

Some Current Factors and Problems that Influence Turkey Production and Health

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Abstract

Currently several factors and problems are influence the turkey production worldwide. These include strong global competition, continuous changes of consumer perceptions with regard to food safety, animal welfare and environmental protection. The loss of consumer confidence and trust in the quality and safety of poultry meat and poultry products will remain a major challenge. Many human foodborne bacterial infections are linked to poultry. Control and/or elimination of these organisms present a great challenge. The development of antibiotic resistant bacteria will also be a continuous public health hazard. The future concept of animal health will cover not only the absence of disease in birds, but also the relationship between the health of animals and their welfare. It will also take into account social, economic and ethical considerations, as well as support the achievement of a high level of environmental protection.

Emergence and re-emergence of infectious turkey diseases will remain an important non-ending challenge. Currently, only a few authorised pharmaceutical veterinary products will be available for the treatment of turkeys as food producing animals. The development of efficient vaccines against bacterial infections will lead to a reduction of the use of antibiotics and subsequently will reduce the development of resistant bacteria.

Genetic resistance and selective breeding to improve production traits and health is a long-standing goal of the turkey industry. Improvement of rearing technology, management and nutrition will help to maintain bird comfort.

Finally, farmers, veterinarians, stockholders and all other partners involved in the production chain need to share more responsibilities.

Keywords: *Turkey Production; Antibiotics; Poultry*

Introduction

The modern turkey industry aims at high production and better quality at a low cost. This, in addition to an increase in the demand for poultry meat, necessitates constant, efficient and goal-oriented healthcare to prevent the development of diseases. In the future, several challenges and problems, in addition to the ones already existing, will face everybody involved in the turkey production chain. These will includes, strong global competition; changes in social, political and consumer perceptions about food safety and animal welfare; increase of environmental protection issues; a steady increase in the cost of feed; the emergence of new and unforeseen diseases, and new legislation that will serve to regulate the related issues. The present paper describes the main challenges facing the turkey production.

Strong global competition

Strong global competition and varying production costs in various regions will lead to an increase in the global movement of turkeys and poultry products.

Rank	Country	Production (1000 MT)
1	USA	2,600.00
2	EU-27	1,920.00
3	Brazil	470.00
4	Canada	170.00
5	Russian Federation	105.00
6	Mexico	9.00
7	South Africa	8.00
8	China	6.00

Table 1: United States Department of Agriculture.

Source: <http://www.indexmundi.com/Agriculture/?commodity=turkey-meat&graph=production>.

This, however, increases the risk of introducing diseases to areas that are now considered to be free from such diseases. The steady increase in the cost of feed will accelerate the global trade. In addition, the increase of biofuel and biogas production will reduce the available land for food grains and feed production, leading to a considerable increase of feed costs for animal production. In the future, the feed industry, however, will also be forced to take more responsibility not only for the quality of the feed ingredients, but also to ensure that no avian pathogens and unwanted contaminants or residues are present in the feed. Furthermore, climatic changes and limited water resources also need to be seriously considered, as they will have an influence on the cost of production [1].

Food safety

The loss of the consumer’s trusts and confidence in the quality and safety of poultry meat is a further challenge. Turkey meat can harbour different food borne pathogens. Many reports from recent years have shown that different *Salmonella serovars* and *Campylobacter spp.* are the most common causes of human food borne bacterial diseases linked to poultry.

In countries with intensive poultry production it has been determined that under current conditions it would be very difficult to eliminate *Salmonella* contamination in poultry production. However, the possibility to eliminate host specific serovars and to reduce non-host specific invasive serovars (paratyphoid) is realistic [2,3].

In November 2003, the European Parliament Council Regulation 2160/2003/EC [4] on the control of *Salmonella* and other specified food-borne zoonotic agents was passed. This regulation covers the adoption of targets for the reduction of the prevalence of specified zoonoses in animal populations at the level of primary production, including meat turkey. After the relevant control programme was approved, food business operators must have samples taken and analysed for zoonoses and zoonotic agents. The competent authority should sample the flocks also.

