Food safety and animal production systems: controlling zoonoses at farm level

J.D. Collins (1) & P.G. Wall (2)

(1) Department of Large Animal Clinical Studies, Faculty of Veterinary Medicine, University College Dublin, National University of Ireland, Belfield Campus, Dublin 4, Ireland
(2) Centre for Food Safety, University College Dublin, National University of Ireland, Belfield Campus, Dublin 4, Ireland

Summary
Controlling zoonotic agents in animal and poultry reservoirs has the effect of reducing the challenge to food safety management systems in processing and further along the food chain. Producing and maintaining healthy stock requires good husbandry practices, which include stock selection and veterinary attention. Feed is a key input, both as a source of pathogen-free nutrients and as a balanced diet to maintain healthy livestock. Safe water, appropriate vermin and wildlife control and an optimum environment to reduce stress are important if animals are to perform. Farms are not sterile environments and initiatives to reduce the zoonotic hazards have to be practical, economically feasible and flexible, depending on the scale of the enterprise, the species being farmed, and the epidemiology of the zoonotic agents in the particular geographical region. Education of farmers and stockmen is crucial to successful on-farm control of zoonoses, as an understanding of why control measures are necessary, and how they can be applied, will improve compliance with protocols and procedures. This understanding is a first step towards the implementation of a longitudinal integrated food safety assurance approach to zoonosis control in the pre-harvest phase of the food chain.

Keywords

Introduction
Ensuring that food is safe from the hazard of zoonotic agents requires controls along the entire continuum from farm to fork. To reduce the challenge to food safety management systems further along the food chain, it is important that everything that is reasonable, practical and economically feasible is achieved on the farm, in the pre-harvest phases. The on-going risk has to be highlighted for management at all stages and any residual risk communicated to the final consumer.

The health of food animals is inextricably linked to the production of safe food and the health of humans. Increasing stocking density, associated with the drive for the economies of scale required to maintain commercial viability in an increasingly competitive global food market, presents the opportunity for build up, and transmission, of infectious agents. Furthermore, global distribution of animal feed permits the dissemination of pathogens to geographical areas, individual farms and susceptible livestock that were previously unexposed. In addition, livestock moving between farms and between countries facilitates transmission of disease. This is often compounded by the stress associated with the transport and the mixing of strange groups of animals.

A series of problems in the food industry, culminating in bovine spongiform encephalopathy, has focused the spotlight on practices in feed mills and farms. The Public Health consequences of failure of controls and inappropriate practices at this level emphasise the fact that farming and milling are food businesses and are just as much an integral part of the food chain as caterers, retailers...
or manufacturers (9). The major retailers and manufacturers are fully aware that their brands and reputations can be irreparably damaged by being linked to food-related incidents or outbreaks or even from being associated with a food scare that has no resulting adverse human health effects. Consumers seek safe food of good quality produced in an environmentally-friendly way with the highest animal welfare standards possible. Farms are not sterile environments; however, an expectation that livestock will receive safe feed, safe water, optimum husbandry and veterinary care, that infected wildlife are controlled and that there is effective effluent management, is not unreasonable.

There are primary biosecurity measures, based on a risk assessment, that are applicable in different farming enterprises that will reduce the incidence of most zoonotic agents. However, different enterprises and different countries require additional controls depending on the epidemiology of the zoonotic agents present in their livestock and in the local human populations and the intensity of their farming operations. The relative importance of different zoonoses varies greatly in different regions of the world in terms of their impact on public health, animal health and the trade in livestock, animal feed and human food. The World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures requires that sanitary and phytosanitary measures be scientifically based (42). The key elements of this agreement are risk analysis, regionalisation, harmonisation, equivalence and transparency. Two of these elements, namely risk analysis and regionalisation, are dependent on information derived from epidemiological surveillance. This approach provides a basis for the practical application of the so-called ‘precautionary principle’ in regard to the importation of animals and animal products. Increasing globalisation and liberalisation of trade present a major challenge as rearing environments, breeds of livestock, husbandry practices, animal diets, exposure to disease, approaches to animal welfare, staff training and perceptions of risk vary greatly between regions. If the goal is enhanced consumer protection there is little point if one country, or region, places legal requirements on their farmers for high standards and the cost of compliance makes them non-competitive and they lose market share to cheaper imports which may not meet similar exacting standards. The drive by the major retailers for global food safety standards is encouraging the development of accredited quality assurance schemes to ensure consistently safe, top quality product no matter what the country of origin. These schemes are quite prescriptive regarding the procedures that must be adhered to in the pre-harvest phase and often stipulate requirements above those that are mandatory in law.

A sustained supply of safe food products requires good communication between the risk assessors, regulators and food safety agencies throughout the global village in which we now live. A multidisciplinary approach with all the stakeholders and professionals along the food chain working in unison will deliver optimum results. It is important to have feedback from medical epidemiologists on the disease agents of public health significance. Monitoring trends in human disease, detecting emerging pathogens and identifying food vehicles of infection and other modes of transmission of zoonotic agents are all important if interventions on farms are to be efficient and targeted appropriately. Communicating with farmers and millers about the risks and how, and why, those risks should be managed in a ‘common sense’ and practical way appropriate to the scale of the enterprise, will improve compliance.

**Food chain issues**

All recent international trade agreements have stressed the importance of risk analysis and the application, throughout the food chain, of prevention systems based on hazard analysis and critical control point. The risks involved are very real when one considers the persistence of such human parasitic diseases as trichinosis and taeniasis and bacterial zoonoses such as campylobacteriosis and salmonellosis, conditions which are invariably associated with exposure to contaminated food. Detection and elimination from the food chain of meat derived from visibly diseased animals has been effectively accomplished by the traditional meat inspection procedures, which date from the mid-1800s. Today, however, the main human health hazards originate with the carriage, at the time of slaughter, of the causative agents by clinically healthy animals and poultry. Current methods of inspection used in the regulatory control of meat and meat products are limited in their effectiveness in detecting these hidden food-borne hazards. Therefore, the maintenance of good hygiene practices during processing is the most important factor in consumer protection.

