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THE WELFARE OF BROILERS IN THE EU

Introduction

The EU is a major producer of chickens reared for meat (known by the industry as broilers), being responsible for 11.2% of total world production (12.1 million tonnes). Broiler production in the EU has increased by nearly 23% from 2009 to 2017, now representing about 7.5 billion birds every year. Production and consumption have been increasing steadily and with an average consumption of 26.8kg per capita per year in 2014, chicken comes second after pig-meat as the largest consumed meat in the EU. Poultry meat production in the EU is expected to increase by 3.8% and consumption by 3.4% in the period 2015-2025 ¹.

Intensive broiler systems account for the vast majority (around 90%) of broiler production in the EU, while alternative systems (alternative indoors, free-range, and organic) represent a small proportion of total production (less than 10%). Farms with more than 5,000 broilers represent barely one percent of the total number of broiler farms in Europe, but they account for 93.5 % of broilers reared and slaughtered every year. Three-quarters of the EU production is concentrated in seven Member States: Poland, United Kingdom, Spain, France, the Netherlands, Germany, and Italy which also have the largest farms (table 1) ².

Table 1: Chicken meat production by each EU Member State (2017) ³

Member State	Chicken meat production (Tonnes)	Chickens slaughtered (number of animals x 1000)	Share of EU28 chicken meat production
Poland	2,102,990	1,140,955	17.33%
United Kingdom	1,629,000	1,089,000	13.43%
Spain	1,317,487	690,837	10.86%
France	1,102,774	826,626	9.09%
Netherlands	1,034,319	621,653	8.53%
Germany	1,009,565	631,000	8.32%
Italy	1,006,677	549,262	8.30%
Belgium	455,364	300,502	3.75%
Romania	391,958	236,805	3.23%
Hungary	341,107	174,000	2.81%
Portugal	317,918	221,277	2.62%
Denmark	171,184	112,851	1.41%
Czech Republic	154,477	113,808	1.27%
Sweden	152,500	103,407	1.26%
Greece	150,695	86,895	1.24%
Austria	126,800	88,700	1.05%
Finland	120,780	71,302	1.00%
Lithuania	110,816	60,366	0.91%
Bulgaria	87,029	50,074	0.72%
Ireland	80,628	76,533	0.66%
Slovakia	69,656	45,134	0.57%
Slovenia	67,282	40,230	0.55%
Croatia	48,321	55,923	0.40%
Latvia	33,393	19,144	0.28%
Cyprus	24,927	12,687	0.21%
Estonia	20,400	11,822	0.17%
Malta	3,676	2,126	0.03%
Luxembourg	270	198	0.00%
TOTAL	12,131,993	7,433,117	100.00%

Genetic selection

The number of broilers slaughtered in the EU is higher than ever, and the broilers themselves grow larger and faster every year. The chickens produced today have been bred to increase efficiency at a cost to their welfare. Birds grow exceptionally fast and live with very little space to move around. The genetic selection of broilers has led to a 400% increase in broiler growth rate, achieving market weight in 60% less time than broilers 50 years ago. The amount of breast meat on an individual bird increased by two-thirds⁴. These broilers achieve the target live weight of 2-2.5 kg in around 35-45 days, in comparison to 16 weeks back in the 1950s⁵. The vast majority of the EU chicken meat sector uses fast-growing strains. The most widely used breed in all Member States is the Ross, which accounts for at least 70% of all broilers slaughtered in the EU, while Hubbard and Cobb breeds are less widely used². 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 shows⁶, 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.

Fast-growing broilers 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 higher welfare birds⁷. Their ability to perform even basic natural behaviours is 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 muscle rather than legs)⁸. The rapid growth and increased muscle size has come at a direct cost to the bird as they suffer an increased incidence of musculoskeletal and cardiovascular disorders such as leg weakness, ascites, and breast muscle myopathies^{9,10}.

Poor leg health

One of the most serious welfare problems in broiler production is the high incidence of skeletal disorders, particularly those that lead to impaired mobility or lameness⁸. The development of many of these conditions is related to selection and management for rapid growth, since they are rarely seen in higher welfare strains and laying strains of poultry but are very common in commercial fast-growing chickens such as the Ross 500¹¹. Skeletal problems are not just a welfare issue; they are also costly to the industry. They are by far the most costly diseases for poultry producers in terms of output loss, resource wastage, and treatment and prevention costs¹¹.

