

Agribusiness Reports


Volume 2013 *AGRIBUSINESS REPORTS* | 2013

Article 3

12-2013

The Welfare of Animals in the Chicken Industry

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Recommended Citation

(2013) "The Welfare of Animals in the Chicken Industry," *Agribusiness Reports*: Vol. 2013 , Article 3.
Available at: <https://www.wellbeingintlstudiesrepository.org/agreports/vol2013/iss2013/3>

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An HSUS Report: The Welfare of Animals in the Chicken Industry

Abstract

More than 8.5 billion chickens are slaughtered for meat production in the United States every year. Raised in industrial production systems, these animals experience crowded indoor confinement, unnatural lighting regimes, poor air quality, stressful handling and transportation, and inadequate stunning and slaughter procedures. Because they are selectively bred for rapid growth, broiler chickens are prone to a variety of severe skeletal and metabolic disorders that can cause suffering, pain, and even death. Broiler breeders, the parent birds of chickens raised for meat, are subjected to severe feed restriction, and males may undergo painful toe and beak amputations, performed without pain relief. Scientific research on the behavior and welfare of broiler chickens demonstrates that these are substantial and important issues. Rapid and immediate reform is needed to improve the welfare of chickens raised for meat.

Introduction

Chickens raised for meat are the most numerous of any land animal farmed in the world. In a single year in the United States, more than 8.5 billion chickens, termed “broilers” by industry, are slaughtered for human consumption.¹ Over the last several decades, the broiler chicken industry has adopted the industrial model of farm animal production. As explained by the U.S. Department of Agriculture’s National Agricultural Statistics Service, “The broiler industry has evolved from millions of small backyard flocks, where meat was a by-product of egg production, to less than 50 highly specialized, vertically integrated agribusiness firms.”² Chickens are raised largely by contract producers,^{3,4} who typically confine them indoors in large, warehouse-like “grow-out” facilities. These buildings, each typically 122-152 m (400-499 ft) by 12-14 m (40-46 ft),^{5,6} approximate the size of a football field and might hold about 20,000 birds at one time.⁷ Most operations consist of 1-4 houses, but larger broiler producers can have as many as 18 buildings.⁸ Grow-out houses are usually artificially lit, force-ventilated, and completely barren except for litter material on the floor and long rows of feeders and drinkers.

Rapid Growth*

Broiler chickens have been selectively bred for rapid growth to market weight.⁹ In 1920, a chicken reached 1 kg (2.2 lb) in 16 weeks,¹⁰ but today’s broiler chicken strains may now reach 2.6 kg (5.9 lb), a size large enough for slaughter,¹¹ in only 6 weeks.¹² Daily growth rates have increased from 25 g (0.88 oz) to 100 g (3.52 oz) in the past 50 years—an increase of more than 300%.¹³ Genetic selection is so intense that the age by which broiler chickens reach market weight and are slaughtered has decreased by as much as one day every year.¹⁴ Ongoing selection for rapid growth is a severe welfare problem as it has resulted in poor bone health,¹⁵ leg disorders including deformities, lameness, tibial dyschondroplasia (TD), and ruptured tendons, and has been correlated with metabolic disorders such as ascites and sudden death syndrome.^{16,17,18,19,20,21} Broiler chickens selected for

* For more information, see: “An HSUS Report: Welfare Issues with Selective Breeding for Rapid Growth in Broiler Chickens and Turkeys” at www.humanesociety.org/assets/pdfs/farm/welfiss_breeding_chickens_turkeys.pdf.

faster growth also suffer from weakened immune systems, making them more susceptible to a variety of additional diseases.²²

Due in part to genetic selection for unnaturally fast growth, muscle outpaces bone development during the early life of chickens, leading to metabolic bone disease. As a result, broiler chickens often suffer from leg deformities and lameness.^{23,24,25,26,27,28} Heavier broilers (>2400 g) are more likely to be lame.²⁹ In some cases birds become non-ambulatory,³⁰ completely unable to walk. Studies consistently show that approximately 26-30% of broiler chickens by 40-42 days of age suffer from gait defects severe enough to impair walking ability,^{31,32,33} although at least one U.S. study reports lower levels.³⁴ Additional research strongly suggests that while conformational differences account for some gait differences,³⁵ birds at this level of lameness are probably in pain.^{36,37,38} Extrapolating these percentages to the U.S. broiler chicken flock suggests that 2.2-2.6 billion chickens may have difficulty walking and experience pain. Severe leg deformities are fatal if birds can no longer stand to reach food or water;^{39,40} about 1% of broiler chickens die or are culled due to leg problems.^{41,42}

Valgus-varus deformity, angular bone deformity, and twisted legs are all terms used to describe deviations from normal in growth of leg bones. In addition to genetic selection, another contributing factor may be continuous bone growth associated with lack of a daily rest period (due to nearly continuous lighting, see below), which would permit the growing bones to correct the mis-alignment. These deformities are the most common cause of lameness in broiler chickens, accounting for up to 60% of skeletal disease. Ways to prevent valgus-varus deformity include slowing early growth rate and providing a long nightly dark period.⁴³