Classifying pig farms on the basis of meat juice enzyme-linked immunosorbent assay screening for salmonella, as developed in Denmark, demonstrates how modern technology and feedback from processors to farms are driving standards up and contributing to a safer product. The operation of salmonella-free pig and poultry units, by reducing the number of pathogens entering the food chain at the initial production stage, reduces the pathogen load and serves as an example as to how biosecurity on farms can directly contribute to an improvement in the health status of the consumer of these products. Likewise, the implementation of preventive measures promoted by the Department for Environment, Food and Rural Affairs in Great Britain, reduced the prevalence of salmonella in pig and poultry production units, but had little effect on the prevalence of campylobacter (3). While the results were encouraging, the
impact of these measures was not assessed. The study emphasised the need for on-going surveillance in both the animal and human populations over time and on a multi-agency basis in order to determine the true value of such preventive measures at farm level. Developments in biotechnology, notably those relating to rapid methods for the detection of unwanted contaminants, biological or otherwise, provide a new and practical approach to food safety assurance based on statistical sampling programmes, internal quality control systems and real-time feedback to farms.

The European Commission White Paper on Food Safety (9) acknowledged the need to ensure that there is a scientific basis for decision making within the food safety programme. Accordingly all the elements of risk analysis are seen to apply to each phase of the food chain, and to the pre-harvest phase in the first instance. The latter means that on-farm quality risk management programmes have to be developed and implemented (29). The need to ensure the safety of food of animal origin in respect of the potential risk posed by the transmissible spongiform encephalopathies (TSEs) of animals has increased the importance of sound data on the quality and safety of animal feedstuffs, the traceability of food animals and their products and the dynamics of internal trade in animals in each country and region. The recent move to active surveillance of TSEs has provided further data on the regional and national incidence of these diseases for use in the strategic design of control and preventive measures based on quantitative risk analysis. This pro-active approach serves as a model for the surveillance of zoonotic agents associated with livestock production and has an immediate application in the assessment of the risk posed by a wide range of food-borne agents such as the Campylobacter spp., Toxoplasma spp. and Salmonella spp.

A herd/flock health approach to zoonosis control

Food animal production methods have undergone substantial changes over the past fifty years. The rate of change has varied from country to country and, worldwide, from region to region, with consequential differences in the nature and quality of the products produced under the different regimes in operation in each region. Herd health and production management programmes are examples of this development. The main focus of these programmes is on-farm economics and especially operational management through the application of veterinary-zootechnical skills and a wider knowledge of the commercial and societal consequences of disease in the food-producing animal (30). Key elements in such a programme include risk assessment and priority setting at the start, followed by farm inspections and clinical examination of animals, data monitoring and herd/flock problem analysis and prevention. The approach has to be adapted depending on the species of animal involved and the intensity of the farming enterprise (6). These protocols define the farm objectives, which then provide the basis for the analysis of production and other data, the interpretation of collected information including putative risk factors for disease occurrence, and the development and application of preventive procedures and critical monitoring of the effectiveness, or otherwise, of their implementation.

Some infections cause no morbidity in animals (e.g. Escherichia coli O157 and other verocytotoxigenic E. coli [VTEC]) yet can cause serious illness in humans, whereas other diseases such as brucellosis, salmonellosis and leptospirosis are important from both a public health and animal health standpoint. With the operation of control and eradication programmes and good hygiene practices in the food chain a further category of zoonoses has emerged, namely, those involving zoonotic agents that can now be regarded as animal production diseases that have a minimal impact on public health.

Awareness on the part of food animal producers and the meat, poultry and dairy industries that zoonotic hazards exist is the first step towards their control. It is the primary producer who must take all reasonable measures to prevent the entry of pathogenic agents onto his or her holding. They are responsible for the health of their stock and must adopt a positive approach to animal health on the farm with the objective of eliminating or minimising exposure of food-producing animals to zoonotic agents. This is an essential component of the longitudinal integrated safety assurance (LISA) schemes now being adopted in many developed countries. This forms an integral part of food quality and safety assurance schemes and is a natural development of modern farming practice and veterinary preventive medicine in relation to the production of foods of animal origin for human consumption. The objectives are to ensure that the food, as produced on the farm, is both wholesome and marketable, that the efficiency of the animal as a food-producing animal is not compromised, and that the animal itself is dealt with in a humane manner throughout its life. In addition to mandatory requirements, many supermarket companies now require their suppliers to participate in approved food quality and safety assurance schemes, components of which include comprehensive specifications regarding animal health and welfare status. Compliance with recognised norms of animal health and welfare, therefore, is now a commercial necessity for primary producers, the demands of which in many cases are greater than those of the regulatory authority.

As a starting point, maintenance of the integrity of the herd or flock as a distinct and self-contained entity, if possible,
remains a key objective of health control in food animal production. To begin with, where stock has to be purchased, it is essential to ascertain the origin of such stock so as to define as far as possible the health status of the herd of origin and to ensure the traceability of the animal and its produce as it moves through the food chain. Traceability of all inputs to the farming enterprise, both goods and stock, is important because if a farm manager is unaware of the origin of inputs, he/she cannot be assured that best practices were adhered to in its production.

Selective pressure associated with the inappropriate use of antimicrobials can generate multidrug-resistant organisms which can become a public health problem and which can also damage consumer confidence when reports of 'superbugs' and 'residues in food' appear in the media. For example, multiresistant strains of Salmonella newport and Salmonella typhimurium DT 104 are a cause of major concern for both humans and animals. Antibiotics are necessary to control disease and prevent animal suffering, but they should not be a substitute for good husbandry practices and should be used prudently under veterinary supervision. This is all the more relevant to the current situation, as it has recently been recognised that the pattern of antimicrobial resistance exhibited by enteric isolates recovered from pig farmers may mimic that seen in the pigs they attend to in the course of their work (2). In recent years in Northern Europe the withdrawal from use of antimicrobials used in the past for growth promotion has had no negative consequences for farmers' profits or animal health in the case of both pig and broiler production. The effect of such withdrawal in these countries has been a decrease in antimicrobial resistance in animals, food products and humans (13, 37, 39). Vaccination can raise herd immunity and reduce the risk of disease and the consequent need for antibiotics. Probiotics can have a role in promoting enteric health. Husbandry practices such as segregating age cohorts, feeding colostrum, isolating sick animals and adequate disinfection can prevent the spread of disease and contribute to maintaining the health of the herd or flock. Appropriate ecto- and endo-parasite control prevent animals becoming debilitated and more susceptible to other diseases. Policies for the use of animal remedies should be science-based and all use should be documented and continuously reviewed.

Operating a quality management system can be easier in larger enterprises where procedures can be documented and a more regimented approach adopted. In smaller enterprises much knowledge remains in the heads of the farm owner or a small number of staff who are engaged in a wide range of activities. If free trade is to be safe trade, governments and farmers' organisations have to ensure the provision of training, education and support appropriate to the scale of the farming enterprise so as to maintain consistent high-standard output from their farming sector. Confirmation of the disease-free status of recently purchased animals is best achieved through pre-purchase testing and segregation before such animals are allowed to join the flock/ herd. This concept of quarantine is best continued throughout the production system, with persons other than farm personnel directly engaged on the farm being allowed only limited access to animals or feedstuffs.