The development of large muscle mass on an immature skeleton leads to locomotor problems in fast-growing chickens¹², with the highest levels of lameness seen in the fastest growing birds¹³. Even broilers with moderate lameness (\leq gait score 3 on a score from 0 - 5) have been shown to suffer pain from their impaired walking ability¹⁴. Chickens given the ability to self-medicate with feed containing painkillers consumed a significantly higher proportion of feed as the severity of lameness increased¹⁵. Around 27.6% of commercial intensively-reared broilers presented leg abnormalities and 3.3% were almost unable to walk, according to a study from the UK¹⁶.

Poor leg health can be caused by a number of different factors, including bacterial chondronecrosis and osteomyelitis (BCO), sometimes referred to as femoral head necrosis^{13,17,18}, tibial dyschondroplasia^{19,20},

and viral arthritis^{21,22}. In severe cases, birds lose the ability to walk so they can't even access 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 a stocking density of around 39 - 42 kg/m² (19.5 - 21 birds/m² when slaughtered at 2 kg). Such high stocking densities negatively affect their walking ability¹⁶. Fast-growing broilers with poor leg health spend an increased amount of time sitting, and long periods of time spent on poor litter which can lead to the painful condition footpad dermatitis (inflammation and necrotic lesions on the plantar foot), as well as hock burns and breast blisters^{23,24}. The ability to walk is absolutely necessary to avoid pecking from other aggressive birds in the flock¹⁰.

Ascites

Ascites, commonly known as 'water belly', is an accumulation of fluid in the abdominal cavity²⁵. Since ascites develops gradually, the birds suffer for an extended period before they die⁹. It is a multifactorial disorder. However, the main contributor of the condition is believed to be an increased oxygen demand by the fast-growing muscle. The increase in blood pressure required to push the blood through the blood capillaries in the lung and the increase in workload for the right side of the heart results in pulmonary hypertension and ventricular hypertrophy. The increased blood pressure in the veins, liver, and abdominal vessels forces plasma fluid out of the vessels, particularly the ones of the liver, into the abdominal space^{10,26,27}. Thus, the increase in metabolic demand, coupled with exposure to environmental conditions such as temperature, lighting and ventilation, and nutritional factors such as feed form or content, all seem to promote the development of ascites^{28,29}. It is most commonly seen in male chickens and ascites mortality can range from 0 to 30% in broiler flocks³⁰. It is the main cause of carcass condemnations in UK slaughterhouses since 2003 (reaching an annual high of 2.7 million birds in 2013)³¹.

Sudden Death Syndrome

Sudden death syndrome (SDS), or 'flip-over', is a condition in which apparently healthy fast-growing broilers die unexpectedly from no apparent causes³². Birds will suddenly start violently flapping their wings, extend their neck, squawk and die within minutes³³. The condition is estimated to cause mortality of 0.8 to 4% in broiler flocks, with males predominantly affected³⁴⁻³⁶.

The cause of flip-over in broilers is still unknown. It is often associated with nutrition (high density diets)³⁷ and environmental factors (noise, lighting)³², but a growing body of evidence suggests that it may relate to broilers' high predisposition to cardiac arrhythmia³⁸. Ventricular fibrillation appears to be the immediate cause of death³⁹. Sudden death syndrome can occur as early as 2 days of age and continuing until birds reach market weight. Peak mortality usually occurs between days 21 and 27⁴⁰.

Breast Muscle Myopathies

Muscle myopathies, or diseases 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 intensive genetic selection of broilers to improve their growth rate, body weight, and breast yield⁴¹⁻⁴⁵. Deep pectoral muscle myopathy has been studied for some time, while other abnormalities such as white striping, wooden breast and spaghetti meat have not been reported until recently^{46,47}.

Deep pectoral myopathy (DPM) 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 tissue⁴⁸. The occurrence of DPM in broilers is estimated to vary between 0.02% and 1.9% (around 1.5 to 140 million birds)^{49,50} with more cases reported in faster growing strains and in males⁵¹.

Wooden breast (WB) is characterised by necrotic muscle fibres and the replacement of muscle with connective tissue, water, and fat, causing a palpably firm consistency of the breast muscles⁵². WB often occurs with the condition known as 'white striping' (WS)⁵³. WS is found on the outside of the pectoral major muscle. It is visible as white striations running parallel to the muscle fibres⁵⁴. These striations are found to be adipose (fat) tissue⁵⁵. Even though the cause of both conditions is unclear, several studies have suggested that their pathogenesis is associated with several biological processes, such as localised hypoxia within the muscle, oxidative stress, increased intracellular calcium build-up, and repair of cellular damages^{46,56-58}.