In June 2008 commission regulation (EC) No 584/2008 of implementing Regulation (EC) No 2160/2003 of the European Parliament and of the Council as regards a Community target for the reduction of the prevalence of *S. enteritidis* and *S. typhimurium* in turkeys was put into force [5]. The Community target is the reduction of both *Salmonella serovars* to the maximum percentage of fattening and breeder flocks remaining positive to 1% or less by 31 December 2012. The testing scheme necessary to verify progress in the achievement of the Community target is set out in the Annex of this regulation and applied from 1st January 2010. All flocks of fattening and breeding turkeys

should be investigated on the initiative of the food business operator within three weeks before the birds are moved to the slaughterhouse. In fattening turkeys at least two pairs of boot/sock swabs shall be taken. For free range flocks of turkeys, samples shall only be collected in the area inside the house. All boot/sock swabs must be pooled into one sample.

In addition, flocks of breeding turkeys should be investigated during the rearing at day-old, at four weeks of age and two weeks before moving to the laying phase: During the laying period they are to be investigated at least every third week at the holding or at the hatchery.

Sampling by the competent authority in breeding turkey flocks with at least 250 birds should be carried as follows:

- Once a year, all flocks on 10% of holdings with at least 250 adult breeding turkeys between 30 and 45 weeks of age but including in any case all holdings where *S. enteritidis* or *S. typhimurium* was detected during the previous 12 months and all holdings with elite, great grandparents and grandparent breeding turkeys; this sampling may also take place at the hatchery,
- All flocks on holdings in case of detection of *S. enteritidis* or *S. typhimurium* from samples taken at the hatchery by food business operators or within the frame of official controls, to investigate the origin of infection.
- Each time the competent authority considers it necessary.

Sampling by the competent authority in holdings with at least 500 fattening turkeys should be carried as mentioned by breeding flocks.

Campylobacter infections are now the leading cause of human bacterial gastroenteritis in many developed countries. In human Campylobacteriosis are steadily increasing and have already exceeded the number of salmonellosis cases in some EU countries [6,7].

Comparative food-borne illness rates (persons/100,00 population) in USA and EU

Illness	US	EU
Campylobacteriosis	14.3	55.5
Salmonellosis	16.42	22.2
Listeriosis	0.25	0.41
Pathogenic <i>E. coli</i>	1.12 (0157) 1.16 (non 0157 STEC)	1.15 (VTECs)

Table 2: Source: <http://achesongroup.com/2014/03/foodborne-illness-us-eu-compare/>.

Campylobacter infections in humans are mainly transmitted by contaminated food. No evidence has been found either for vertical transmission or for horizontal transmission from one flock to the next via persistent house-contamination. However, since the organism has been detected in the intestines of most slaughtered poultry, the major route for campylobacter contamination of poultry appears to be the horizontal transmission from the environment. Specific flocks that become infected show rapid rate of intra-house transmission and a high isolation rate from caecal swabs, water and litter.

Investigations indicated that the external campylobacter load per chicken is increasing during transport, de-feathering and evisceration, and decreasing at the other processing steps studied, with an overall reduction of the mean load from production-to-consumption of about 4 to 5 logs. Good hygienic practice protocols should be prepared and strictly followed in all stages of production. Biosecurity should be improved throughout the production chain. Since *Campylobacter* is found in the environment, hygienic barriers should be constructed to keep them outside the house [8]. Controlling these foods borne organisms requires beside legislations a broader understanding of how microbial pathogens enter and move through the food chain, as well as the conditions that promote or inhibit growth for each type of organism.

Changes in social, political and consumer perceptions antibiotic resistant and associated problems

The development of antibiotic resistance in bacteria, which is common in both, animals and humans, is and will also be a continue to be a continuous public health hazard.