The enforcement of sanitation rules including the use of disinfectants at key points and the wearing of protective clothing and footwear, together with effective controls on the hygienic quality of feedstuffs and water sources, including rodent and pest control, are standard biosecurity practices which are necessary if the integrity of the production unit is to be maintained. The practice of an "all in/all out" policy of stock movement together with the early segregation of all clinically ill animals offer a direct means of enforcing disease control and prevention at the herd or flock level. The increased volume of animal slurries produced on farms and in particular, their disposal, is a cause of public health concern since, unlike manure, such materials are not composted and are likely to contain high numbers of pathogens voided by infected animals (in some cases infected animals may continue to void pathogens for up to one year). The need for care in dealing with animals kept under intensive conditions or in large numbers on the farm is therefore all the greater, from the public health viewpoint. This is especially the case in both pig and poultry production, where the prevalence of infection with such agents as salmonellas and campylobacters may be considerable, irrespective of the fact that, generally, the extent of clinical disease associated with these infections is low. Furthermore, in the eradication of diseases such as bovine brucellosis, proper effluent control on farms and in meat plants receiving known infected cases has now been recognised as an essential element in preventing the spread of Brucella abortus onto neighbouring farms. The adoption of good agricultural practices and the implementation of practical minimum guidelines for the management and use of animal effluents provide a suitable environment for the production of safe food from healthy animals.

Validation of herd and flock health records and husbandry practices are now integral parts of contract purchasing on the part of supermarket chains and is a development which emphasizes the importance and relevance of the LISA system approach. As an integral component of the food chain, this provides the foundation for a better working relationship between millers, livestock producers and their veterinary and other advisers, in response to the demands of international as well as local trade.

In 1995 a group of leading public health specialists in the Animal Production Technical Analysis Group on Risk and Health Impact in the United States of America (USA) ranked food-borne pathogens according to acute and chronic human health effects in the USA. The top six
priority food-borne agents were adjudged to: Salmonella spp. (non-typhoid), Campylobacter jejuni/colic, Toxoplasma gondii, E. coli O157:H7, Listeria monocytogenes and jointly, Yersinia enterocolitica and Trichinella spiralis. Of these, Listeria is a particularly challenging organism to control as, in addition to being a zoonotic agent, it can be ubiquitous in many environments. The entry of animals infected or colonised with some of these species into meat plants poses risks for operations, in addition to the food safety risks. More recently, Hensel and Neubauer (19) extended this list to include a number of viral agents and also considered the effects of recent environmental and industrial changes that have increased risks associated with modern on-farm practices.

The protozoan parasite, T. gondii, is a frequent cause of ovine abortion. The sheep is an intermediate host, as are humans (24). This agent is acquired by the ewe from infected feral cats through the inhalation or ingestion of infective oocysts. Avoidance of undercooked mutton and other meats could reduce human exposure by between 30% and 63% (10). The prevention of toxoplasmosis in sheep is difficult; vaccines are available which reduce abortion rates, but these do not entirely protect the ewe.

A summary of the effectiveness of on-farm control measures against microbiological hazards that do not necessarily cause clinical disease in animals, but which are associated with food animal production, is presented in Table I.

The prevention of contamination of the food product with zoonotic hazards at farm level rather than the ‘detection/inspection’ which is intrinsic to the implementation of food safety control programmes at factory or ‘post-harvest’ level, is and remains, a primary objective. In achieving product protection at the ‘pre-harvest’ level in integrated systems of beef, pig and poultry production, these principles will already have been applied by both the farm manager and the field veterinarian. This will have been carried out in the course of assessing, for example, water and feed quality, animal health and performance records, animal welfare, the level of safety applied in the choice and use of therapeutic agents, and the clinical condition of the food animals, as well as the safety of the environment as affected by the standard of animal effluent management and utilisation on the farm (20). On this basis a reasoned conclusion can be reached concerning the (relative) safety of the food animal and its suitability for slaughter for human consumption. Such information is a basic requirement of LISA-based programmes and for the extended health control of foods of animal origin, which includes the following elements:

- approval of production holding, water supply and feedstuffs
- on-farm identification and health examination of animals (on-site screening and laboratory support where applicable)

Food safety and the importance of appropriate animal transport

The stress of transport suffered by animals, due to, for example, poor ventilation, noxious odours, uncomfortable conditions, loading density and lack of space, predisposes latently infected animals to shed large numbers of

---

**Table I**

Factors affecting the microbial safety of foods of animal origin: the effectiveness of implementing control measures at certain stages in the production process

<table>
<thead>
<tr>
<th>Microbial agents of concern</th>
<th>Providing safe feed and water</th>
<th>Increasing dry matter content of silage</th>
<th>Effective effluent management</th>
<th>Hygiene and stress reduction during transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmonella spp.</td>
<td>+++</td>
<td>n/a</td>
<td>++</td>
<td>n/a</td>
</tr>
<tr>
<td>Listeria spp.</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Aeromonas spp.</td>
<td>++</td>
<td>n/a</td>
<td>n/a</td>
<td>–</td>
</tr>
<tr>
<td>Escherichia coli O157:H7</td>
<td>+</td>
<td>n/a</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>Campylobacter spp.</td>
<td>++</td>
<td>–</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Yersinia</td>
<td>+</td>
<td>n/a</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Clostridium spp.</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Listeria monocytogenes</td>
<td>++</td>
<td>n/a</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>Cryptosporidium spp.</td>
<td>+</td>
<td>n/a</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Taenia saginata</td>
<td>+</td>
<td>n/a</td>
<td>–</td>
<td>+</td>
</tr>
<tr>
<td>Toxoplasma gondii</td>
<td>++</td>
<td>–</td>
<td>–</td>
<td>n/a</td>
</tr>
<tr>
<td>Brucella abortus</td>
<td>+</td>
<td>n/a</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Mycobacterium bovis</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>++</td>
</tr>
<tr>
<td>Enteroviruses</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Mycotoxins</td>
<td>++</td>
<td>n/a</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

* Other control measures include:
  - importance unknown
  - identification of animal/farm of origin/carrier and segregation of clinical cases
  - identification and approval of casualty/emergency cases for slaughter for human consumption

n/a: not applicable – there are no known implications for control

---

- veterinary certification of animal health at the farm gate
- animal transport controls
- in-plant ante-mortem examination
- carcass identification and post-mortem examination (on-site screening and laboratory support where applicable)
- veterinary health certification of carcass and offals
- cold-line/processing/transport/distribution controls.