Although the incidence rate of WB in commercial chickens is unknown, it is becoming increasingly common⁵⁷ and flocks that are affected have up to 50% of birds with the disease^{53,59}. Affected chickens are most likely to be those that grow faster, have greatest feed efficiency, heaviest body weight and higher breast muscle yield^{43,45}. A recent study found that WB is associated with an impairment of gait scores, and may thus be partly linked to the common walking abnormalities in broilers⁴⁵.

Meat that comes from birds suffering from WB or from those with both conditions are found to have a harder texture, impaired ability to hold water, and poorer nutritional value⁶⁰. WS has found to increase the fat content and decrease the protein content of affected fillets⁶¹ and also impacts the general appearance of the breast meat⁵⁴. These conditions are forcing the downgrading of meat due to the lack of aesthetic appeal⁴³ and it is estimated that the incidence of these conditions can result in an excess of \$200 million (€ 176 million) per year lost in the US⁴⁷. The disposal of breast muscles by poultry processing plants in Poland due to DPM causes annual losses of € 2 million⁴⁹.

More recently, a new muscular abnormality termed as 'spaghetti meat' (SM) has emerged⁶². SM, often associated with WS, is characterised by poor muscle cohesiveness due to the immature intramuscular connective tissues. The affected muscle is so loose in structure that the muscle fibre bundles can be pulled away easily with the fingers, like spaghetti^{44,46}. Broilers displaying higher breast size seem to be more prone to be affected by SM⁶².

While there is a clear meat quality issue, the pain or discomfort caused by these breast muscle myopathies is yet to be determined. While WB is apparently asymptomatic, clinical signs such as outbulging of the lateral forebreast and decreased wing movement have been noted in severely affected birds⁵². Also, the degenerative process leading to WB is similar to Duchenne muscular dystrophy in humans⁵², a painful and debilitating condition^{63,64}. Thus, it may be possible that broilers affected with WB also experience similar pain and discomfort.

Stocking density

Stocking density is considered one of the most important factors for the welfare of broilers. Although there are no doubts that keeping broilers at high stocking densities compromises health and welfare, birds continue to be given very little space to move around with varying degrees of density allowed by EU law and in specific countries.

The EU Broiler Council Directive 2007/43/EC outlines the minimum required environmental conditions for maximum stocking densities. According to the Directive 2007/43/EC, the maximum stocking density in a holding or a poultry house on a holding should not at any time exceed 33 kg/m². A higher stocking density of a maximum of 39 kg/m² is permitted with a set of environmental requirements. The stocking density may rise to a maximum of 42 kg/m² if cumulative daily mortality rate is low. Environmental conditions include ventilation, heating and cooling systems to maintain the appropriate temperature, humidity and CO₂ and NH₃ concentrations ¹.

However, some Member States have chosen to go beyond these requirements by implementing more stringent legislation or standards. Maximum stocking densities have been set in Austria (30 kg/m²), Denmark (40 kg/m²), Sweden (36 kg/m²), Germany (39 kg/m²), and the UK (39 kg/m²) ².