It is generally known, that supplementation of poultry feed with antibiotic growth promoters (AGPs) improves performance of live-stock. The effect of AGP on gut flora results in improvement of digestion, better absorption of nutrients, and a more stable balance in the microbial population. As consequence, the prevalence and severity of intestinal disorders are reduced. However, AGPs also can increase the prevalence of drug-resistant bacteria. Based on "Precautionary Principle" and experiences made in some European countries, the EU completely banned the use growth-promoting antibiotics in feed of food producing animals by January 2006. Field observations in Europe showed that the poultry industry faced several problems after the ban of AGPs. The impact of the ban has been seen on the performances (body weight and feed conversion rate) as well as on the rearing husbandry (wet litter and ammonia level), animal welfare problem (foot-pad dermatitis) and general health issues on the birds (enteric disorders due to dysbacteriosis and clostridial infections). Investigations indicate that competitive exclusion, prebiotics, probiotics, enzymes, and acids can impact the incidence and severity of clostridial infections in poultry. According to Langhout [9] these approaches will need adaptations in the feeding program and/or feed production. The practical relevance of these approaches may vary between the different areas in the world. At this moment it is difficult to evaluate novel strategies developed to antibiotic-free feeding concepts. Combination of different approaches is necessary, to enhance the performance and health status of the birds such as: selection of highly digestible feed ingredients to reduce nutrients for microbial degradation; introduction of a special pre-starter diet in the feeding program; improvement of climate control in the poultry house to avoid stress in the animal and keeping litter quality in optimal condition.

Multi-resistant bacteria are increasingly posing a hazard to human and animal health worldwide, impeding successful antibacterial treatment [10]. In addition, the development of novel antibiotics does not keep step with the emergence of antimicrobial resistance in bacteria [11]. Increasing application of antibiotics for the treatment of humans and animals and the use of the glycopeptide, avoparcin in subtherapeutic levels as a growth promoter in the past have been generally held responsible for a progressive deterioration of the resistance situation in bacteria [12,13]. Among multi-resistant bacteria, vancomycin-resistant enterococci (VRE) have been estimated as one of the most common bacteria causing a rise in cases of nosocomial infections in humans in the last few years [10]. The prevalence of vancomycin-resistant enterococci (VRE) in 20 turkey flocks reared in the southwest of Germany was recently investigated [14]. The VRE could be isolated by means of a procedure combining bacterial cultivation in an enrichment broth and on a selective solid media. Enterococci were identified biochemically and subsequently tested on the presence of the vancomycin resistance genes *vanA*, *vanB* (*B1/B2/B3*), and *vanC* (*C1/C2/C3*) using real-time PCR assays. Vancomycin-resistant enterococci were detected in 15 (75%) of the 20 turkey flocks investigated. In 5 flocks, all animal samples and environmental dust samples taken were VRE-negative. In a total of cultivated 68 isolates from birds and dust samples, enterococci bearing *van*-genes were detected. Of these, 12 isolates carried the *vanA* gene (17.6%) and 56 isolates carried the *vanC1* gene (82.6%). Neither *vanB* (*B1, B2, B3*) genes nor the *vanC2* or *vanC3* genes could be detected.

In addition, Livestock-associated methicillin-resistant *Staphylococcus aureus* (LA-MRSA) have been isolated from a number of livestock species and persons involved in animal production. Infections with MRSA often prove difficult and expensive to treat. During the last few years LA-MRSA have been isolated from a number of farm animal species including pigs, veal calves, dairy cattle and broilers [15-17]. In addition, turkey meat was shown to be contaminated with MRSA [18], however, only limited information is available concerning the situation in turkey flocks with respect to prevalence, site of colonization or infection and involved strains. Richter, *et al.* [19] investigated the prevalence of LA-MRSA in fattening turkeys and people living on farms that house fattening turkeys. Eighteen (90%) of 20 investigated flocks were positive for MRSA. All female flocks were positive, while 8 male flocks were positive. On 12 of the farms 22 (37.3%) of 59 persons sampled were positive for MRSA. None of them showed clinical symptoms indicative of an MRSA infection. People with frequent access to the stables were more likely to be positive for MRSA. In most flocks, MRSA that could be assigned to clonal complex (CC) 398 were detected. In five flocks, MRSA of spa-type t002 that is not related to CC398 were identified. Moreover, other methicillin-resistant *Staphylococcus* spp. were detected on 11 farms and in eight people working on the farms.