Further examples of zoonoses that may arise on farms and affect farming personnel as well as food industry employees and consumers are presented in Table II.
Table II
Examples of the risks associated with zoonotic diseases related to food animal production

<table>
<thead>
<tr>
<th>Zoonosis</th>
<th>Animal source</th>
<th>Environmental factors</th>
<th>Particular risk</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Particular hazards for farming families</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuberculosis (Mycobacterium bovis) *</td>
<td>Cattle, goats, infected wildlife</td>
<td>Closed housing, slurry, equipment</td>
<td>Raw milk, clinical cases</td>
<td>Care must be taken when spreading manure (land spreading) and caution should be exercised with tuberculin reactors</td>
</tr>
<tr>
<td>Brucellosis (contagious abortion)*</td>
<td>Cattle</td>
<td>Abortion, cleansings</td>
<td>Abortions, raw milk</td>
<td>Aerosol spread at abortions and during land spreading</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>Cattle</td>
<td>Contaminated urine, acute /jaundiced cases, rodents, equipment</td>
<td>Milking parlour</td>
<td>Highly infectious</td>
</tr>
<tr>
<td>Leptospira icterohaemorrhagiae</td>
<td>Cattle</td>
<td>Abortion, cleansings</td>
<td>Enteric cases, abortions, raw milk</td>
<td>Aerosol spread during land spreading can result in exposure of personnel and livestock</td>
</tr>
<tr>
<td>Leptospira hardjo</td>
<td>Cattle</td>
<td>Clinical cases: abortions, enteric disease, febrile conditions leading to excretion in slurry</td>
<td>Vaccination available</td>
<td></td>
</tr>
<tr>
<td>Salmonellosis *</td>
<td>Cattle, sheep, pigs, poultry, pets, horses</td>
<td>Clinical cases: abortions, enteric disease, abortions, aerosol spread during land spreading can result in exposure of personnel and livestock</td>
<td>Enteric cases, abortions, raw milk</td>
<td></td>
</tr>
<tr>
<td>Toxoplasmosis *</td>
<td>Sheep, cats</td>
<td>Detritus of abortion in ewes on land, contaminated droppings from feral cats</td>
<td>Contamination of feed</td>
<td>Undercooked mutton is a major source of infection for pregnant women; exposure to cat droppings is a risk for both pregnant women and children</td>
</tr>
<tr>
<td>Chlamydirosis</td>
<td>Sheep</td>
<td>Abortion</td>
<td>Resistant pathogens: plasmid-mediated resistant strains</td>
<td>Pregnant women should not assist at lambing</td>
</tr>
<tr>
<td>Multi-resistant bacteria *</td>
<td>Pigs, poultry</td>
<td>Survive in slurry</td>
<td></td>
<td>Bacteria are carried over from live animals to carcasses and raw foods</td>
</tr>
<tr>
<td>Orf</td>
<td>Sheep, at and after lambing</td>
<td>Infected fleece</td>
<td>Handling lambs during orf vaccination</td>
<td>Highly infectious; skin lesions persist, e.g. on arm</td>
</tr>
<tr>
<td>Dermatomycosis [ringworm]</td>
<td>Cattle, especially calves, horses</td>
<td>Contaminated pens</td>
<td>Handling affected calves</td>
<td>Highly contagious for other persons</td>
</tr>
<tr>
<td>Taeniasis (Taenia saginata, the beef tapeworm)</td>
<td>Cattle exposed to human excreta</td>
<td>Leaks from septic tanks are a source of ova for cattle</td>
<td>Keeping young stock near the farm house</td>
<td>Cysts that are infectious for humans can be found in the muscles when animals are slaughtered</td>
</tr>
<tr>
<td>Hazards for consumers of foods of animal origin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Campylobacteriosis</td>
<td>All animals, especially poultry</td>
<td>Readily established in housed populations; usually asymptomatic</td>
<td>Prevalence increases during transit</td>
<td>The most common food-borne bacterial disease in Ireland; difficult to control at all stages</td>
</tr>
<tr>
<td>Listeriosis</td>
<td>Cattle, sheep</td>
<td>Present in the environment, on soil, in silage</td>
<td>Silage-fed cattle; raw milk from clinical cases</td>
<td>Contaminant of raw dairy products; pregnant women are vulnerable</td>
</tr>
<tr>
<td>Verotoxin-producing Escherichia coli</td>
<td>Cattle, sheep, pigs</td>
<td>Excreted in faeces by asymptomatic animals</td>
<td>See ‘clean cattle schedule’ (Fig. 1)</td>
<td>Difficult to prevent risk of carcass contamination at carcass dressing; contaminated raw milk and vegetables are examples of other sources; acute disease in human patients may result</td>
</tr>
<tr>
<td>Other conditions under consideration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paratuberculosis</td>
<td>Cattle, sheep, goats</td>
<td>Persists in soil; present in slurry</td>
<td>Raw milk from clinical and non-clinical cases in infected herds</td>
<td>Excreted in the milk of a proportion of non-clinical cows; a causal relationship to human Crohn's disease has been proposed but not proven</td>
</tr>
<tr>
<td>Cryptosporidiosis</td>
<td>Calves</td>
<td>Water, other unknown origins, present in faeces of clinical enteric cases</td>
<td>Contaminated wells</td>
<td>Links with human cases are not clear</td>
</tr>
<tr>
<td>Anthrax</td>
<td>All species</td>
<td>Persists in soil</td>
<td>Clinical cases</td>
<td>Contact with exudated blood</td>
</tr>
</tbody>
</table>

* Also of concern to food processors and consumers of food of animal origin
pathogens. For example, the stress associated with road transportation can lead to a ten-fold increase in the numbers of campylobacters in the alimentary tract of broilers by the time they arrive at the poultry meat plant (41). This is likely to result in the contamination of trucks and the general environment of the lairage, as well as the slaughter hall and eventually equipment and the carcass itself. This is the basis for insisting that only animals as clean as practically possible are presented for loading and transport for slaughter and that all animals, including poultry, that are presented in an unclean state for slaughter at meat plants should be rejected on health and safety grounds. There is also a challenge here for engineers and designers of vehicles and other equipment if the considerable losses directly attributed to faulty design and operation are to be avoided. Greater attention must be given to the sanitation design aspects of such vehicles, as efficient cleaning and disinfection as assessed by direct visual inspection at meat plants, as well as at frontier posts, is now integrated into animal health control systems in most countries.

