness due to abnormal skeletal development or bone disease, so that many have difficulty in walking or even standing.

Lameness, characterised by abnormal gait, posture and impaired walking ability, can be prevalent in these rapidly growing birds and has been highlighted as a major welfare concern. It is during the later stages of rearing, when the bird is becoming heavy and may be achieving weight gains of over 50 g per day, that lameness begins to have an economic and welfare impact on the flock and to compromise the behaviour of large numbers of birds (Butterworth et al 2003). Lame broilers spend up to 86% of their time lying down. They may be unable to reach up to their drinking water containers and can go without water for several days (Turner et al 2005).

Heat stress

Modern fast growing broilers are susceptible to heat stress. There are management techniques available to reduce heat stress on farm. The recommended ambient temperature for fast growing broilers should be re-evaluated as it may be too high considering current growth rates and expected future growth rates. The optimal growth rate of the genetic lines should be evaluated in hot climates and slow growing lines selected for these climates (EFSA 2010).

Metabolism

A continuously increasing production level in poultry breeding has resulted in changes in metabolism. Selection procedures in breeding programmes are focused on an increase in growth rate and on a decrease in feed conversion ratio (less feed intake per unit of deposited tissue). These procedures do not pay attention to the maintenance requirements of birds. Imbalances between production (protein and fat deposition) and supply of energy for maintenance requirements lead to homeostatic regulation and to diseases of organs which supply the energy for production and maintenance. The alarming increase in metabolic diseases, such as heart failure syndrome, ascites, and oedema in the lungs and

heart, can be directly related to an insufficient oxygen supply (Scheele 1997).

Ascites and sudden death

As a result of selective breeding, broilers' hearts and lungs often cannot keep up with their bodies' fast growth rate. A genetic predisposition exists for both ascites and sudden death syndrome and there is a link with growth rate. The prevalence of ascites is thought to have decreased over the last 10 years as breeders have included this health problem in their selection schemes, but its prevalence should be monitored and given a high weighting in selection indices (EFSA 2010). They frequently suffer from heart failure when they are only a few weeks old. Acute heart failure known as Sudden Death Syndrome kills 0.1% to 3% of broilers in European countries. A second form of heart failure known as ascites affects nearly 5% of broilers worldwide. Using United Kingdom industry figures, nearly 130 million broilers may die in the European Union from heart failure annually (Turner et al 2005).

Restricted feeding

Broilers that are allowed to grow to adulthood to be used for breeding are restricted to between one fifth and one half of the amount of food they want to eat during their growing period. Broiler breeders are routinely fed restricted during rearing which has a major negative effect on their welfare. They suffer from hunger and frustration from thwarting of feeding. Restricted fed broiler breeders show behavioural abnormalities that are indicative of hunger and frustration of the feeding motivation, like hyperactivity and abnormal oral behaviour (stereotyped object pecking and overdrinking) (De Jong et al 2002, De Jong et al 2005). Morrissey et al. (2014) also indicated feed restriction leads to chronic hunger and followed by stereotypic behavior. Less severe feed restriction (up to 50%) may be continued in adulthood (SCAHAW 2000, Turner et al 2005).

Conclusions

- The major welfare issues for commercially reared laying hens and broilers are resulted due to high egg production and fast growth rate.
- Common welfare issue raised for the layer hens are bone problems such as osteoporosis and the high incidence of resultant bone fracture, behavioural deprivation resulting from housing in cage systems and beak trimming. Beak trimming, this mutilation is not acceptable in organic farming and also prohibited by many free-range labels.
- The major welfare issues for commercially reared broilers are leg disorder and lameness, metabolic disorders, and hunger in restricted-fed broiler breeder flocks.
- Increased body weight can also lead to ascites sudden death syndrome, which is associated with acute heart failure.
- To reduce the problem in the future more emphasis should be given to health and welfare traits particularly if poultry should be selected and tested for their subsequent rearing and production environments by the breeders.

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Received 28 July 2016; Accepted 6 October 2016; Published 1 December 2016

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