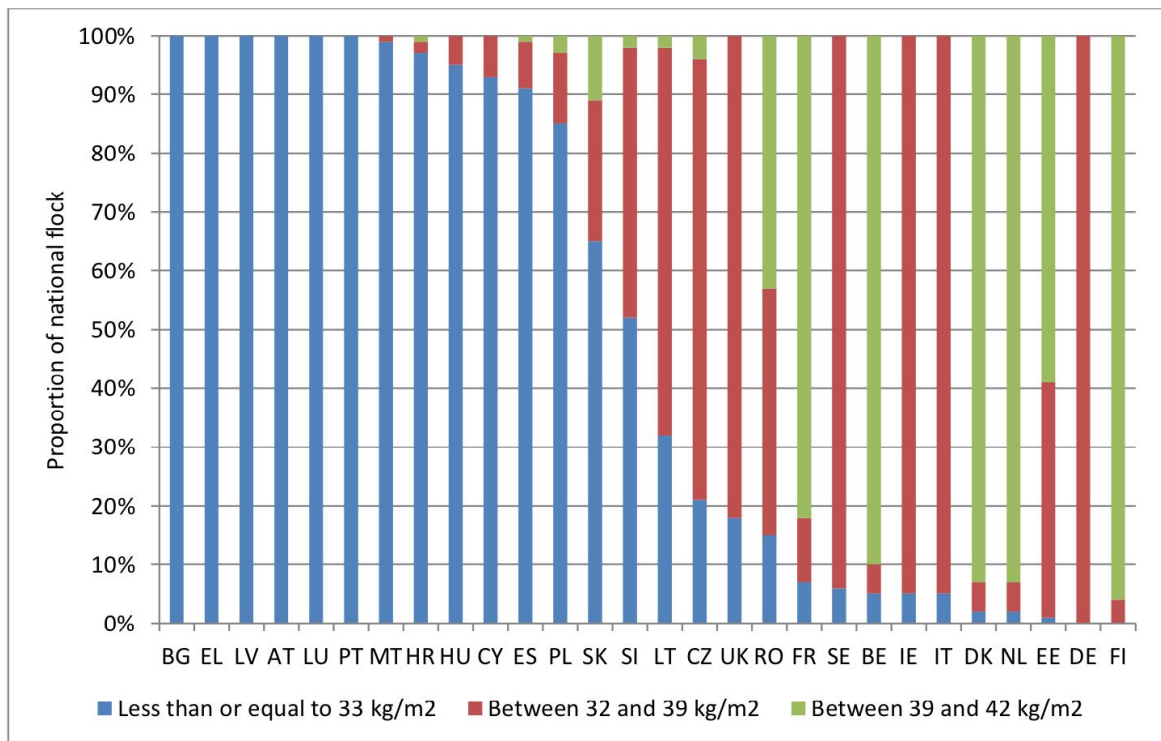


Figure 1: Proportion of national broiler flock by stocking density in each European Member State ⁶⁵.

In five Member States (Austria, Greece, Latvia, Luxembourg and Portugal) all commercial broilers are kept at stocking densities up to 33 kg/m². In Croatia, Cyprus, Hungary, Malta and Spain more than 90% of the national flock is kept at this stocking density, as is 85% of the Polish broiler flock ⁶⁵.

Just over four-fifths (82%) of French commercial broilers are stocked at the top stocking density of 39 - 42 kg/m². While the stocking densities permitted in the Netherlands are the same as those set out in the Directive, there is an additional requirement on those stocking at between 39 kg/m² and 42 kg/m² to maintain a low score for foot-pad dermatitis ⁶⁵.

High stocking density in broiler sheds restricts the chickens' behaviour and causes health problems. Studies have shown that higher stocking densities decrease locomotor activity, stretching behaviour, walking, eating, preening, and shaking ^{66,67}. Jostling of other birds, disturbance of resting birds, birds climbing on top of one another ^{68,69}, and fights ⁷⁰ are also observed at higher stocking densities. The restriction of space and locomotor activity in crowded sheds can reduce the consumption of feed, which is followed by a decrease in final body weight ⁷¹⁻⁷³. Carcass quality may also be compromised due to scratches, bruising, poorer feathering, and condemnations ^{74,75}.

High stocking density leads to greater litter moisture, increased microbial activity, and increased temperature and ammonia concentration which can give rise to hock burn, foot-pad dermatitis, breast blisters ^{9,23,73,75-78} and respiratory diseases ⁷⁹. High levels of ammonia can compromise their immune system, increasing the birds' vulnerability to infections ⁸⁰.

Light

The majority of broilers produced in the UK are reared in environmentally controlled buildings without windows, where artificial light is provided. Light is an important factor as it allows the bird to establish rhythmicity and synchronise many essential functions like feeding and digestion, body temperature and reproduction ⁸¹. Under natural conditions, birds are active during the daytime light period and rest and sleep at night when it is dark. There is an increase in activity around dawn and dusk, as the birds forage for food. Long day lengths can cause sleep deprivation, which can negatively impact broiler welfare ⁸². Despite this knowledge, producers routinely utilise almost continuous light regimes, at low light intensities, with the notion that these lighting schedules decrease activity and increase feed intake, consequently maximising growth rate and production.

