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THE 88%

SUMMARY

- 88% of land animals raised and slaughtered for food in the United States (US) are meat chickens (broilers)
- Consumption of chicken in the US is ever increasing, with consumers eating nearly as much chicken meat as pork and beef combined
- Living for only 6 - 7 weeks, the volume of meat produced has been achieved by genetically selecting breeds of chickens to grow faster and with bigger breast muscle
- Fast growth and substantially bigger breast muscle causes birds to suffer from a host of painful chronic and life-threatening illnesses. A bird today is marketed at more than twice the body weight and reared in half the time as 50 years ago
- The quality of chicken meat is also substantially affected too, with white striping and wooden breast impacting the texture, fat content and nutritional value
- Mechanization of slaughter further facilitates vast production of chicken meat, with 140 - 180 birds killed every minute in waterbath stunning systems, having first been hung inverted while fully conscious, often weakened, legs in metal shackles
- Improved welfare is possible through the use of breeds that improve leg health and reduce the risk of muscle diseases, alongside providing more space, natural light and enrichment and slaughtering birds with controlled atmospheric killing (CAK) or low atmospheric pressure stunning (LAPS).

INTRODUCTION

In a recent consumer survey by the National Chicken Council, nearly three quarters of those surveyed consumed chicken between 2 and 4+ times per week (National Chicken Council 2016a). This is a long way removed from the days when chicken was consumed infrequently, and many households had backyard flocks (National Chicken Council 2012). The increased consumption has been driven by the productivity of broiler production, coupled with a change in consumers demand, and further exacerbated by high use of chicken meat in the foodservice sector (Davis et al. 2013; Massimiliano Petracci and Cavani 2012). Low price, a perception of higher nutritional value, and absence of cultural or religious effect have all driven consumers to choose chicken more than other meats (M. Petracci et al. 2013).

Consumers are now eating nearly as much chicken pound for pound as pork and beef combined, compared to in 1990 when it was only half as much (National Chicken Council 2016b). This is alongside a giant export market utilising the availability of leg-quarters which are less desired in the US. Over 15% of chicken meat produced in the US is exported (National Chicken Council 2016c; Davis et al. 2013). In the US in 2015, nearly 9 billion chickens were slaughtered (USDA 2016c), however with around 15% of chicken meat being exported, US consumption of chicken accounted for 7.8 billion birds in 2015, equating to 88% of land animals raised and slaughtered for food in the United States (US) being broiler chickens (see Table 1).

Table 1. The number of land animals raised and killed for food production in the United States (calculated accounting for import and export values)

SPECIES	NUMBER OF FARMED ANIMALS SLAUGHTERED AND CONSUMED IN THE US	PERCENTAGE OF TOTAL FARMED ANIMALS SLAUGHTERED AND CONSUMED IN US
Chicken[1,3]	7,847,718,748	88.69%
Turkey[1,3]	242,210,62	2.74%
Laying hens and chicks[4]	565,598,000	6.39%
Ducks[3]	2,823,000	0.32%
Cattle[5,6]	33,828,699	0.38%
Dairy Cows[5]	1,552,833	0.02%
Calves[5]	469,016	0.01%
Bison[5]	60,800	0.00%
Hogs[5,7]	123,217,030	1.39%
Sheep and lambs[5,6]	5,255,457	0.06%
Goats[5]	590,700	0.01%
TOTAL	**8,847,179,075**	**100%**

[1.] (USDA 2016a) [2.] (USDA 2016b) [3.] (USDA 2016c) [4.] (USDA 2016d) [5.] (USDA 2016e) [6.] (USDA 2016f) [7.](USDA 2017a)

Chickens today are raised with tens of thousands of birds in one shed. Ninety five percent of all the broilers raised for meat in the US are produced on 25,000 farms that have production contracts with a food company (National Chicken Council 2016d). Nearly all producers are contracted with large companies that vertically integrate from hatching to slaughter, including the feed production for the birds (Nehring et al. 2015). In 2010, there were 41 broiler farms federally inspected, down from 55 in 1995 (Davis et al. 2013). Consequently, while chickens make up the vast majority of farmed animals, there is a clear shift towards fewer farms and a drastic increase in intensive practices.