Tibial dyschondroplasia (TD), an abnormal mass of cartilage at the growth plate of a bone, usually the tibia, is also a cause of leg problems. The end of the tibia may become enlarged and weakened, and the bone may bend backward as it grows. Spontaneous bone fracture and necrosis of the cartilage can occur, and in some cases, birds go down on their hocks, no longer able to stand.^{44,45} Faster growing broilers are more prone to TD than slower growing birds.⁴⁶ Sources differ broadly on the prevalence of TD in broiler chicken flocks, with percentages reaching 30-40% in extreme cases.⁴⁷ Aviagen, a leading breeding company, has worked to reduce the incidence of TD, and a 2001 report estimated that the incidence of TD would fall from approximately 8% in 1989 to a projected level of less than 2% by 2005.⁴⁸ However, studies published in 2001 and 2003 report elevated cases in common commercial chicken strains, with a mean prevalence of approximately 45-57%.^{49,50} While TD may be relatively common in chickens raised for meat, it is rare or absent in other types of birds.⁵¹

Because bone and tendon may lack sufficient strength to support the weight of the rapidly growing bird, painful tearing of tissues can occur. This is associated with several conditions including spondylolisthesis (dislocation of the fourth thoracic vertebra, which causes pinching of the spinal cord), epiphyseitis (inflammation of the growth plates), backward bending of the leg bones made weak from dyschondroplasia, and pressure-induced micro-fractures, all of which cause pain when a heavy broiler stands and walks.⁵² In spondylolisthesis, damage to the spinal cord can lead to partial paralysis. Affected birds may fall to one side or are observed sitting on their tail with their feet extended.⁵³ Rupture of the gastrocnemius tendon, the ligament that runs along the back of the leg is another common problem in heavy broiler chickens. If one leg is affected, the added stress may cause rupture of the tendon in the other leg. Hemorrhage can lead to discoloration on the back of the legs. A ruptured tendon is a chronic, debilitating, and painful condition.^{54,55}

Rapidly growing broiler chickens show altered patterns of behavior, beginning as young as two or three days old. By 17 days of age, they spend more time lying down than slow-growing broiler strains.⁵⁶ Between 5-7 weeks of age, broiler chickens spend 76-86% of their time resting, depending on the degree to which they suffer from lameness. This unusually high level of time spent lying down is thought to be related to fast growth and heavy body weight,⁵⁷ and, in turn, leads to breast blisters, hock burn, and painful⁵⁸ foot-pad dermatitis.⁵⁹ Hock burn tends to be worse in heavier birds.⁶⁰ Because sheds are sometimes cleared of litter and accumulated excrement only after several consecutive flocks have been reared,^{61,62,63} the birds often must stand and lie in their own waste and that of previous flocks.

Rapid gain and increased body weight are also implicated in metabolic disorders including sudden death syndrome (SDS) and ascites, which together can account for 50% of the mortality of highly productive broiler chicken strains.^{64,65} SDS is associated with acute heart failure caused by dysrhythmias.⁶⁶ Young birds die from SDS after sudden convulsions and wing-beating, and are frequently found lying on their backs.⁶⁷ The condition has been recognized since the 1950s as more broiler chickens were grown in large numbers for commercial production.⁶⁸ Between approximately 1-4% of broiler chickens may die from this condition,⁶⁹ which has been linked to their unnaturally rapid growth rate.⁷⁰

Ascites is a condition in which rapidly growing broiler chickens do not have the heart and lung capacity needed to distribute oxygen throughout the body,⁷¹ and is a leading cause of mortality as the birds reach market weight.⁷² Characteristic symptoms include accumulation of fluid in the abdominal cavity, an enlarged flaccid heart, the appearance of a shrunken liver, and heart failure. For commercial broiler chickens, most cases are the result of pulmonary hypertension, elevated pressure in the arteries that supply blood to the lungs. The high metabolic demand for oxygen and relatively low capacity for blood flow through the lungs of rapidly growing birds increase the workload of the heart, leaving them susceptible to mortality caused by ascites.^{73,74,75,76}

Even though there is evidence that genetic selection for improved leg soundness would have minimal effects on economically important carcass traits and body weight,⁷⁷ poultry breeding companies have not yet adequately addressed broiler chicken health or overall welfare. Although there are programs to improve leg health,^{78,79} growth has consistently been the top selection trait in highly productive lines since the 1950s, followed only by other economically important traits, such as breast muscle (meat) yield and feed efficiency.^{80,81} However, in response to consumer demand, new strains of slower growing broiler lines have been developed,⁸² but these have not yet been widely adopted.