According to the Council Directive 2007/43/EC, all poultry buildings should have lighting with an intensity of at least 20 lux during the lighting periods, measured at bird eye level and illuminating at least 80 % of the useable area. Lighting must follow a 24-hour rhythm and include periods of darkness lasting at least six hours in total, with at least one uninterrupted period of darkness of at least four hours from 7 days of age onwards until three days before slaughter ⁸³.

Low light intensity has a negative effect on broilers' welfare as it impacts activity level, behaviour patterns, performance of comfort behaviours, foot and eye health ⁸⁴⁻⁹¹. Broilers perform more active behaviour, such as foraging, under the brightest light available (200 lux) ⁹². Also, provision of natural light reduces the percentage of time that broilers spend lying and improves leg health ⁹³. It has been shown that lighting programs with a minimum intensity of 50 lux stimulate higher diurnal activity levels in broilers without negatively affecting weight gain ⁹⁴.

Continuous lighting is detrimental to broilers as it has been shown to decrease activity and comfort behaviours such as preening and wing-shaking^{95,96}. Fearfulness (shown by a behavioural measure) is greater in broilers reared under continuous light compared to those reared with a proper dark period^{95,97–99}. Normal ocular development in the chick requires a minimum of four hours of darkness per day, provided at the same time of the day without interruption¹⁰⁰. Constant lighting results in the disruption of behavioural rhythms for broiler flocks, and four hours of darkness may not be enough to ensure full rhythm development⁸².

Research has shown that giving broilers an uninterrupted dark period resulted in decreased mortality¹⁰¹, leg⁹⁷ and foot problems⁹⁶, rates of sudden death syndrome^{32,102} and ascites¹⁰³, and improved broilers' antioxidant status and nonspecific immunity¹⁰⁴. Given these clear impacts on health and welfare, current dark periods should be increased from the standard four hours to a minimum of six hours and must be continuous.

Environmental enrichment

Environmental enrichment is defined as "an improvement of the environment of captive animals which increases the behavioural opportunities of the animal and leads to improvements in biological function"¹⁰⁵. Broiler houses are usually barren environments, which contribute to the low behavioural activities of broilers. The addition of enrichment items has been shown to increase activity levels¹⁰⁶.

For alternative breeds with outdoor access, providing access to perches inside the house increased the percentage of time the birds spent standing¹⁰⁷. Provision of perches has been associated with the reduction of disturbances (pushing and trampling)¹⁰⁸ and in the number of hock burns and foot pad dermatitis¹⁰⁹. Broilers have been observed to use perches from as early as six days of age, and on average from nine days of age¹¹⁰. Platforms have been found to positively affect leg health, as birds with access to platforms have improved gait scores and lower prevalence and severity of tibial dyschondroplasia¹¹⁰. Provision of panels has been observed to reduce disturbances during rest¹¹¹ and also serve as shelter areas¹¹².

Provision of straw bales and pecking objects, such as bundles of string, in environments with natural light affect walking ability and decrease time spent lying down^{93,113}. Provision of multiple enrichments results in higher overall activity levels and a higher likelihood of birds engaging with the enrichment items¹¹³.

Slaughter

In Europe, the welfare of animals—including poultry—at the time of killing is protected under Regulation (EC) 1099/2009. This regulation requires the use of approved stunning methods for poultry in EU and extends to slaughterhouses in third countries that export meat to the EU. Today 80% of broilers in the EU are slaughtered in an electrical water-bath system¹¹⁴. With this method of slaughter, conscious birds are hung by the legs upside-down on a moving metal shackle line and their heads pass through an electrified water-bath before having their throats cut¹¹⁵.

Water-bath stunning was created to allow fast processing of birds, however there are many welfare problems associated with this stunning system. The birds' legs are compressed during shackling, causing

pain¹¹⁶, especially in birds with thicker legs or suffering from painful lameness due to leg diseases, bone dislocations or fractures. Bird inversion increases the levels of stress that poultry are subjected to during the shackling process¹¹⁷. Rough shackling can significantly contribute to wing flapping leading to dislocations and bone breakages. Pre-stun electric shocks can occur if the birds' wings make contact with the water-bath before their heads do^{114,118,119}. It has been shown that electrical stunning is not completely effective. Occasionally some birds are not properly stunned because they miss the stunner by raising their heads and missing the water¹²⁰, or when their heads do enter the water-bath but the currents are too low to induce unconsciousness^{115,121}.