The increased productivity of the poultry sector is due to changes to the birds genetics, the production system, and the slaughtering process. A broiler chicken's growth rate is 6 times greater than it would have been in 1925, reaching a higher slaughter weight today in less than half the time, weighing nearly 4lbs more (6.18lbs vs. 2.5lbs) (Barbut et al. 2008; National Chicken Council 2016e). For example, while it would have taken 16 weeks to get to a marketable slaughter weight in 1950, by the 1990's this was achieved in just 6 to 7 weeks (Schmidt et al. 2009). The industry's ability to grow birds to heavier weights in such a shortened time means they can control the production costs, using less feed and developing a bird that produces a considerably larger amount of breast meat to match the consumer demand for white meat, which is the premium cost of the carcass (Davis et al. 2013). The shortening lives of a fast-growing chicken ensures farms can produce more and more birds in the same time frame, without the need for further investment in infrastructure. Slaughtering has become mechanised, with a single slaughterhouse typically killing between 140 - 180 birds a minute using a waterbath stunning system (Smith 2014). This allows for rapid processing and has ensured mass production of chicken. Ultimately, these intensive systems have been designed based on economic incentives which do not adequately consider chicken welfare.

GENETIC SELECTION

The numbers of broilers slaughtered in the US is higher than ever, and the broilers themselves grow larger and faster every year. Live weight has risen by 30.2g annually over the past 30 years, alongside an ever decreasing food conversion ratio of around 0.036% year on year (National Chicken Council 2016e; Bailey et al. 2015). The increasing productivity of the broiler industry is a direct consequence of the birds being genetically selected for improved feed conversion and a larger breast muscle (Bokkers and Koene 2003; Havenstein, Ferket, and Qureshi 2003). Achieving the best food conversion rate with the premium cut of breast meat is the economic driver for the broiler industry we have today. The sentience of the animal is not part of the economic program. However, as a recent paper by Marino (2017) shows, chickens are cognitively intelligent, they can demonstrate self-control, they communicate with one another in a complex way, and have the capacity for reason and logic. They also have distinct personalities, and like other animals have complex positive and negative emotions such as joy, fear and pain. They also show some ability to empathise (Marino 2017). Fast-growing broilers, due to their genetics, spend less time carrying out important natural behaviours such as walking/running, scratching/pecking litter and perching, and more time sitting and eating/drinking than slower-growing birds (Bokkers and Koene 2003). Their ability to perform even basic natural behaviours is being impacted by their own genetics, which sees them grow unnaturally fast and with a changed body shape, delivering for the steady increase in demand of white meat (breast meat rather than legs) (Davis et al. 2013). This increase in growth and muscle size has come at a direct cost to the bird as they suffer an increased incidence of conditions such as leg weakness, ascites, and breast muscle myopathies (Dransfield and Sosnicki 1999).

POOR LEG HEALTH

The multi-national breeding companies Aviagen (Ross and Arbor Acres breeds), Cobb-Vantress (Cobb and Sasso breeds), and Groupe Grimaud (less popular breeds such as the Hubbard) produce the vast majority of farmed broilers in the US (Elfick 2012). In 1990 the average chicken at slaughter was 4.37lb at 48 days (National Chicken Council 2016e). Today the Ross 308, Ross 708 and Cobb 500 is expected to reach that weight by 34, 35 and 35 days respectively (Aviagen 2014a; Aviagen 2014b; Cobb-Vantress 2012).

The development of large muscle mass on an immature skeleton leads to locomotor problems in fast-growing chickens (Pompeu et al. 2012), with the highest levels of lameness seen in the fastest growing birds (Wideman 2016). Broilers with even moderate lameness (≤ gait score 3) have been shown to suffer pain from their impaired walking ability (McGeown et al. 1999). Chickens given the ability to self-medicate with feed containing painkillers consumed a significantly higher proportion of feed, as the severity of lameness increased (Danbury et al. 2000). While statistics in the USA are lacking for the overall level of lameness in broiler flocks, a UK study showed that 27.6% had poor locomotion and 3.3% were almost unable to walk (Knowles et al. 2008). There is no reason to suggest that broiler chicken leg health would be better in the US, in fact it is likely to be worse, as birds grow longer and to heavier weights putting even more strain on their weak joints.