Safe unloading and animal handling facilities under satisfactory lighting conditions are essential at this stage; failure to provide such facilities compromises the efficiency of safe food assurance programmes, as follows:
– the identity of each animal may not be verifiable
– moribund animals and animals in an advanced stage of clinical disease and unsuitable for entry into a food premises, or which need to be diverted to a sanitary slaughter facility immediately, cannot be identified
– animals whose hides or skins are grossly contaminated with faecal and other material may not be identified and they will therefore not be immediately rejected as unsuitable for slaughter for human consumption.

The latter condition is exemplified by the concerns expressed regarding the introduction of large numbers of VTEC organisms into meat plants by cattle in a grossly contaminated state. A proportion of these organisms may be human-pathogenic VTEC (HP-VTEC). Examples of cattle that are in an acceptable hygienic state and fit for slaughter, and of others that are not, are presented in Figure 1.

**Examples of farm-level control of food-borne zoonoses of current concern**

Many biosecurity measures are general and not specific to particular zoonoses and should be part of good farming practice. The authors have selected, as an example, the control of *Campylobacter* spp., but elements of campylobacter control can be applied in principle to the prevention of exposure to other zoonotic agents in a variety of animals, particularly those reared under intensive conditions.

**On-farm control of *Campylobacter* spp.**

*Campylobacter* spp. of public health concern, notably *C. jejuni* and *C. coli*, are widespread in the intestinal tract of domestic animals, including food animals and household pets (1, 38). The prevalence of intestinal colonisation with *Campylobacter* spp. varies from time to time in any group of animals and is a function of a number of factors, including the general health of the individual animal and the risk of exposure to *Campylobacter* spp. posed by the animal’s environment (15, 21).

Infection with *C. jejuni* and *C. coli* rarely causes clinical disease in animals, although a variable proportion of animals in populations of cattle, sheep and pigs, as well as poultry, should be regarded as carriers of these organisms. Therefore, in terms of risk management, it is reasonable to
proceed on the basis that all flocks and herds contain animals that are likely to be colonised with and excreting considerable numbers of C. jejuni, C. coli and other Campylobacter spp. of public health importance. The management of risk in relation to such populations must be undertaken on a whole herd/flock basis at all stages of production, processing and distribution.

Wild birds are considered to be an important reservoir of infection for domestic and food animals. Campylobacter spp. have been found in domestic pets as well as in rodents, flies and other insects (23). Campylobacter coli is particularly associated with pigs. Because Campylobacter spp. are ubiquitous in animal populations, no animal can be excluded as a potential source of human infection.

Campylobacter spp. have a low infective dose and therefore are a hazard for visitors to farms if good hygiene is not observed. Recently published revised guidelines for open farms are available (11, 18). These contain recommendations regarding farm layout, animal contact, eating areas, washing facilities, information and signs, training and supervision, livestock management, and manure and compost heaps.

**Beef, dairy and pig production**

In beef and dairy production units, and in pig production, the housing together of animals from different sources at various stages of production represents a significant risk of introduction and spread of Campylobacter spp. (27). Animals of different ages have a different immune status and gut microflora and the mixing of different age cohorts introduces stress, thus facilitating the transmission of zoonotic agents from infected or colonised animals to susceptible ones. Likewise, Campylobacter spp. can be found in dairy herds and may, therefore, be present in raw milk as a result of faecal contamination.

**Poultry production**

Once exposed, the alimentary tract of a bird is rapidly colonised by Campylobacter spp. and other microorganisms and within a relatively short period following initial exposure a high proportion of the population become lifelong excreters of large numbers of these microorganisms. The source of colonisation is not always clear, but it is often attributed to the introduction of the organisms by way of contaminated boots and clothing (22). Depletion of poultry houses in three or four phases (i.e. thinning) presents a clear opportunity for farm-to-farm spread of Campylobacter spp. via the personnel involved. Consequently, this practice should be discontinued. The possibility of vertical transmission (i.e. from breeder flocks to progeny) has been suggested (33), but is not widely accepted.

Provided proprietary animal feed is properly protected from contamination at the point of consumption, it is generally not regarded as a primary source of infection for Campylobacter. If adequate protection measures are not in place the animal’s food and water supply may become contaminated shortly before consumption by droppings from infected rodents, birds, and other animals and may also contain infected insects, in which case transmission of Campylobacter spp. may ensue.

The essential elements of a campylobacter control programme in poultry production include the measures described below.

**Structural and general measures**

a) an “all-in/all-out” policy regarding the movement of stock into and out of houses and preferably, into and out of individual sites, should be practised
b) in all cases, the poultry houses should be sound in structure and be capable of being cleaned and disinfected
c) the poultry houses should be vermin-proof and rodents should be controlled by systematic baiting in the surrounds
d) the site should be maintained in a tidy state and the growth of grass and vegetative cover (including shrubs, trees) should be controlled
e) entrances into poultry houses should have a well drained, concreted surround
f) where there are exit points for the air ducts at the side of the poultry house, the surrounding area should be concreted and be maintained in a tidy state at all times
g) each poultry house should have a separate lobby inside the entrance that is suitable for changing into and out of protective clothing and footwear, and hand washing facilities should be provided
h) litter removal and disposal points outside the houses should be located in well drained, concreted areas, be clearly marked and be maintained in a clean and tidy state at all times
i) spillage from feed bins should be removed promptly
j) shavings storage facilities should be kept tidy and be rodent-, bird- and pet-proof
k) the water supply to poultry houses should meet bacteriological standards comparable to those required of potable water.

**Operational measures during production**

a) cleaning and disinfection facilities for footwear should be provided at the entry point(s) into each house and they should be regularly replenished; personnel must follow a
strict procedure of cleaning and disinfection each time they enter a poultry house
b) separate protective clothing and footwear should be worn when entering each poultry house
c) personnel should use the hand-washing facility each time they enter a poultry house
d) the number of visitors entering poultry houses should be minimised
e) visitors should be provided with protective clothing and footwear and be required to follow exactly the same procedures as staff when entering poultry houses
f) the practices of thinning and point-selling during production represent a serious possibility of introducing Campylobacter spp. The industry should, therefore, operate an “all-in/all-out” policy
g) all dead birds should be promptly removed and disposed of in a hygienic manner
h) all animal waste and unused feed should be removed from houses and be disposed of hygienically
i) pets should not be allowed to enter poultry houses at any time
j) where rigorous biosecurity measures are in place, these measures could be part of a sequence leading to a time when producers could eventually label their products ‘this comes from a flock tested as campylobacter-free’.