Indeed, even though leg disorders, ascites syndrome, and many other health problems are common among chickens raised for meat, producers are economically inclined to use fast-growing birds. According to Scott Beyer, a Kansas State University poultry scientist, “Although a small percentage of birds may be predisposed to leg problems, use of highly selected fast-growing strains is recommended because savings in feed costs and time far outweigh the loss of a few birds.”⁸³

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. In the chicken meat production industry, stocking density is usually expressed in terms of live bird weight in a given area of floor space. The National Chicken Council recommends 36.6 kg/m² (7.5 lbs/ft²) for a broiler chicken weighing 2.0 to 2.5 kg (4.5 to 5.5 lb).⁸⁴ For a chicken nearing market weight (2.27 kg or 5 lb), the average industry stocking density is slightly larger than the area of a single sheet of letter-sized paper, 628-762 cm² (97.3-118.1 in²) per bird.[†]

Lack of adequate space can have negative consequences on the health, behavior and physiology of broiler chickens. Respirable particle (dust) concentrations are positively correlated with the biological loading, or number and weight of the birds in the buildings,⁸⁵ and ammonia concentrations increase with the stocking density,⁸⁶ although this will vary with the effectiveness of the ventilation system. Crowding at the average industry stocking density is associated with a decrease in locomotor activity,⁸⁷ and this lower level of activity has been postulated as the cause of poor walking ability found in some stocking density research.⁸⁸ Crowding also results in thigh sores and scabs, and scratches on the back⁸⁹ from birds disturbing⁹⁰ and climbing over⁹¹ one another. When birds lie in wet litter, ammonia produced by the decomposing organic material may irritate the skin.⁹² Hock and foot-pad dermatitis, lesions on the back of the legs and feet, respectively, which may be superficial or progress into deep ulcers,⁹³ may develop indirectly by deteriorating litter quality,^{94,95,96,97,98,99} a consequence of keeping so many birds in the limited confines of the broiler house. There is also a documented

[†] Calculated from values given in: Estevez I. 2007. Density allowances for broilers: where to set the limits? Poultry Science 86:1265-72.

decrease in growth and an increase in stress indicators (H:L ratio, bursa weight) when comparing stocking densities at the industry average to lower levels.¹⁰⁰ At stocking densities exceeding the industry average, litter wetness due to greater fecal content, poor ventilation, and spilled water from the automated drinking system may become more problematic.¹⁰¹ Air quality continues to deteriorate as stocking density increases, and broiler chickens may experience more bruising,¹⁰² heightened fearfulness,¹⁰³ and further stress.^{104,105}

Rest is important for young, growing animals,¹⁰⁶ and crowding increases the frequency with which birds disturb and walk over each other, interrupting resting patterns.^{107,108,109} Since broiler chickens are juvenile, growing animals, stocking density is thought to be a factor that can affect their physical development. Some researchers have speculated that interrupted resting patterns may underlie bone quality problems, including decreased tibia strength and increased bone curvature. Decreased bone quality is a concern because it could in turn lead to bone fracture during catching and transport for slaughter.¹¹⁰

Scientists studying the behavior of animals have devised methods for determining how the chickens perceive the social space around them. One study used three different methods of spatial analysis including measurements of inter-individual distances, nearest neighbor distances and Dirichlet polygon areas (a measure of the space around an individual that is closer to that individual than to any other) to better understand the way broiler chickens experience different space allowances. The researchers reasoned that broiler chickens would increase the distance to their pen mates if high densities (with close proximity to pen mates) were aversive to the birds, and that they would decrease this distance if close proximity was experienced positively. The results suggested that broilers in groups of 19 birds per 3.3m² (0.5 birds/ft²), a stocking density that is far less crowded than typical US grow-out houses, started to experience the proximity of conspecifics as aversive.¹¹¹ However, the effect of crowding on the subjective state of the birds may depend on the type of behavior the bird is expressing at a particular period in time, and chickens may choose to cluster during certain activities.

Researchers have also assessed the value of additional space to the birds themselves using motivational assessment experiments. In this behavior research, spatial preference was determined by monitoring bird movements from one enclosure with 14.7 birds/m² (1.4 birds/ft²) over a barrier to another enclosure with 9.3, 12.1 or 14.7 birds/m² (0.9, 1.1, 1.4 birds/ft²). This corresponded to 40, 31.5 and 23.3 kg/m² (8.2, 6.5, and 4.8 lb/ft²) at 39 days of age. The experiments showed that the lower the stocking density on the other side of the barrier, the more birds crossed over to the other side. Broiler chickens preferred the lower stocking density even when they had to cross over a barrier that was high enough to deter 20-25% of birds from crossing to access feed after six hours of food deprivation. The researchers concluded that broiler chickens prefer more space than the 40 kg/m² (8.2 lb/ft²) provided in their study, and that a lower stocking density is therefore important to broiler chickens.¹¹²

Despite the clear welfare problems associated with high stocking density, broiler chicken producers have an economic incentive to overcrowd birds. Since the total kilograms produced per unit of space will increase with stocking density, profit margins will also increase to a point, as birds are raised in increasingly crowded environments.¹¹³ As two poultry industry specialists write, “[L]imiting the floor space gives poorer results on a bird basis, yet the question has always been and continues to be: What is the least amount of floor space necessary per bird to produce the greatest return on investment?”¹¹⁴

Although reducing stocking density is important for improving the well-being of animals, large-scale studies under commercial conditions suggest that careful control of litter quality, temperature changes, ventilation, and humidity may ameliorate some of the negative effects of increased stocking density.^{115,116} The maximum permitted stocking density by law in the European Union is 33 kg/m² (6.8 lb/ft²), but derogations permit up to 42 kg/m² (8.6 lb/ft²) if specific air quality, temperature and humidity requirements can be met.¹¹⁷ For a 2.27 kg (5 lb) chicken, this is 14.5 to 18.5 birds/m² (1.35 to 1.72 birds/ft²). In the United States, no laws specify minimum space requirements for broiler chickens on conventional farms.