Poor leg health can be caused by a number of different factors, including osteomyelitis (Kittelsen et al. 2016), femoral head necrosis (Wideman 2016), tibial dyschondroplasia, and arthritis (Kittelsen et al. 2015). In severe cases birds lose the ability to walk so they can't access even the basic resources of food and water, which can lead to starvation and a slow and painful death if they are not culled. Broilers are typically reared in barns with around 8.6lb/square foot, but as there are no restrictions in the US on stocking density, it could even be as high as 9.4lb per square foot. Such high stocking densities negatively affect walking ability (Knowles et al. 2008). Fast-growing broilers with poor leg health spend an increased time sitting, and a large amount of time spent on poor litter can lead to the painful condition footpad dermatitis (inflammation and necrotic lesions on the plantar foot), as well as hocks burns and breast blisters (de Jong, Gunnink, and van Harn 2014).

POOR METABOLIC HEALTH

The speed and volume of muscle mass growth of the pectoral muscle (breast muscle) has other consequences for the bird physiologically. A study in 2009 compared the Ross 708 (a popular fast-growing breed) with a heritage breed from 1950 and found that the Ross 708 breast muscle mass constituted 18% of the overall body mass at 5 weeks of age compared to just 9% for the heritage birds at the same age (Schmidt et al. 2009). Aviagen Ross 708 performance objectives now puts breast muscle mass percentage at between 22 - 23% for the same aged bird and for heavy weight birds the breast muscle mass could make up as much as 24.5% of total body weight (Aviagen 2014b). Schmidt et al (2009) also found that the Ross 708 heart muscle mass had decreased relatively, so that muscle mass was being favoured in the pectoral area rather than the heart in the modern birds.

In a study published in 2014, the Cobb 500 (one of the most common fast-growing broiler breeds) was compared with a 1950's style breed of broiler. Collins et al (2014) found that the breast muscle mass of the birds had been favoured over external body parts, such as the head and neck, as well as the internal vital organs, including the heart, lungs and liver, which had all decreased in relative size in the modern broiler. It is as a result of these changes that the authors conclude that genetic selection for fast-growing broilers with large pectoral muscle mass 'has altered the broiler in many other ways that makes feeding and managing this bird for optimum growth and livability challenging' (Collins et al. 2014).

ASCITES

Metabolic diseases are common in fast-growing birds. One such condition is ascites (otherwise known as 'water belly' caused by fluid accumulating in the abdomen) (J. M. Balog et al. 2003).

The growth rate of the breast muscle tissue outgrows the blood vessel capacity of the tissue (Janice M. Balog 2003). This is a multifactorial disorder, however, the main contributor of the condition is believed to be an increased strain on the heart as it tries to provide oxygen to the rapidly growing breast muscle which may have an impaired oxygen supply (Hoving-Bolink et al. 2000). This causes cardiopulmonary changes which eventually leads to hypertension and ventricular hypertrophy and finally results in ascites (Baghbanzadeh and Decuypere 2008). It is most typically seen in male chickens and is due to rapid growth (Awachat and Majumdar 2014; Siddiqui F. et al. 2009; Olkowski et al. 2008). This is a chronic and painful disease that leads to the birds having difficulty breathing, and eventually their heart becomes too weak to support the needs of the body and the bird slowly dies. It is estimated that up to 5% of broilers die from ascites (Urbaityte 2009).

SUDDEN DEATH SYNDROME

An acute, rather than chronic, disease suffered by broiler chickens is 'sudden death syndrome'. It is also referred to as 'flip over' by producers. Birds will suddenly start violently flapping their wings, extend their neck, squawk and die within minutes (Siddiqui F. et al. 2009). This condition is typically seen in male chickens due to rapid growth (Awachat and Majumdar 2014; Siddiqui F. et al. 2009; Olkowski et al. 2008). The fast-growing broiler has a predisposition for cardiac arrhythmias. Sudden death syndrome is likely brought on by stress, their predisposition leading them to suffer ventricular fibrillation (rapid, erratic heart beats) leading to death. This alone is estimated to cause mortality of 0.5% - 4% in broiler flocks (Merck Veterinary Manual 2016).