Controlled atmosphere stunning (CAS), or gas stunning, has become increasingly common during the last 20 years in Northern Europe, mainly as a result of the animal welfare and product quality advantages in comparison with water-bath stunning¹¹⁴. It works by exposing broilers to either a mixture of inert gases (nitrogen and argon) or concentrations of carbon dioxide (CO₂), causing a reduction in available oxygen (O₂) thus inducing loss of consciousness in the birds. In comparison to electrical water-bath stunning, one major advantage of CAS is that uncrating and shackling of live poultry can be completely eliminated, hence avoiding pre-slaughter handling-induced fear, anxiety, distress, suffering and pain in conscious birds^{119,122}. However, carbon dioxide is an acidic gas, causing the birds to experience some discomfort and stress before loss of consciousness if inhaled at high concentrations^{118,123}. In multi-phase stunning systems, the birds are first exposed to relatively low concentrations of CO₂ (<40%) to be less aversive, and then, once the birds are unconscious, they are exposed to a higher concentration (80%–90%), which is sufficient to induce a deeper state of unconsciousness or death^{114,123}.

Low atmospheric pressure stunning (LAPS), a newly-approved method of killing poultry under EU law, kills birds with a slow, continuous, controlled decompression causing a gradual reduction of oxygen tension in the chamber, leading to progressive hypoxia^{124,125}. Loss of posture, regarded as a behavioural marker for loss of consciousness, occurs on average at 80 seconds¹²⁶. The major welfare benefits of LAPS over electrical water-bath stunning systems include no handling of live birds and no live shackling (since the birds are stunned in the modules used to transport them), no risk of pre-shocks, and no risk of ineffective stunning as LAPS reliably and irreversibly stuns all the birds^{125,127}. Some researchers consider LAPS to be superior than CAS since LAPS does not use any gases during the stunning process, being safer for humans in the area¹²⁸ and because it is a less aversive method to the animals. There is also potential for small slaughterhouses to convert to this system more easily than to CAS.

Higher welfare breeds

The use of higher welfare breeds accounts for less than 5% of total number of broilers slaughtered in the EU². However, higher welfare breeds represent 90% of the fresh retail market for chicken in the Netherlands, and it is estimated that by 2020 all chicken meat sold in retail grocery stores in the Netherlands will be from higher welfare production schemes. In the UK, higher welfare breeds represent almost 10% of broiler production, while in France the Label Rouge higher welfare breeds make up 15% of the market share¹²⁹.

The breeds currently acceptable for use under the RSPCA welfare standards for meat chicken include the JA757, 787, 987, Ranger Classic, Rambler Ranger and the Ranger Gold. The most commonly-used breed is the JA757.

Higher welfare broilers have lower mortality rate than typical commercial fast-growing broilers^{130,131} and are less susceptible to leg disorders and heart problems¹³². Higher welfare birds are more active, and perch, walk and scratch more than conventional breeds. Fast-growing broilers spend more time sitting on the floor, eating, and drinking than higher welfare birds^{133–135}. Although fast-growing broilers are motivated to perform their natural behaviours if their environment allows for this, their physical ability to perform some behaviours becomes increasingly restricted as they age, most probably because of their heavy weight^{7,136} and the high stocking densities observed in conventional production systems¹³⁷.

It is believed that selection for rapid growth reduces immune-competence and increases susceptibility to diseases¹³⁸. Under experimental conditions, higher welfare birds infected with *Escherichia coli* were less affected compared to fast-growing birds¹³¹. A study done in the Netherlands showed that the overall amount of antibiotics used and the frequency with which antibiotics are used are higher in broiler farms with conventional breeds compared to farms with higher welfare broilers¹³⁹. The Dutch broiler sector observed a 30.1% decrease in antibiotic use in broiler farms in 2016, compared to 2015, due to the fact that Dutch poultry farmers have more often chosen higher welfare broiler breeds¹⁴⁰.

Conclusion

The cost of cheap chicken is paid for with the suffering of fast-growing birds on a mass scale living in large and cramped sheds lacking in environmental stimulation, and experiencing poor slaughter practices. The impact of faster growth and enlarged breast muscle—driven by economic factors—is highlighted by the extensive list of diseases these birds are becoming increasingly predisposed to suffering.

However, 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 slaughter conditions using multi-phase CAS, we would see an improvement in the level of welfare for the billions of chickens farmed for meat production every year.

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