Artificial Lighting

Although there are a wide variety of artificial lighting regimes,¹¹⁸ broiler chickens are commonly reared under nearly continuous lighting.^{119,120} A lighting schedule with 23 hours of light and 1 hour of darkness per 24 hours has been used to hasten growth compared to a more natural photoperiod.¹²¹ However, reduced nightly periods of darkness are detrimental, because they limit the opportunity for sleep and rest (which is especially important for young fowl¹²²), cause abnormal eye development,^{123,124} and promote feeding behavior, further enhancing growth, which can exacerbate problems with leg disorders, sudden death syndrome, higher mortality, and ascites syndrome.^{125,126,127,128,129,130,131,132}

These problems have not gone unnoticed by poultry scientists, and increasing the period of darkness to slow early growth is now recommended.¹³³ Long, uninterrupted dark periods early in their lives may reduce growth by curbing feeding activity and subsequently reduce associated health problems of broiler chickens.^{134,135,136,137,138}

In the United States, 95% of chickens are raised by producers who adhere to guidelines of the National Chicken Council,¹³⁹ an industry group that recommends 4 hours of darkness, given in increments of 1, 2, or 4 hours, per 24-hour period.¹⁴⁰ However, a four hour period of uninterrupted darkness has been described by scientists working at the Silsoe Research Institute as an “absolute minimum” requirement.¹⁴¹ Studies show that a longer period of darkness could further improve gait score (an indicator of leg problems)¹⁴² and reduce mortality and culls.^{143,144} In the European Union, a minimum of 6 hours of darkness per 24-hour period is required by law.¹⁴⁵

Although the lighting in broiler chicken sheds may be nearly continuous, the light intensity is extremely dim. A typical business office may have a light level of 23.2 footcandle (250 lux),¹⁴⁶ but a broiler chicken shed’s light intensity is often less than 1 footcandle (10 lux). Because light intensities greater than this level stimulate activity, which can decrease growth rates, many producers gradually and increasingly dim the lighting below this intensity as the birds grow.¹⁴⁷ Lack of brighter lighting may result in uncomfortable, eventually painful changes in the eye morphology of chickens due to abnormal eye development.^{148,149} It can also alter patterns of behavior, resulting in less preening, foraging,¹⁵⁰ standing, walking,¹⁵¹ and overall activity.¹⁵² Broiler chickens kept in 1 lux lighting conditions have an increased incidence of ulcerative footpad lesions compared to those kept at higher light intensities, an effect explained by additional time spent resting in low light.¹⁵³ One study found that bruising was reduced under brighter lighting conditions (180 lux), and leg disorders were lower in one trial at six weeks of age.¹⁵⁴ The effects of light intensity on leg health are complex, however, because another study found more hock and footpad bruising but fewer hock erosions when broiler chickens were reared at 200 lux compared to 5 or 50 lux.¹⁵⁵ The lack of contrast between day and night illumination during a 24-hour cycle also alters the activity patterns of broilers, and contributes to disrupted rest periods.^{156,157}

Preference testing in animal behavior experiments is a powerful tool for determining the wants and needs of animals. Using this methodology, it has been determined that broiler chickens prefer different light intensities depending on the activity being performed and the age of the birds. At 2 weeks of age, broiler chicks spend more time in bright lighting (200 lux) when they have a variety of illumination level options, but by 6 weeks of age, when broiler chickens are less active, they spend more time in dimmer light (6 lux) while sitting and resting, which takes up more of their daily time-budget as they age. For all other activities six-week-old broiler chickens still preferred brighter lighting.¹⁵⁸

Air Quality

Rapid deterioration of air quality within the sheds is another common result of overcrowded confinement typical of U.S. broiler chicken production systems. As successive flocks are sometimes kept on the same litter,^{159,160,161,162} as mentioned above, excrement from tens of thousands of birds accumulates on the floors. Failure to clean between batches of chickens has been linked to higher respirable particle concentrations in the air of the poultry house.¹⁶³ Bacteria break down the litter and droppings, causing the air to become polluted with dust, bacteria, fungal spores, and ammonia.

Excessive ammonia levels in the litter and air can lead to ocular abnormalities,¹⁶⁴ eye lesions,¹⁶⁵ structural damage to the lungs,¹⁶⁶ skin and respiratory problems (such as pulmonary congestion, swelling, and hemorrhage), and even blindness.^{167,168,169,170} At exposure levels of 50 parts per million (ppm) ammonia over four weeks, broiler growth is depressed and at 75 ppm for the same time period mortality levels double.¹⁷¹

When tested in behavior experiments, broiler chickens demonstrate that they find high concentrations of ammonia aversive. They will push through weighted doors to exit an ammoniated atmosphere of 40 ppm, and the time it takes them to exit the ammoniated chamber does not increase as the door becomes heavier, demonstrating an inelastic demand for fresh air.¹⁷² Preference testing experiments have shown that when broiler chickens are given a choice between atmospheric environments of 4, 11, 20 or 37 ppm ammonia, they will avoid the 20 or 37 ppm chambers.¹⁷³