GREEN MUSCLE DISEASE, WOODEN BREAST AND WHITE STRIPING

Breast muscle myopathies (disease of the muscle tissue) impact both bird welfare and meat quality. They are more commonly seen today than in previous years and are all associated with the rapid growth and large breast muscle mass of the modern broiler (Barbut et al. 2008; Dransfield and Sosnicki 1999; Mudalal et al. 2015). The muscle fibres in the breast of fast-growing chickens have a greater diameter than slow-growing birds and appear to have an increase in giant fibres which have a diameter 3 - 5 times larger than normal fibres (Dransfield and Sosnicki 1999). These differences may contribute to myopathies.

Deep pectoral myopathy (DVM) is caused by ischemic necrosis to the breast muscle (lack of blood supply to the muscle fibres causing fibres to die and become necrotic). It is known as green muscle disease due to the appearance of green flesh within the muscle tissue (Bailey et al. 2015).

The most recently identified myopathies are Wooden/Woody breast and white striping (Bailey et al. 2015; Mudalal et al. 2015). Wooden breast is becoming increasingly common (Abasht et al. 2016) with flocks that are affected having up to 50% of birds with the disease (Owens 2014). It is thought that this now affects 1 in 10 deboned whole breast fillets in the US (Fielding 2016). This is caused by severe degenerative pectoral myopathy and appears as the colloquial name suggests — the breast becomes tough and wood-like, and white striations may be seen in the meat (Thornton 2016). Research is limited on this emerging disease but it is believed it could be caused by a lack of oxygen to the muscles, a build up of free radicals and calcium in the breast tissue (Mutryn et al. 2015), to the formation of connective tissue (Bailey et al. 2015). Results show that affected chickens are most likely to be those that grow faster, have greatest feed efficiency and heaviest body weight (Mudalal et al. 2015). It is for this reason that some producers are pulling away from rearing to the heaviest weights of 9lb (Thornton 2016).

Wooden breast often occurs with the condition known as 'white striping' (Soglia et al. 2016). White striping is found on the outside of the pectoral major muscle. It is visible as white striations running parallel to the muscle fibres (Kuttappan et al. 2009). These striations are found to be adipose (fatty, connective) tissue (Bailey et al. 2015). White striping has found to increase the fat content and decrease the protein content of affected fillets (Kuttappan et al. 2012). Meat that comes from birds suffering from woody breast or from those with both conditions are found to have a harder texture, impaired ability to hold water, and poorer nutritional value (Soglia et al. 2016). White striping by itself also impacts the general appearance of the breast meat (Petracci et al. 2013). These conditions are forcing the downgrading of meat due to the lack of aesthetic appeal (Mudalal et al. 2015).

While there is a clear meat quality issue, the pain or discomfort caused by these breast muscle myopathies is yet to be determined, having only been recently discovered. However, these diseases cause inflammation and changes to muscle fibres in the breast, which are are relied upon for wing flapping. Consequently, we cannot rule out the welfare issues that may be associated with these diseases, such as pain and discomfort.

SLAUGHTER

Chickens in the US are typically slaughtered in an electrical water-bath system (Shields and Raj 2010). This method of slaughter stuns birds by inserting their head into an electrified water bath before cutting their throat. While today there is concern for the humaneness of slaughter, waterbath stunning was developed to allow fast processing of birds (Boyd 1994). The mechanisation of slaughter makes way for an ever increasing production of chicken. A waterbath system are the most commonly used method for the stunning and slaughter of chickens. This system is used with the intention of rendering birds unconscious for long enough to allow their neck to be cut and for them to bleed to death while unconscious. It is also reduces carcass damage through immobilisation, however, there are a number of serious welfare concerns (Raj 1998).

