ACTA SCIENTIFIC NUTRITIONAL HEALTH

Volume 3 Issue 7 July 2019

Short Communication

Forces Influencing Poultry Production

Matthew Oldnall*

Poultry Specialist at MASSEY BROS (FEEDS) LTD, UK

***Corresponding Author:** Matthew Oldnall, Poultry Specialist at MASSEY BROS (FEEDS) LTD, UK.

Received: May 16, 2019; **Published:** June 05, 2019

Forces influencing profitable poultry production with focus on intensive broiler production

The human population is drastically increasing with a projected plateau at 9 billion people globally by 2050 [1]. This has meant political and economic pressures have been placed upon all forms of agriculture. Broiler production is a clear and definitive example of how this pressures has led to the creation of forces which drive production and proven to have positive effects in terms of agricultural output as well as economic gain both commercially and at consumer level. The term broiler comes from the phrase 'to broil' which means to cook meat by exposing it to direct heat [2] and was given due to the small size of the birds, that meant they could easily be prepared due to the size being able to be cooked in order to serve a half carcass to a person. This has changed over the years with the forces driving production which has meant that birds grow to larger weights and in less time improving both the economics of the practice as well as the food produced requirement of modern society. Addendum 1 shows the improvement in bird size with a 1957, 1977 and 2007 birds all feed the same diet and grown to 55 days.

The forces which are the major driving forces of broiler production are nutrition, management practices, genetics and disease prevention or biosecurity. Historically broiler production began with small scale farmers growing few birds for subsistence purposes or small scale business transactions. These practices did not involve scientifically balanced diets, detailed management practices or strict breeding protocols. The early broiler production in the United Kingdom was limited due to the limited per capita consumption of both meat and eggs -100 eggs per capita [3].

Historical events mainly the war led to more focus being placed on poultry as a staple food source due to the food rationing implementations. The broiler industry officially began in 1954 in the United Kingdom with focus on meat producing birds with all previous production being dual purpose birds and as such complete differentiation between meat and egg production. Anthony Fisher is known as the father of the UK broiler industry after he smuggled broiler eggs into the country after a visit to the United States of America and begun Buxted Chicken [3]. This made broiler birds the norm commercially by 1960. Through scientific advancements the ability to practically select for improved genetics with the trials beginning as recent as 1986. This time frame shows how drastically the poultry industry has grown in a short time frame compared to other extensively produced livestock species. The increased selection of birds led to the beginning of diet formulation with formal diets being introduced as well as the recognition of disease being a major factor influencing production. The broiler industry is still constantly undergoing scientific studies to constantly improve with focus on the main forces – nutrition, genetics, management practices and disease control.

Genetic improvement is the single biggest force which has driven the broiler industry too where it is today with it stated that the origins of the modern day broiler is the Jungle Fowl or Gallus Gallus [4]. It can stated that 85% of the bird size, growth rate and food conversion improvement over the last 50 years is due to genetic selection [5]. The broiler industry is dominated by several major breeder companies – Aviagen, Cobb-Vantress and Hubbard. This companies almost exclusively control the commercial genetics of broilers worldwide. Through phenotypic mass selection the end product of the commercial broiler is achieved. Pure bred Great Grandparent stock are cross to create F1 hybrids which undergo further selection to create the F2 generation or parent stock. This parent stock gives rise again through hybrid vigour to the modern day broiler. Along with the phenotypic selection, quantitative genetics began and has also had a major role in the breeding schemes of these companies. Quantitative genetic selection has since led to BLUP breeding programmes across all species and poultry is no different as well as further genetic techniques such as Marker

assisted selection amongst other direct gene selection. Laughlin, 2007 also states that utilising the BLUP system has allowed breeder companies to identify progeny breeding stock sooner and thus shorten the generation interval even further.

The importance of quality genetics in modern day intensive broiler production is immense, as all the other major driving forces are there to further exploit genetic potential of the birds rather than be sole forces on their own. It is always worth stating the simple Quantitative genetics equation described by Conner and Hartl [6].

P = G + E

Phenotype = Genetics + Environment)

This states the phenotypic outcome will be a 50:50 relationship between the genetic ability of the bird as well as the environmental interactions on the genetics. All the other major driving forces in broiler production are about manipulating the environmental conditions which shows the genetic ability of the bird is of extreme importance. The implications commercially of the genetic advancements in broiler production is positive as selection for feed conversion and growth are of utmost importance however as it does have its draw back due to genetic linkage and interactions [7]. The main drawbacks are due to the increased growth rates, the birds have an increase in mortalities due to an increase in leg problems as well as other increase growth rate disorders such as ascites. However through the years selection against this drawbacks has become a vital part with the industry. This issues are also negated to some extend via management practices as well as nutrition which is discussed later in this essay. Another important thing to note when discussing genetic selection in broilers is the intended consumer market, with the different breeder companies having different priorities in terms of consumer outcomes. In the United Kingdom and the United States the leaner meats and portion market is of utmost importance with emphasis on breast tissue yield, in developing countries these niche portions are not of as much importance when determining the breeding strategy for production of broilers for those countries, for example in Zimbabwe and rural Africa the lesser cuts such as offal, whole carcass and feet have as much commercial significance in terms of market revenue as the portioned cuts do in the developed world.