U.K. standards require that broiler chicken sheds not exceed ammonia levels of 20 ppm,¹⁷⁴ while U.S. standards permit 25 ppm.¹⁷⁵ However, data published in 2006 report that ammonia levels in U.S. broiler chicken sheds may reach 80 ppm, especially in the winter months when ventilation rates slow. These results show that ammonia levels can quickly become excessive as birds grow, even when they are placed initially on new litter.¹⁷⁶

Ammonia fumes also inhibit chickens' sense of smell. Wrote Christopher Wathes, Professor of Animal Welfare and head of the Centre for Animal Welfare at the Royal Veterinary College, University of London, "For a bird with an acute sense of olfaction the polluted atmosphere of a poultry house may be the olfactory equivalent of looking through dark glasses."¹⁷⁷

Broiler "Breeders"

Chickens used for breeding, known as "parent stock" or simply "breeders" are typically raised on separate sites from those raised for meat. Female breeding birds lay eggs that are collected, incubated, and hatched to supply chicks to the meat production sector. Broiler breeders, like their progeny, are confined in large, warehouse-like sheds with littered floors, but the buildings in which they are housed also contain long rows of nest boxes that facilitate the collection of fertilized, hatching eggs. Typically, nest boxes are elevated above floor level. Wooden or plastic slatted areas in front of the nest boxes and below the drinkers allow manure and water to pass into a pit below.

Unlike broiler chickens, who are usually slaughtered between 6-7 weeks of age,¹⁷⁸ mature parent stock are kept for one or, if force-molted, two years.¹⁷⁹ For birds, molting is a natural process of feather loss and re-growth, and results in reproductive quiescence during which hens cease egg-laying for several months. Because the time period during which females stop laying can be lengthy, commercial hatching egg producers speed up the molting process by stressing the birds with complete feed withdrawal for 10-14 days, until they lose 25% of their body weight.¹⁸⁰ This process is viewed by producers as "recycling" the flock,¹⁸¹ as the chickens would otherwise be slaughtered and replaced by younger birds. Although male broiler breeders are typically killed and replaced after one breeding cycle (after approximately one year), some are "recycled."¹⁸²

One of the most problematic daily welfare issues for parent birds is routine, severe feed restriction.^{183,184} If allowed to feed to satiety, broiler breeders would show health and reproductive problems^{185,186,187,188} due in part to their unnaturally rapid growth rate and size. As such, parent birds are usually feed-restricted, starting when they are as young as one week old.¹⁸⁹ In many parts of the world, including the United States, broiler breeders may be fed on a "skip-a-day" regimen in which the animals are fed as infrequently as every other day^{190,191,192} — though this practice has been outlawed in several European countries.¹⁹³ In some cases, water may also be restricted in order to reduce litter moisture.¹⁹⁴

Experimental studies suggest that artificial selection for increased body weight may have altered the brain mechanism controlling satiety and appetite,¹⁹⁵ and evidence from behavioral studies suggests that feed

restriction interferes with learning¹⁹⁶ and causes stress,^{197, 198} boredom, and chronic hunger.^{199,200,201} Breeders receive only 25-50% of the amount of feed they would otherwise eat if given free access.²⁰² While free-range chickens normally devote about 50% of their daily time budget foraging,^{203,204} feed-restricted breeding birds can consume their daily feed allotment in as little as 15 minutes,²⁰⁵ leaving a substantial amount of their daily time budget unoccupied. Feed restriction is believed to cause undernourishment, nutritional deficiency, and abnormal behavior including increased pecking at non-feed objects, pacing, heightened aggression,^{206, 207} greater water intake,^{208,209} and reduced resting behavior.²¹⁰ Given that target body weights for broiler breeders have changed little in the past 30 years, but broiler body weight continues to increase, the welfare of parent birds may become more serious in the future.²¹¹ After an extensive scientific review, the European Commission's Scientific Committee on Animal Health and Animal Welfare concluded that "current commercial food restriction of breeding birds causes poor welfare."²¹²

It may be possible to improve the welfare of broiler breeding hens by offering a low-density diet. Researchers have suggested that low-density diets may promote satiety by providing more bulk and gut fill, and indeed these diets can extend feeding time^{213,214} and sometimes reduce stereotypic object pecking in the first half of the rearing period.²¹⁵ However, the results of different studies have been mixed, with some showing welfare benefits, but others not, and what improvements there are may not be substantial.²¹⁶ There is also, however, a promising experimental genotype (the *dw*, or "dwarf" characteristic in female hens) that may have fewer health and behavioral problems under *ad libitum* feeding.^{217,218} Potential solutions to the hunger-health dilemma are possible and could be further explored with research.

To prevent males from dominating access to the feed, male broiler breeders may be fed separately from females. Several methods of excluding males from the hens' feeders are in practice. One technique uses a metal grill with partitions spaced too close together for roosters, who have slightly larger heads than breeding hens, to access the feed. However, when the birds are young, males may be small enough to reach into the feeder. To prevent the young roosters from accessing the females' feed, their nasal septums may be pierced horizontally with a plastic stick inserted into the nares (nasal openings) of their beaks, blocking them from passing their heads through the bars of the grill. These "Noz Bonz"^{TM219,220} undoubtedly impair welfare.