Operational measures when the site is entirely de-stocked

a) all animal wastes and leftover feed should be removed and disposed of hygienically
b) the interior of the houses, including all water and feed distribution equipment, should be thoroughly cleaned
c) the concreted areas at personnel entry points, litter removal points and around side extraction air ducts should be cleaned and disinfected
d) all gross debris should be removed from cleaned areas and be disposed of hygienically and these areas should then be cleaned and disinfected
e) the use of an insecticide prior to or following cleaning and disinfection should be considered
f) in cases where the flock in question has been found to have been infected with Campylobacter spp., the house(s) should be examined using drag swabs or by other means, in order to assess the efficacy of the cleaning and disinfection procedures followed
g) following cleaning and disinfection, each house should be allowed to dry before being re-stocked
h) in all cases the time and details of the sanitation programme as applied, together with the names of the personnel involved, should be recorded
i) a written sanitation programme should be drawn up with the agreement of the personnel concerned and this programme should then be the subject of an independent audit. The outcome of any such audit, including a site inspection, should be made known to the management of the integrated production/processing operation before re-stocking is allowed to commence.

Biosecurity measures such as these have enabled the elimination of Campylobacter spp. from up to 60% of commercial broiler flocks in Sweden and have reportedly reduced the within flock prevalence from 50% to 10% (28). The approved control measures must be efficiently implemented as standard operating procedures at a consistently high standard at all stages and at all times if elimination of Campylobacter spp. is to be effective.

Other control measures

Competitive exclusion exploits the principle of competition between microorganisms for similar ecological niches. The technique has been applied as a component of a successful strategy for the control of some bacterial infections, including salmonellosis in poultry. To date, this approach has been unsuccessful. However, some competitive exclusion experiments have been shown to reduce the numbers of campylobacters in the caeca of treated birds (26). Effective vaccine strategies directed against infection with Campylobacter spp. in broiler chickens have yet to be developed.

Overall, it is far from clear if sustained campylobacter-free status can be achieved on poultry farms under commercial conditions, with even the most intensive level of biosecurity that is practicable. However, the slaughter of birds from flocks shown to have been free of infection immediately prior to despatch and which are transported under strict hygienic conditions to the poultry meat plant and slaughtered separately from other birds, should be encouraged. Such a procedure is feasible and can lead to reductions in contamination rates in the dressed carcasses.

Zoonotic tuberculosis caused by Mycobacterium bovis

Tuberculosis in cattle and its importance as a cause of disease in some human populations represents one of the principal reasons for the introduction of direct inspection methods for meat control and the pasteurisation of dairy products. As a clinical entity in cattle this disease has now been almost completely eradicated in most developed countries. Isolated incidences in which there is direct involvement of infected cattle as the source of Mycobacterium bovis infection in humans still occur (12, 31, 36). In a number of developing countries, where the
disease in cattle and related species is not controlled due to lack of national funds, the disease poses the same if not a greater threat to human health as it did a century ago in most developed countries of today, since immunocompromised individuals are particularly susceptible.

One of the beneficial effects of national bovine tuberculosis eradication programmes has been the effective removal of most infected cattle before they reach the clinical stages of the disease and before the major organs show overt signs of involvement. Animals which show a high responsiveness to bovine tuberculosis are the animals most likely to display gross lesions at slaughter. This demonstrates that the tuberculin test is an effective screening test and it may, therefore, provide a basis for the strategic removal of reactors at local or regional level in countries in which financial constraints prevent the implementation of a national eradication programme for this disease. Meanwhile, every effort should be made to prevent the entry of such infection into herds of cattle and, in some regions, sheep flocks and herds of goats and deer as well, through the unwitting purchase of infected stock or contact with neighbouring infected herds or flocks and tuberculous wildlife (8). Segregation of stock of differing ages, effective composting of manure, attention to sanitary issues, including disinfection and a prudent culling programme, are of significant importance in maintaining a tuberculosis-free herd or flock, particularly in regions in which the prevalence of tuberculosis in the animal population is a concern.

Paratuberculosis (Johne’s disease) caused by Mycobacterium avium paratuberculosis

Mycobacterium avium paratuberculosis (MAP) is the causative agent of paratuberculosis (Johne’s disease), a production disease in ruminants, and a hypothesis exists that MAP may be involved in the aetiology of Crohn’s disease, a chronic inflammatory bowel disease in humans. The hypothesis is not proven, but the general principle that diseased animals should not be used as a source of food for humans should be adhered to. However, control of Johne’s disease in dairy herds is difficult and is based on two principles, namely, the identification and elimination of infected animals and the prevention of new infections (34). Essential to this process is a clear understanding on the part of the herd owner of the fundamental processes involved. These include the following:

- determining the prevalence of the disease in the herd
- culling clinical and subclinical cases identified by the diagnostic tests available
- reducing the contact between newborn calves and their dams where the status of the dam is unknown
- ensuring that replacement heifers are fed pasteurised milk replacer and colostrum from Johne’s disease-free cows
- managing the farm and its environment so as to ensure that stock do not graze on contaminated pasture
- strictly assessing the status of bought-in stock based on serological testing and the history of the herd of origin
- vaccinating, where permitted, to reduce faecal shedding of the organism and the number of clinical cases (this may not affect the prevalence of infection) (40).

Verocytotoxigenic Escherichia coli

The VTEC is present in the gut and faeces of healthy cattle and sheep and these animals therefore act as reservoirs from which humans can become infected. Livestock are a reservoir for most VTEC, with cattle being the principal source of E. coli O157:H7 and other VTEC. Studies from the United Kingdom (UK) and the USA have shown that VTEC is, at least occasionally, present on most farms (16). In these studies, when faecal samples, from both beef and dairy cattle, were examined over the course of a year, prevalence rates for VTEC ranged from 0.5% to over 36%, with an annual average of 15.7% (7, 16). A recent study in the UK showed that VTEC was isolated from 752 (15.7%) of 4,800 cattle and the monthly prevalence rates were between 4.8% and 36.8% (7). As animals carrying VTEC show no clinical signs, visual inspection will not distinguish carriers of VTEC from non-carriers. These bacteria have become part of the normal gut flora of healthy livestock; at any time, an unknown proportion of these may be HP-VTEC.