Nutrition is the next important force driving intensive broiler production and is a science on its own. Kleyn, 2013 describes nutrition as the process of providing a population of animals with a nutrient sufficient diet in order to enable the animal to meet its maintenance, metabolic function and immune system requirements. The impact of nutrition on broiler production is substantial as by definition it enables the bird to perform all its metabolic requirements to exploit genetic potential and according to University of Pretoria, 2015 can have as much as 15% effect on the total growth of broilers due to the fact broilers are 100% reliant on the diet for all there nutritional requirements [8]. This has led nutritionist to perform a multitude of experimental trials to obtain the best possible diet which include raw material testing on all raw products to know exactly what the nutritional content is in each material. Nutrition has undergone several major advancement in in the previous couple decades with the traditional broilers scratching around and feeding off natural food chains. The most important of these advancement is nutritional modelling, with the modern day model being least cost formulation [8], which enabled the development of phase feeding diets, the major difference with UK broiler diets opposed to America and Africa is the inclusion of wheat as the energy raw product opposed to maize used in other countries. Maize as a raw product does have a better energy profile to wheat but the economic implications of using maize are vast due to its sheer expense. The single most important aspect of poultry nutrition is feed intake, with the birds intake increasing as it gets older. However, the nutritional requirement in order to establish optimum growth is higher during the younger days of the bird's life when intake is lower, and hence phase feeding. Phase feeding can be described as a multitude of diets given over a broilers life in order to meet the nutritional requirement of the bird at that age [5], this means the starter crumb will be highly nutrient dense with high protein content and lower energy content required to meet the maintenance requirements and through the various phases of the diet decreasing the protein content and increasing the energy content of the diet with the increasing energy for maintenance requirement of the bird. Genetics once again proves its power as a driving force with the breeder companies detailing the nutritional requirements of the birds, these companies are moving towards Nutrigenomics, in order to exploit epigenetic effects within the birds for improved performance [8]. Not only does the nutrient content of the diet change throughout the bird's life as does the physical form of the feed. Pelleting was another major advancement in the field of nutrition as it meant the amount of feed consumed by the bird could be managed to a small extent. This matches up with the phase feeding with the initial diet – starter crumb- being a mash form diet which is easily consumed by young flocks. As the birds get older the diets move to a pellet form with different pellet sizes being possible for different phases of the diet. Pellets size has a direct correlation on weight gain, feed conversion ratio, feed intake and gizzard weight [8] and as such size and quality of the pelleting is important factor driving nutrition in broilers.

The animals feeding behaviour also has an effect on nutrition, studies have shown [8] that birds take three times as long to consume mash as they do pellets and this in turn means by using mash as a starter ration we can control intake. Other obvious factors such as taste and appearance of the ration also play a role, the biggest practical issue with these ration changes during production is the taste and appearance do differ between rations including the pelleted rations and this sometimes means that changing over from one ration to another can cause depressed feed intake in the flock until the birds have become adjusted to the new ration. Depression in feed intake has a knock on effect in that during the depressed feed intake, growth of the birds in depressed which has economic ramifications. These effects can however be negated in some extend by supplying the birds with a multivitamin solution in their drinking water effectively aiding in there nutrient intake during these perceived times of stress.

Management practices are divisive yet strong forces which drive broiler production, as they will be differ between farms and differ between companies. The basic principle behind management practices is the manipulation of the environment to allow for optimum production. These practices involve temperature regulation, lux levels and dark period length manipulation, ventilation, feeding regimes, stocking density, relative humidity, and gaseous compounds build up as well as litter management. The practices is closely link to the genetic component of broiler production as there are clear differences between how to brood chicks from different parent flocks in order to achieve the genetic potential the birds contain.

Although there are differences between farms the breeder companies do issue all growers with their recommendations for which will aid optimal production [9,10] as well as these there are laws governing the extent to which the environment may be manipulated. These welfare laws are based on the principles of the 5 freedoms all animals have an intrinsic right to: Freedom from hunger and thirst, freedom from discomfort, freedom from pain, injury or disease, freedom to express normal behaviour and freedom from fear and distress [11]. Welfare laws are an important driving force in the UK broiler industry due to consumer demand for ethically raise animal products, and as such the major supermarkets will only purchase broilers from farms which have undergone these stringent audits from organisations such as Integra and Red Tractor [12]. The welfare rules do bring up debate amongst broiler producers due to different ideologies amongst growers with regards to the ideal environmental controls for optimum growth, what is important to note is some welfare regulations are specific to the United Kingdom which have economic impacts on the producers. One such legislation is the requirement for all broiler houses to contain windows [13] in order to allow the birds a minimum of 6 hours normal daylight a day. The cost to capital expenditure is high due to the need for purchase of windows and installation however there is debate as to the implications in terms of production. The debate that arose in the UK, is it the only country forced by welfare laws to use windows for natural lighting and as such the breeder companies do not breed birds for natural lights as there global market does not require this and is of far greater commercial revenue to the companies. The different management strategies across different farms will play a large role in the farms economics, an example of this is litter management. The type of litter and the amount of top up bales used above the legal limit (1.5 bales per 1000 birds) [12] in order to keep the litter acceptable will have an effect on the percentage of footpad dermatitis, hock burns and breast blisters all which have financial implications to the farm and industry as a whole.