Unlike other chicken breeds,^{221,222} broiler breeding males may display uncharacteristically aggressive behavior, including aberrant sexual aggression toward females during breeding, including chasing, grabbing and pulling the comb, forced copulation, and pecking the hen while mounted.²²³ There have been reports of males injuring and even killing hens.^{224,225,226} Studies disagree on whether or not aggression is a consequence of frustrated feeding motivation due to feed restriction,^{227,228} but at least one study suggests that the problem of female-directed aggression is somehow a consequence of genetic traits and may be associated with breeding birds for meat production.²²⁹ Large group sizes, separate rearing of males and females (which is common in commercial practice), and stocking density could all be causative factors as well.²³⁰

Male broiler breeders are commonly beak-trimmed, "dubbed" (their combs are cut off), and de-toed at the hatchery,^{231,232,233} all performed without anesthesia or analgesia.^{234,235} Beak-trimming is the removal of one-third to one-half of the beak tip,^{236,237,238} an alteration meant to prevent injurious pecking. Commonly performed with a heated blade,^{239,240,241} beak-trimming causes a growth setback,²⁴² tissue damage and nerve injury, including open wounds and bleeding, resulting in inflammation, as well as acute and possibly chronic pain^{243,244,245,246,247} when a neuroma (a tangled nerve mass) forms in the healed stump of the beak.^{248,249,250} De-toeing involves cutting off the hallux (the inner-most toe on each foot) to prevent the growth of claws, which can severely scratch hens during mating. Neuromas may also form during toe amputation, however the degree to which these are painful is less certain.²⁵¹

Catching and Crating‡

When broiler chickens have reached market weight, usually between 6-7 weeks of age,²⁵² they are caught and crated for transport to slaughter. In the southeastern United States, where broiler chicken production is geographically concentrated,²⁵³ opening the doors so catching crews can work lets outside air into the barn, which may cause the overall building temperature to rise.²⁵⁴ Once catching ensues, the birds are typically gathered by the legs, inverted, and carried in groups of 3-4 birds per hand to transport crates.²⁵⁵ During an average shift, a single catcher will lift 5-10 tons of birds at a rate of 1,000-1,500 animals per hour.^{256,257} Birds experience fear, stress,^{258,259,260,261} and, due to skeletal defects associated with leg problems, likely pain during the process.²⁶² Any elevation in temperature associated with incoming warm air increases the probability of birds experiencing heat stress and death loss.²⁶³ Handling can become even rougher as crews become fatigued. Based on their own experience catching chickens in field tests, one team of researchers concluded that “as fatigue sets in, one’s primary motivation becomes just getting the job over with. Catching and crating the birds as quickly as possible with the minimum effort possible becomes the major focus. Careful handling becomes secondary.”²⁶⁴

Indeed, birds may be injured and bruised in the process, suffering dislocated and broken bones, as well as internal hemorrhages.^{265,266,267, 268} One study noted:

Hip dislocation occurs as birds are carried in the broiler sheds and loaded into the transport crates. Normally the birds are held by one leg as a bunch of birds in each hand. If one or more birds start flapping they twist at the hip, the femur detaches, and a subcutaneous haemorrhage is produced which kills the bird....Dead birds that have a dislocated hip often have blood in the mouth, which has been coughed up from the respiratory tract. Sometimes this damage is caused by too much haste on the part of the catchers.²⁶⁹

Transportation

Once the crates are loaded onto trucks, the chickens are transported to the slaughter plant. Transport causes further stress for the birds,^{270,271,272,273} as they experience noise, vibration, motion, overcrowding, feed and water deprivation, social disruption, and potential temperature extremes.^{274,275,276,277}

Some chickens do not survive the trip. Birds may die en route from infectious disease, heart and circulatory disorders, and trauma experienced during catching and crating,²⁷⁸ including dislocated femurs, crushed skulls, and dislocated and broken bones.²⁷⁹ Bone, ligament and tendon trauma associated with profuse hemorrhaging is often fatal.²⁸⁰ Disease and infection problems on the farm are thought to reduce stress resistance and the ability of the birds to withstand the stresses associated with live haul.²⁸¹

If the birds are shipped during temperature extremes, they can die from exposure in below freezing weather,²⁸² or heat stress during the summer.²⁸³ Transport trucks are not uniformly ventilated, which can lead to a high temperature core, while at the same time leaving birds in locations near air inlets, such as the lower back section of the truck, exposed to wind, rain and road grit.²⁸⁴ During cold, winter conditions, the amount of heat and moisture produced by the birds’ bodies in crowded transport crates can overwhelm the limited passive ventilation capacity of the trailer, leading to a situation where some birds can become too hot while others become chilled and wet, and where both hyperthermia and hypothermia are possible.^{285,286}

Many studies report average dead on arrival (DOA) figures. Estimates from the larger studies range from 0.12-0.46%,^{287,288,289,290,291,292,293,294,295,296,297} but variation is considerable between farms, seasons and specific journeys. If these average figures are applied to the approximate figure of 8.5 billion broiler chickens slaughtered in the United States annually, it suggests that about 10-39 million birds die during transport every year.