Waterbath stunning systems require birds to be hung upside down by their legs in metal shackles on a moving processing line while fully conscious before having their head dunked into an electrical water-bath to stun them (Shields and Raj 2010). The inversion of the birds is stressful and is likely to cause pain (Sparrey and Kettlewell 1994). Birds exhibit wing flapping in panic at inversion, which can lead to dislocations and bone breakages (Shields and Raj 2010). The metal shackles used to hang inverted birds often do not account for leg diameter variation and this leads to operators forcing larger birds with thick legs into narrow shackles (Gregory and Bell 1987). Chickens may also experience painful pre-stun electric shocks if, in their panicked flapping, their wing tips enter the bath before their head (EFSA 2004). There is a risk that birds do not get stunned correctly or miss the stun bath altogether by flapping and raising their head when they are meant to enter the waterbath. In the event that their head does enter the waterbath, there is still a risk that the electrical stunning is ineffective in ensuring unconsciousness, leaving the birds fully conscious but immobilized and appearing unconscious, having suffered a painful electrical shock (Shields and Raj 2010). This means that the birds would be conscious while their neck is cut. Even birds which are successfully stunned and unconscious when their neck is cut may regain consciousness as they are bleeding out, and enter the scald tank alive before drowning in the hot water (Shields and Raj 2010). In 2016, over half a million birds (USDA 2017b) were registered as cadavers post mortem at the slaughterhouse, meaning they died for reasons other than slaughter, and it is possible these birds were alive and conscious when entering the scald tank (Shields and Raj 2010).

IMPROVING THE WELFARE OF CHICKENS

Breeds that allow the bird's physiology to support the increase in body weight and develop greater leg strength will improve the welfare of chickens. Examples of this include, current slower-growing chicken breeds which have been shown to have a reduced mortality, footpad dermatitis and hock burn (Barnett and Hemsworth 2009). These birds are more active and perform more of their natural behaviours like foraging, dust-bathing and perching (Bokkers and Koene 2003). Further research is being conducted in the next two years to assess further breeds for possibilities to improve overall welfare. Reducing the stocking density to a maximum 6lbs./sq. ft gives birds the space to lie comfortably, perform their natural behaviours and have improved walking ability (Kittelsen et al. 2016). Good ventilation and dry good quality litter is vital. Providing the right resources and environment for birds is crucial for improving the welfare of chickens. Windows in sheds provide natural light which stimulates bird's behaviour (Lewis and O'Connell 2011). Perches, pecking material and straw bales allow birds to scratch around the litter, perch, dust-bathe and forage (Bokkers and Koene 2003).

Slaughter conditions are improved by the use of controlled atmosphere stunning or killing (CAK) which involves transferring the birds to a controlled atmosphere chamber with gases or gas mixtures (gases permitted are carbon monoxide, carbon dioxide and inert gases such as argon and nitrogen) (Shields and Raj 2010). Low atmospheric stunning may also provide a more humane method of slaughter (Mackie and McKeegan 2016). The birds are thus stunned or killed, depending on the length of exposure to the gases or low pressure. Both methods eliminate the need for live handling, shackling and inversion of conscious chickens, and should ensure chickens are fully unconscious at neck cutting and dead by the time they reach the scald tank (Shields and Raj 2010; McKeegan, Sandercock, and Gerritzen 2013).

CONCLUSION

The cost of cheap chicken is paid for with the suffering of intensive fast-growing birds living in cramped sheds and enduring poor slaughter practice. The impact on the birds of economic drivers for faster growth and enlarged breast muscle is highlighted by the extensive list of diseases they are becoming increasingly predisposed to suffering. The fact that nearly 9 out of 10 land animals farmed for food are broiler chickens shows the immense level of suffering nearly all farmed animals endure in intensive factory farm systems. There is an alternative; breeds exist that can alleviate many of the negative predispositions we see with the current typical fast-growing breeds. By utilising these higher welfare breeds and giving birds more space, enriching the environment, and improving slaughtering conditions using CAK or LAPS, the industry would see an improvement in meat quality and, most importantly, an improved level of welfare for the billions of chickens farmed for meat production every year.

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