Management practices also extend into another major force influencing broiler production in the United Kingdom and the rest of the world – Biosecurity. Biosecurity can be defined as methodologies and control process put in place in order to prevent disease and other external organism which may transmit disease access into the broiler houses [14]. Bio-security is fast becoming one of the major driving forces behind broiler production in the UK as well as the rest of the world. It has an influence from the very concept of modern day farms with it influencing the designs of farms through to final marketable product. By increasing bio-security and thus decreasing the risk of contamination by pathogens one can further aid creation of the optimal environment for flocks to produce. Biosecurity has two major advantages in production with the first being if the flock is slightly immune compromised with an underlying illness such as Campylobacter, Salmonella, bacteria arthritis and femoral necrosis the birds health with suffer which in turn will effect production figures and thus the profitability of the enterprise. This illustrates the need for biosecurity between broiler houses on farm as if one shed is infected the disease can be transmitted by the stockmen between sheds. With disease being rife such as Avian Influenza being prevalent and currently a major issue across the UK and Europe bio-security between farms is also of utmost importance. This diseases as with others are easily transmitted between farms with AI being transmitted by wild birds and movement of people between farms. AI is the perfect example as to the economic driving force forcing the broiler industry into improved bio-security due to the nature of it being a notifiable disease. If AI is confirmed on any farm the entire flock will need to be culled and incinerated with major economic losses. Bio-security has been

a recent development in intensive broiler production with it becoming a very topical concern within the last decade but now carries the same driving force of other factors such as nutrition, genetics and management practices and has become a topic of scientific study on its own. Bio-security protocols will vary between farms due to implementation approaches and strictness between the lower alert levels between farms however the department of environment, food and rural affairs [15] has legislation as to the different alert levels when there is disease outbreak – this have an escalating scale and follow a robot scale of green, amber and red alerts.

To conclude, quantitative genetics simply states that the phenotype of any broiler is related to the interaction between the genetic potential and environment of the bird. This clearly allows for forces which drive profitability of any broiler unit. The four major forces all have a contribution in the final bird produced with genetics being the major driving force behind profitability and nutrition, management practices and bio-security all major forces used to manipulate the environmental aspect of the phenotype. These forces are scientific fields in their own right and much deeper and further discussion into the fields is possible, however this highlights the importance of them and their ability to manipulate the broiler markets profitability. These forces are the major forces which govern broiler production and although there capital cost if often high the advantage in production performance far outstrips the initial capital, and with the increasing global population and increasing need for nutritious affordable feed sources exploitation of the genetic potential of broilers via correct breeding, improved nutrition, bio-security and management practices the UK has the ability to solidify its ability to be self-sustaining through future global food shortages in terms of broiler meat.

Bibliography

1. Charles H., *et al*. "Food Security: The Challenge of feeding 9 billion people". *Science* 327.5967 (2010): 812-818.

2. Oxford dictionary of English. 3rd edition. Oxford University press (2010).

3. Harper Adams University. "The development of the UK poultry industry. Forces influencing poultry production A7051 (2016).

4. Laughlin k. "The evolution of genetics, breeding and production". Temperton fellowship, Harper Adams University. Report 15 (2010).

5. University of Pretoria. "Broiler housing and management". Poultry nutrition and management PVK420 (2015).

6. Conner J and Hartl D. "A primer of ecological genetics". Conneticut: Stamford (2004).

7. Emmerson D. "Commercial approach to genetic selection for growth and feed conversion in domestic poultry". *Poultry Science* 76.8 (1997): 1121-1125.

8. Kleyn R. "Chicken nutrition: A guide for nutritionists and poultry professionals. United Kingdom: Packington (2013).

9. Aviagen. Ross 308 Performance objectives (2014).

10. Cobb – Vantress. Broiler performance and nutrition supplement (2015).

11. Kristensen HH., *et al*. "The preferences of laying hens for different concentrations of atmospheric ammonia". *Applied animal Behaviour Science* 68.4 (2000): 307-318.

12. Red Tractor. "Chicken standards: Broilers and Poussin. Red Tractor (2014).

13. Commission regulation (EU) No 2007/43/EC of 28 June 2007 laying down minimum rules for the protection of chickens kept for meat production. Official journal of the European Union L182/19.

14. Meyerson LA and Reaser JK. "Biosecurity: Moving towards a comprehensive approach to biosecurity is necessary to minimize the risk of harm caused by non-native organisms to agriculture, the economy, the environment and human health". *Bioscience* 52.7 (2002) 593-600.

15. Department of environment, food and rural affairs. Biosecurity and preventing disease. Department of environment, food and rural affairs (2005).

Volume 3 Issue 7 July 2019