‡ For more information, see: “An HSUS Report: Welfare Issues with Conventional Manual Catching of Broiler Chickens and Turkeys” at www.humanesociety.org/assets/pdfs/farm/HSUS-Report-on-Manual-Catching-of-Poultry.pdf.

Handling-related conditions contributing to DOA counts²⁹⁸	
Condition	Total DOA %
Ruptured liver	25.0
Ruptured lung	15.0
Head trauma	13.5
Asphyxia	13.5
Leg trauma	12.0
Mutilation (multiple trauma)	5.5
Miscellaneous broken bone	3.0
Unknown	12.5

Farm-related conditions contributing to DOA counts²⁹⁹	
Condition	Total DOA %
Airsacculitis and septicemia	58.0
Ascites	31.0
Cull	7.0
Unknown	4.0

Factors leading to higher DOA numbers include longer transport time or distances,^{300,301,302,303,304,305} temperature and season of the year,^{306,307,308,309,310} increased stocking density in the transport crates and on the truck,^{311,312,313} increased bird body weight,^{314,315} and climatic conditions such as wind and rain.³¹⁶ Careful management of the catching, crating and transport process can reduce the effects of these factors. For example, large, portable fans can be used to blow air through loaded, stationary trailers; financial incentive programs to reduce traumatic injuries caused by catching crews can be instituted;³¹⁷ mechanical ventilation systems can be used to keep the thermal environments of poultry transport vehicles within the prescribed range, 20-21 °C (68-70 °F);³¹⁸ holding areas in hot and humid regions can be climate controlled;³¹⁹ and arrival times to reduce time in lairage can be carefully planned to improve the welfare of the birds.

Slaughter

At the slaughter plant, transport crates are unloaded from the trucks and the chickens are dumped onto conveyors and hung upside-down in shackles by their legs. Shackling is painful,^{320,321} and this pain is likely to be worse in birds suffering from diseases or abnormalities of leg joints or leg bones,^{322,323} especially those with dislocated joints or bone fractures induced by rough handling during catching, crating, and uncrating,³²⁴ and for large broiler breeders if their shanks are too big for the shackles.³²⁵ Moreover, hanging upside-down is a physiologically abnormal posture for chickens. Handling, inversion, and shackling are traumatic and stressful, as reported in multiple studies that measured physiological indicators of stress.^{326,327,328,329} Birds may struggle in the shackles³³⁰ and commonly flap their wings vigorously,³³¹ which may lead to additional dislocated joints and broken bones.³³²

Despite the fact that birds make up more than 95% of all land animals slaughtered for food in the United States,[§] the U.S. Department of Agriculture (USDA) does not include them under the protections of the Humane

[§] Calculated from values given in: U.S. Department of Agriculture National Agricultural Statistics Service. 2013. Livestock slaughter: 2012 summary; and U.S. Department of Agriculture National Agricultural Statistics Service. 2012. Poultry slaughter: 2013 annual summary.

Methods of Slaughter Act.³³³ Thus, there is no legal requirement that chickens must be rendered unconscious before they are slaughtered. However most chickens are conveyed through an electrified water bath, which is meant to stun and immobilize them before they are killed by an automated knife. Following throat-cutting, the birds die from exsanguination (blood loss). After the bleed-out process, birds enter the scald tank in preparation for the next step, mechanical feather plucking. Line speeds may be as fast as 140-180 birds per minute.³³⁴

It is well-documented in the scientific and trade literature that some birds experience painful electric shocks prior to being conveyed through the electrified water bath.^{335,336,337,338,339,340} This can happen when a bird's leading wing makes contact with the water before the head does or if wing-flapping occurs at the entrance to the stunner.³⁴¹ Newer designs in stunners may, however, prevent overflow of electrically charged brine onto the entry ramp,³⁴² and can lower the incidence of pre-stun electrical shocks.³⁴³

Scientific studies suggest that the electrical stunning process itself may not be instantaneous or effective. Although it is theoretically possible to induce immediate unconsciousness using electricity of sufficient magnitude, evidence that this occurs in commercial practice in the United States is lacking. The World Animal Health Organization, of which the United States is a member country, has specified internationally recognized parameters for the stunning and killing of poultry at slaughter in the *Terrestrial Animal Health Code (TAHC)*,³⁴⁴ to ensure the welfare of the birds. Section 7.5.7.3.b of the TAHC specifies that the amount of current necessary to stun chickens when using a frequency of 200-400 Hz is 150 milliamperes (mA) per bird, and when using a frequency of 400-1500 Hz, 200 mA is necessary.³⁴⁵ However, in the United States, while the use of 350-500 Hz frequency settings is common, electrical water-bath stunners may be set at only 10-28 volts, delivering 10-45 mA per bird.^{346,347,348} This low voltage/current setting is not utilized in Europe,³⁴⁹ and is based on meat quality concerns.³⁵⁰ Research published in 2006 suggests that the electrical settings currently in use in U.S. slaughter plants probably do not render all birds immediately unconscious.^{351,352}

Of further concern is that some birds are conveyed through the stunner without ever making contact with the electrified water bath. This can happen if birds struggle and lift their heads, the height of the stunner is not correctly adjusted, or birds are too short to reach the water-bath.^{353,354,355} In 2007, one of the top disease challenges facing poultry veterinarians in the United States was Runting Stunting Syndrome (RSS). RSS-affected flocks have poor uniformity, hindering processability,³⁵⁶ possibly worsening the problem of small birds missing the stunner.