The organism can survive in soil for several months (4). Cases in farm families and farm visitors have resulted from direct contact with livestock or faeces or from drinking unpasteurised milk. The effects of animal husbandry practices on the prevalence of VTEC in animals are to a considerable extent unknown. Moreover, no defined carrier state has been identified which can be targeted for an intervention programme. Therefore, eradication of VTEC from the farm livestock or farm environment does not seem to be a reasonable goal. However, risk reduction measures can be implemented on-farm to minimise the risk of VTEC infections (14). Examples of these measures are outlined below.

Water and feeds

Water troughs on farms have been frequently found to contain VTEC and, as a result, contaminated water troughs
and water have a role in the transmission of the organism (17). The VTEC survives in water trough sediments for at least four months and appears to multiply there, especially in warm weather. Water troughs should be cleaned frequently to prevent the accumulation of sediments. Escherichia coli O157:H7 does not survive in silage (5) and feeding hay, grass, or silage high in propionic or acetic acids may reduce the likelihood of VTEC shedding by cattle (25).

Animal slurry
The role of spreading slurry and manure on land in the transmission of VTEC between livestock has not been established (16). However, it is good practice to withhold livestock from pastures for four to six weeks after the spreading of slurry. The use of raw manure or slurry on or near the vicinity of crops, particularly fruit and vegetables to be eaten raw, is potentially hazardous, as VTEC can persist in animal faeces (4).

Unpasteurised milk
Serious outbreaks of VTEC infections have been associated with the consumption of raw or unpasteurised milk; VTEC may be present in milk, even when produced under apparently hygienic conditions, as a result of faecal contamination.

Cleanliness of animals on leaving farms for slaughter
The immediate source of most bacteria, including VTEC, on carcasses after slaughter is the soiled hide (32). Efforts to reduce the level of hide soiling are warranted for the control of VTEC and other food-borne disease-causing organisms. Certain diets will result in the production of large quantities of watery dung. Wilting of silage to increase the dry matter content and free access to straw helps to reduce this problem. Poor housing design and management contribute significantly to contamination of animal hides. Clipping the backs of finishing cattle at housing reduces sweating and the risk of wet dirty hides. Stocking rates should be appropriate to the size of the cattle. In slatted units, as animals are removed for dispatch to slaughter, the area for the remaining cattle should be reduced. Slurry storage space and removal frequency should be adequate to prevent blocked slats. Solid floor areas at the end of slats should be sloped to minimise the build up of manure and this area should be cleaned regularly. In certain circumstances it may be necessary to move some animals from slatted sheds to straw-bedded housing for a period prior to dispatch. A general programme of animal health should include the provision of a well balanced diet, prevention of infections by good hygiene and appropriate parasite control to reduce scours. Any changes in diet should be gradual to allow the animals to adapt.

It is crucial that farmers be aware of their responsibility to send animals to slaughter in a clean and dry condition. Carcasses contaminated during the slaughtering and dressing process represent an important route by which VTEC and other disease-causing organisms can enter the food chain (32). As abattoirs are in the food business, with cattle and sheep their raw ingredients, the hygienic quality of the primary raw materials, such as cattle and sheep, will influence the safety of the end product. Abattoir management must accept their responsibility to protect the health of the public by ensuring that only clean cattle are accepted at the meat plant. That responsibility also extends to the food processor, distributor and the consumer, and it is particularly important when one considers the enhanced vulnerability of the elderly and other groups of society. It is essential that this shared responsibility is communicated to all sectors, by publications such as the one illustrated in Figure 2, and by other means.

Fig. 2
Series of advisory leaflets on the prevention of exposure of consumers to Escherichia coli O157:H7 illustrating the responsibility of each sector
Source: Food Safety Authority of Ireland (www.fsai.ie)
Contagious abortion in cattle caused by *Brucella abortus*

Brucellosis is an infectious disease of man (undulant fever) and animals, mainly cattle, caused by the bacterium, *Brucella abortus*. Infection with this organism causes contagious abortion in cows and deer when large numbers of organisms are shed into the environment. Infection is acquired from infected females at, or following, abortion, from contaminated milk, sexually transmitted from infected bulls, or acquired from a contaminated environment. Infected animals harbour the bacterium in their lymph nodes, udder and uterus, and in the case of bulls, the male genitalia and related lymph nodes. The bacterium survives for upwards of six months in contaminated slurry and can be spread from farm to farm, and can infect people, during spreading.

The disease is or has been the subject of an eradication programme in many countries. Control programmes employ two principal methods, namely, vaccination and the removal for slaughter of infected and exposed animals based on serological testing. These measures are supported by movement controls and quarantine on infected farms (35). Unless infected cows are identified early, and are removed immediately, they are a source of infection for other animals and people, either through direct or indirect exposure. Furthermore, farmers and their families, along with their workers, can be exposed to infection by drinking raw milk produced by infected cows. Likewise, dairy products made from unpasteurised milk from *B. abortus* infected cows are a possible source of this infection for consumers. Pasteurisation makes dairy products safe, but does not deal with the issue of the direct or indirect contact routes of transmission to humans or the disastrous animal production consequences of the disease. The most effective approach, however, is the early identification and removal for slaughter of all *B. abortus* infected cattle from the national herd.

The minimum precautions to be taken to reduce the risk of human infection with *Brucella* on farms include:
- operating a closed herd, or alternatively, purchasing essential replacement stock from verifiable disease-free herds and subjecting these animals to post-purchase tests for brucellosis while in isolation before releasing them into the herd
- segregating pregnant heifers and cows by their expected calving dates
- using calving pens, with strict disinfection precautions at all times
- using proper arm gloves and in some cases face masks when assisting calvings
- disposing of cleansings (afterbirths) hygienically
- treating all abortions as potential brucellosis cases and reporting them, seeking veterinary advice and assistance
- withholding milk for human use from herds in which *B. abortus* infection may be considered to be present, pending proof of the contrary
- boiling or otherwise heat-treating all milk before use on the farm or elsewhere.

Goats and sheep may also acquire infection with *Brucella* spp.; these animals are more prone to infection with *B. melitensis*, which is the more common cause of undulant fever in Mediterranean countries and of which the epidemiology and control measures are similar to *B. abortus*. *Brucella suis* causes clinical disease in pig populations in a number of countries; biovars 1 and 3 are of considerable importance as a zoonosis for pig workers and meat plant operatives, as well as consumers, in these countries (35).