In Europe the Commission regulations 2205/2001 and 1798/1995 have stopped the usage of dimetridazoles as therapeutic or prophylactic drugs in food producing animals [20,21] and council regulation 1756/2002 banned the application of Nifursol from 31 March 2003 [22]. Following a ban of all previously used products for prophylaxis or treatment in the EU, of histomonosis is becoming increasingly responsible for considerable economic problems for the turkey industry, causing disastrous economic losses. A large number of outbreaks in turkey and layer flocks with varying mortality were reported in several European countries.

Changes in social, political and consumer perceptions - Animal welfare

Currently, there is great concern that serious animal welfare and health problems might have been caused already due to genetic selection practices within the turkey industry. Fact is that genetic selection practices within the turkey industry have achieved significant progress in terms of growth rate, better feed conversion, better meat yield and low production cost. All the time this was accompanied by continuous improvement in husbandry practices, nutrition, and disease control. The most outstanding and visible changes in modern turkey compared to their ancestors is the rapid growth and the higher percentage of breast muscle. As a consequence, it is important to understand the relationship between genetic selection pressures and other factors that may have a subsequent impact on the health conditions. This includes the effects on the growth and development of supporting structures such as bone and blood supply. Compared to traditional lines the highly selected birds have reduced cardiopulmonary capacity in relation to their muscle mass, as the ratio of heart and lung development has strongly decreased in modern turkeys. In addition, it is known that the blood pressure of the traditional turkey is only about half the value of that of the modern one [23,24]. This physiological imbalance causes problems such as sudden death syndrome, aortic rupture, deep pectoral myopathy and skeletal disorders, which currently receive a lot of attention as a cause of concern from the animal welfare point of view and are mostly accompanied by economic losses for turkey meat producers due to mortality, predisposition to cannibalism, retardation of growth, increase of the condemnation rate and downgrading at the processing plant. The most common problems of the musculoskeletal system related to fast growth comprise dyschondroplasia and footpad dermatitis. The incidence and severity of both can be influenced by nutrition and genetic selection [25,26].

Stocking density and turkey health under field conditions [27]

Parameter	Farm 1			Farm 2	
	Groups			Groups	
	58 kg/m ²	48 kg/m ²	25 kg/m ²	58 kg/m ²	25 kg/m ²
No. of birds	5936	2394	1288	3563	1700
No. of dead birds	596	283	206	601	136
Mortality %	10.04	11.82	15.99	16.87	8.09
Age at slaughter (day)	147			145	148
No. of birds slaughtered	5340	2111	1082	2962	1564
Mean body weight (kg)	18.03	18.22	18.94	19.17	21.59

According to a published report on a new Animal Health Strategy for the European Union (2007 - 2013), the concept of animal health not only covers the absence of disease in animals, but also the relationship between the health of animals and their welfare. It will also take into account social, economic and ethical considerations, as well as support the achievement of a high level of environmental protection [28].

Emergence and re-emergence of turkey diseases

Beside several managements related and political issues, emerging and re-emerging diseases and/or infections of turkeys are and will remain a continuous challenge for poultry veterinarians and the turkey industry.

An emergency animal disease (EAD) can be defined as a disease condition that is likely to have a significant effect on livestock - potentially resulting in livestock deaths, production losses and in some cases impacts on human health and the environment [29]. Morse [30] defined human emerging diseases as infections that either have newly appeared in a population or have already existed, but are rapidly increasing in incidence or geographic range. In general, most of emerging infections appear to be caused by pathogens already present in the environment that acquired a selective advantage or afforded an opportunity to infect new host populations [30]. Moreover, there are other animal health emergencies that may be caused by non- infectious agents such as chemical residue problems in livestock or food safety problems through contamination of animal products. Several factors can precipitate and/or predispose to disease emergence.

These include changes in the structure and development of the poultry industry, strong global competition and varying production costs in different continents and countries, leading to an increase of the global movement of poultry and poultry products. This could also increase the risk to introduce infections to areas which were previously considered to be free from such diseases [1]. Re-emerging and resurging infections are those that existed in the past but are now rapidly increasing either in incidence or in geographical or host range.