Occasionally, live birds who were not adequately stunned and/or who missed the killing machine, or recovered from the stun due to poor neck-cutting practices are conscious when entering the scald tank.^{357,358,359,360} Although a worker is present on the slaughter line to manually cut the throats of birds who miss the automated blade, in high-throughput processing plants, rapid line speeds can prevent the detection of live birds exiting the killing machine.³⁶¹ In U.S. plants with improper supervision, the rate at which birds enter the scald tank while still alive may be as high as 3%.³⁶² According to the USDA's Food Safety and Inspection Service "Poultry Slaughter Inspection Training" guide, "Poultry that die from causes other than slaughter are condemned under the cadaver category. These birds are not dead when they enter the scald vat. When submerged in the hot water, they drown...."³⁶³ In 2012, 729,189 chickens were condemned under this category.³⁶⁴

More effective and less aversive alternatives to electrified water-bath stunning slaughter are Controlled Atmosphere Stunning (CAS) and Controlled Atmosphere Killing (CAK) systems. In these systems, animals are not handled while they are still conscious, avoiding the problems associated with dumping,^{**} handling, and shackling live birds, and the systems do not risk pre-stun shocks and/or ineffective stunning. In CAS and CAK systems, birds are conveyed through a tunnel filled with carbon dioxide (CO₂), inert gases (argon or nitrogen), or a mixture of these gases. With CAK, birds are exposed to lethal concentrations of gases long enough that they

** Some gas systems are designed in such a way that birds must still be dumped from their transport crates prior to entering the gas-filled chamber on a conveyer belt. While still retaining many of the welfare advantages of CAS and CAK systems, those that move birds through the gaseous atmosphere while they are still in their transport crates are considered optimal.

are actually killed, rather than simply stunned,³⁶⁵ whereas with CAS, the gas or gases induce unconsciousness as the birds pass through before they are hung on shackles, while insensible, and conveyed to the killing machine for slaughter. In both systems, hanging operators do not shackle the birds until after they exit the gas stunning system, so the animals do not endure the pain, fear, and stress associated with this step in the procedure, and there is no potential for pre-stun electric shock or birds missing the stunner.

Conclusion

Many standard practices in the broiler chicken industry are in dire need of reform, as they are simply inhumane. At every stage of the process—from breeding all the way to slaughter—there are substantial welfare issues. Practices must be reevaluated in light of bird welfare concerns in an effort to reduce suffering and enhance quality of life. There are many potential innovations in genetics,³⁶⁶ lighting programs,³⁶⁷ environmental enrichment,^{368,369} and technology for catching,^{370,371} transporting,³⁷² and slaughtering chickens that could greatly improve the welfare of these animals if more widely adopted within the industry.

While all welfare problems of broiler chickens are important, selective breeding for growth without due attention to animal health and well-being, which has resulted in animals who are chronically in pain, is wholly unacceptable. Broiler chickens grow so quickly that they are “on the verge of structural collapse.”³⁷³ According to John Webster, Emeritus Professor of Animal Husbandry at the University of Bristol, “[T]his must constitute, in both magnitude and severity, the single most severe, systematic example of man’s inhumanity to another sentient animal.”³⁷⁴ There are only three major breeding companies that offer commercial broiler lines: Hubbard, Cobb-Vantress (Cobb strains), and Aviagen (Ross strains). Each of these companies now offers a line of slower growing birds. Wider use of these lines could markedly improve the welfare of chickens raised for meat production.³⁷⁵

Chickens are living, sentient individuals and must be recognized as such, rather than commodified and viewed simply as “products”^{376,377} or “breeders.” Scientists are increasingly recognizing the complex cognitive abilities of birds,^{378,379} their capacity to suffer,³⁸⁰ and the ethical implications that these findings carry. Billions of birds in the United States and globally will continue to suffer in industrial production if scientifically documented welfare problems continue to be minimized and left unaddressed by the meat industry.

¹ U.S. Department of Agriculture National Agricultural Statistics Service. 2013. Poultry slaughter: 2012 summary. <http://usda01.library.cornell.edu/usda/current/PoulSlauSu/PoulSlauSu-02-25-2013.pdf>. Accessed December 3, 2013.

² U.S. Department of Agriculture National Agricultural Statistics Service. 2002. U.S. broiler industry structure. Agricultural Statistics Board. <http://usda01.library.cornell.edu/usda/nass/industry-structure/specpo02.pdf>. Accessed December 3, 2013.

³ Perry J, Banker D, and Green R. 1999. Broiler Farms’ Organization, Management, and Performance. Resource Economics Division, Economic Research Service, U.S. Department of Agriculture. Agriculture Information Bulletin No. 748. www.ers.usda.gov/publications/aib-agricultural-information-bulletin/aib748.aspx. Accessed December 3, 2013.

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The Humane Society of the United States is the nation's largest animal protection organization—backed by 10 million Americans, or one of every 30. For more than a half-century, The HSUS has been fighting for the protection of all animals through advocacy, education, and hands-on programs. Celebrating animals and confronting cruelty. On the Web at humanesociety.org.