**Conclusion**

Zoonotic hazards that are associated with food animal production and food processing may arise on the farm, in the food plant and in the distribution chain. Awareness of the part of food animal producers and the members of the food industry that such hazards may exist in foods is the first step towards their control. A positive approach to animal health on the farm with the objective of eliminating or minimising exposure of food-producing animals to these hazards, supported by ante-and post-mortem veterinary examination of all food animals at meat plants, effectively removes overtly diseased animals from the food chain. Good hygiene practices throughout processing and, finally, cooking, provide further safeguards for the consumer. These control measures are the cornerstones of food hygiene practice and are essential to providing a level of safety assurance approaching that required by the consumer and by international trade. Meanwhile, the current system deserves the full support of the scientific community at the national and international level so as to ensure that any shortfalls in terms of zoonosis control are addressed.

In view of the evolving nature of food animal production there is also a need for further and continuing research into the origins of food-borne disease and the means for their prevention. Basic and applied research both have a contribution to make to the further maintenance of a supply of healthy food which is acceptable to consumers both at home and abroad. Such measures as are currently employed to prevent or control the transmission of zoonotic agents via the food chain in the post-harvest phases are unlikely to be successful in isolation. Effective control relies upon the implementation of a consistently high level of production hygiene at all stages of production.
both on the farm and in the processing plant, and throughout the remainder of the food chain. In this respect the role of education remains paramount for all stakeholders at every level of the food industry. In particular, attention is drawn to the need for training and education of the food animal producer, as it is possible by this means, and with the collaboration of veterinary practices and other advisory agencies, to reduce the level of exposure of livestock to microorganisms which are of public health concern, and thereby reduce the initial loading of the meat, poultry meat or dairy product with these contaminants. In this regard the need to address the dangers posed by the emergence of antimicrobial resistance and to quantify and limit the impact of such emergence is all the greater now that the human food chain is recognised as an important route for the passive transfer of resistant pathogens from animals to humans.

The food quality assurance schemes operated in many developed countries have a high educational component and place considerable emphasis upon on-farm hygiene and animal health and welfare criteria which are imposed as a condition of entry into the programme. A multidisciplinary approach to zoonosis control will deliver optimum results and existing approaches need to be flexible to incorporate advances in the breeding of disease resistant stock, new vaccines, new approaches to nutrition, and innovative ways to educate farmers, as the primary food producers.

La sécurité sanitaire des aliments et les systèmes de production animale : la maîtrise des zoonoses dans les élevages

J.D. Collins & P.G. Wall

Résumé
La maîtrise des agents zoonotiques au niveau des réservoirs animaux et avicoles contribue à limiter les problèmes auxquels sont confrontés les systèmes de gestion de la sécurité sanitaire des aliments, que ce soit au niveau de la transformation ou des opérations réalisées en aval dans la chaîne alimentaire. L’adoption de bonnes pratiques d’élevage (la sélection des animaux et le suivi vétérinaire, par exemple) est indispensable pour assurer une production d’animaux sains inscrite dans la durée. Les aliments pour animaux constituent un élément clé, dans la mesure où ils procurent des éléments nutritifs dépourvus d’agents pathogènes et assurent le régime équilibré nécessaire au maintien du bétail en bonne santé. L’apport d’eau claire, la parfaite maîtrise des animaux nuisibles et sauvages et un environnement optimalisé pour réduire le stress ont une grande importance pour l’amélioration des performances animales. Les élevages n’offrant pas de conditions stériles, les mesures mises en place pour réduire les risques de zoonoses seront pragmatiques, économiques et souples. Elles tiendront compte de la taille de l’exploitation, de l’espèce animale et de l’épidémiologie des agents zoonotiques présents dans la zone géographique. La formation des éleveurs et des ouvriers de ferme est cruciale pour le succès des mesures de contrôle des zoonoses introduites dans les exploitations. En effet, une prise de conscience de la nécessité de ces mesures et de leurs modalités d’application se traduira par un respect plus fidèle des protocoles et des procédures. Cette sensibilisation des intéressés sera un premier pas dans la mise en œuvre d’une approche intégrée et longitudinale visant à garantir la sécurité sanitaire des aliments par le contrôle des zoonoses en amont de la chaîne alimentaire.

Mots-clés
Inocuidad de los alimentos y sistemas de producción animal: lucha contra las zoonosis desde la explotación

J.D. Collins & P.G. Wall

Resumen

La lucha contra la presencia de agentes zoonóticos en los reservorios animales y aviares tiene por efecto reducir el nivel de peligro a que hacen frente los sistemas de gestión sanitaria de los alimentos, tanto en el procesamiento de éstos como en todas las etapas subsiguientes de la cadena alimentaria. Para producir y mantener animales sanos se requieren buenas prácticas zootécnicas, lo que incluye aspectos como la selección de los animales o la atención veterinaria. Los alimentos constituyen un ingrediente clave no sólo para aportar nutrientes desprovistos de patógenos sino también para ofrecer una alimentación equilibrada que mantenga sanos a los animales. Para obtener de éstos un buen rendimiento es importante proporcionarles agua salubre y un entorno idóneo, que reduzca sus niveles de estrés, y también instituir un control adecuado de los parásitos y la fauna salvaje. Dado que la explotación agropecuaria no es un medio estéril, las iniciativas para luchar contra los riesgos zoonóticos deben ser prácticas, económicamente viables y flexibles y adaptadas a las proporciones de la empresa, las especies de que se trate y la epidemiología de los agentes zoonóticos presentes en cada región geográfica. Para que la lucha contra las zoonosis en la explotación tenga éxito es fundamental llevar a cabo una labor pedagógica dirigida a granjeros y pastores; pues cuando éstos entienden el porqué de las medidas de control, así como la forma idónea de aplicarlas, mejora el nivel de observancia de los protocolos y procedimientos. Esta comprensión es un primer paso hacia la aplicación de un planteamiento longitudinal e integrado en materia de higiene de los alimentos para luchar contra las zoonosis en las etapas de la cadena alimentaria previas al sacrificio de los animales.

Palabras clave
Epidemiología – Inocuidad de los alimentos – Lucha contra las zoonosis – Medicina preventiva – Salud de los rebaños – Seguridad biológica.

References


13. Danish Integrated Antimicrobial Resistance Monitoring and Research Programme (DANMAP) (2000). – Consumption of antimicrobial agents and resistance to antimicrobial agents in bacteria from food animals, food and humans in Denmark. Report from Statens Serum Institut, Danish Veterinary and Food Administration, Danish Medicines Agency and Danish Veterinary Laboratory, 2001. Danish Zoonosis Centre, Danish Veterinary Laboratory, Copenhagen, 52 pp.