Health disorders and infectious diseases of turkeys are mostly associated with severe economic losses. Several pathogens are incriminated as possible causes of many disease complexes of turkey poultts either alone (mono-causal) or in synergy with different other microorganisms (multi-causal) or accompanied by non-infectious factors. "Non-infectious" means all factors which influence the bird health and include house structure, climatic conditions (ventilation, temperature, and litter condition), stocking density, feed and water supply, hygienic condition as well as the knowledge and qualification of the stockman. These factors affect each other and can promote or inhibit the health condition of the flock. In aim to achieve desired performance results, managers of turkey flocks should integrate good environment, husbandry, nutrition and disease control programs. The rearing management must be directed to satisfy the bird's requirements, to promote the production and to prevent diseases condition. Any disturbance will cause stress, which will reduce the resistance of the birds, increase their susceptibility to infections and reduce their immune-response to vaccines. Infectious diseases caused by several infectious agents such as viruses, bacteria, fungus and parasites are involved in many disease conditions. These infectious agents can be introduced and spread in turkey farms by different routes. It occurs by vertical and/or horizontal route. At early days of age the main disease problems are related to vertically transmitted infections and improper hatchery eggs sanitation (Yolk sac infection/Omphalitis) with *Salmonella*, *E. coli*, *Mycoplasma*, *Aspergillus*, *Staphylococci*, *Streptococci*, *Pseudomonas* and avian encephalomyelitis. Those and other infectious agents can also be transmitted horizontally (laterally) by direct contact between infected and non-infected birds. Currently, the most important problems of turkeys are respiratory diseases, possibly caused by avian metapneumovirus and/or *Ornithobacterium rhinotracheale* and *E. coli*. Furthermore, enteric disorders caused by several viral agents such as coronavirus, astrovirus, rotavirus or due to parasitic infestation such as coccidia and histomonas are common problems.

The severity of clinical signs, duration of the disease and mortality are extremely variable and are influenced by kind, virulence and pathogenicity of the infectious agent as well as by many environmental factors such as poor management, inadequate ventilation, high stocking density, poor litter conditions, poor hygiene, high ammonia level, concurrent diseases and the type of secondary infection.

Future expectations disease diagnosis, treatment and control

In future improvements in laboratory diagnosis, such as diagnostic micro array and other technologies, will allow faster, more sensitive and more accurate diagnosis of infectious diseases, and early interventions will become a reality.

However, only a few authorised pharmaceutical veterinary products will be available for the treatment of poultry as food producing animals. Future scientific findings on the pathogenic mechanisms of bacteria will help to improve the treatment of bacterial infections, and instead of non-specific antibiotic therapy, new drugs will be able to target the signalling mechanisms, which are able to disrupt the pathogenic effects of the pathogen bacteria. Vaccination is regarded as one of the most beneficial biopharmaceutical interventions due to its ability to induce protection against infectious diseases through targeted activation of the immune system. Many valuable new vaccine production technologies have been developed as a result of rapid progress in various areas. The use of future progressive vaccine production technologies, such as recombinant, subunit, reverse genetic and nucleic acid vaccines, can significantly reduce the cost of vaccines, ensure better efficacy, and allow easy and rapid intervention to face the steady mutation of the microorganisms. Furthermore, the development of efficient vaccines against bacterial infections will lead to a reduction of the use of antibiotics and subsequently of the development of resistant bacteria. Genetic resistance and selective breeding: to improve production traits and health is a long-standing goal of the industry. The desire to enhance breeding strategies through the use of molecular techniques (genetic linkage maps) will lead to the characterisation of genome structure and genes that are associated with production traits and disease susceptibility and resistance. This will allow selecting bird lines that are genetically resistant to several pathogens. In addition, improvement of rearing technology, management and nutrition will help to maintain bird comfort [1].

Conclusions

In the future, the global cooperation and trade will force the governments to harmonize the existing different legislations related to trade, animal disease control, animal nutrition as well as the licensing of drugs and vaccines for veterinary use.

Finally, the consumer expectations for high standards quality of poultry products will strongly influence the production methods. This means that farmers, veterinarians, stockholders and all other partners involved in the production chain will have to share more responsibilities and that cooperation will be intensified.

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