

# Safety of feed and animal products

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## Abstract

The intensification of livestock production and the increasing trade in raw materials for the feed industry, as well as livestock products, demands greater attention to risk management by all countries. International standards, guidelines and recommendations on food quality and safety are the responsibility of the Food and Agriculture Organization of the United Nations/World Health Organization (FAO/WHO) Codex Alimentarius Commission. The Codex *Ad Hoc* Intergovernmental Task Force on Animal Feeding has been established with a view to developing a Code of Practice on Safe Animal Feeding. The task force is examining issues relating to raw materials of animal, plant and marine origin, and discussing labeling, traceability, and inspection and control procedures. It is suggesting that feed additives should be assessed for safety and approved under stated conditions of use and that antibiotics should not be used in feedstuffs for growth-promoting purposes in the absence of public-health safety assessment. It is clear that undesirable substances such as pesticides, industrial and environmental chemicals, heavy metals, and microbiological contamination of feedstuffs should be rigorously controlled. For the industrial production of animal feedstuffs, the producer or manufacturer should establish quality assurance systems based on the principles of good manufacturing practice (GMP) and the application of hazard analysis and critical control point (HACCP) principles. The task force is also addressing the more difficult aspect of good agricultural practices (GAP) for on-farm production and use of feedstuffs.

On the particular issue of bovine spongiform encephalopathy (BSE), FAO has advised that countries at risk should implement effective surveillance for BSE in cattle, and controls on the animal feed and meat industries. At present, this means a ban on the use of animal by-products in ruminant feed, laboratory testing of slaughtered cattle, correct disposal of fallen stock, removal of specified risk materials, and improved processing of by-products. Some of the issues include the production of animal feed, the raw materials used, cross-contamination in the feed mill, labeling of manufactured feeds, the feed transport system, monitoring imported live animals, slaughtering methods, the rendering industry and the disposal of waste materials. Legislation to control the industry and its effective implementation are required, together with capacity building and the training of operatives and government officials. FAO is undertaking projects for capacity building in a number of countries at risk.

## Introduction

THE livestock sector plays an essential role in agricultural and economic development as well as food security. The global livestock output is growing at a rate of 2.5% per year and meat production now exceeds 230 million t, and world demand for and consumption of livestock products are expected to nearly double again in the next 20 years (Delgado et al. 1999). Most of this increase is expected to take place in developing coun-

tries, associated with greater population growth and emerging economies, particularly in Asia. As a global average, animal products provide about 16% of the calories in the diet. Meat and other animal products provide essential fatty acids, vitamins and minerals. The livestock industry therefore can be seen to have great economic and nutritional significance in the world as a whole.

In the Asian and Pacific countries (excluding China), meat production has risen from 18 million t in 1981 to 34 million t in 2001, a growth of 5% per year for 20 years. In particular, chicken meat has increased from 3.8 million t to 10.1 million t in that period; pig meat from 4 million t to 7.6 million t; beef and buffalo

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meat from 6.5 million t to 11 million t; and sheep and goat meat from 3.3 million t to 4.6 million t. In addition, milk production has increased from 82 million t to 184 million t and egg production from 5.4 million t to 10.7 million t in those 20 years (all data from FAOSTAT 2002).

Most of this increase in production has been achieved from grain and protein cake. The authors estimate that the requirement for cereals for feed in Asia-Pacific countries (excluding China) has increased from 75 million t in 1981 to 150 million t in 2001 (figures which agree with the FAOSTAT supply utilization account). The corresponding quantity of protein feeds has increased from 15 million t to 29 million t. The total feed requirement for poultry has increased from 21 million t to 49 million t over this period; pig feed from 20 million t to 38 million t; and cattle feed from 27 million t to 61 million t.

This demonstrates the increase in demand for live-stock feed, and particularly for poultry, pig and dairy feeds, from the feed industry. Given the increasing concern about the safety of animal feeds from human and animal health and environmental perspectives, this paper considers the potential hazards and the actions that should be taken.

## Control of feed-borne hazards

In recent years and in many countries, public concern about the safety of foods of animal origin has heightened due to problems that have arisen with bovine spongiform encephalopathy (BSE), dioxin contamination, outbreaks of food-borne bacterial infections, and mycotoxins, as well as growing concern about veterinary drug residues and microbial resistance to antibiotics. These problems have drawn attention to feeding practices within the livestock industries and have prompted health professionals and the feed industry to closely scrutinize quality and safety to avoid contamination of foods of animal origin as a result of feeding systems.

Given the direct links between feed safety and the safety of foods of animal origin, it is essential that feed production and manufacture be considered as an integral part of the food production chain. Feed production must therefore be subject, in the same way as food production, to quality assurance systems based on risk analysis.

Several international organizations are actively involved in work related to the safety of animal feed-stuffs. They generate and disseminate information on various aspects of feeds and their use, including potential food safety hazards linked to feed. Furthermore, they provide technical assistance to countries, aimed at improving feed production, feeding practices and feed control programs.

Animal feed safety has become one of the priority areas in the Animal Production and Health Division of the Food and Agriculture Organization of the United Nations (FAO), which has established a substantial information system on animal feed resources available on the Internet, CD-ROM and in printed publications. The system includes detailed scientific and practical information on over 700 feedstuffs, with data sheets, full-text articles and reviews. There will be increasing emphasis on feed safety, and already several reports have been commissioned on this subject, including one on the use of wastes and by-products.

The Codex Alimentarius Commission (CAC), which was established by the Joint FAO/WHO Food Standards Programme in 1962, is an intergovernmental body comprising 165 members whose responsibility it is to develop and publish international standards, guidelines and codes of practice related to food quality and safety (see paper by Yamada in these proceedings). Codex Alimentarius standards are recognized in the World Trade Organization (WTO) SPS Agreement (Agreement on the Application of Sanitary and Phytosanitary Measures) as the benchmarks for food safety.

Several existing Codex standards, guidelines and recommendations include provisions relating to the quality and safety of animal feeds and food of animal origin (Codex 2002). These include:

- Codex General Standard for Contaminants and Toxins in Food (Codex Standard 193-1995)
- List of Codex Maximum Residue Limits (MRLs) for Pesticides and Codex Extraneous Maximum Residue Limits (EMRLs) (General Text, Volume 2A and MRLs, Volume 2B)
- List of Codex Maximum Residue Limits (MRLs) for Veterinary Drugs (Volume 3)
- Recommended International Code of Practice for Control of the Use of Veterinary Drugs (CAC/RCP 38-1993, Volume 3)
- Code of Practice for the Reduction of Aflatoxins in Raw Materials and Supplemental Feeding Stuffs for Milk Producing Animals (CAC/RCP 45-97)
- Codex Standards for Processed Meat and Poultry Products (Part 1, Volume 10, 1994)
- Codes of Practices and Guidelines for Processed Meat and Poultry Products (Part 2, Volume 10, 1994)
- Meat Hygiene Codes (Part 3, Volume 10, 1994).

There are several issues currently being considered by CAC that are directly related to the safety of feed-stuffs. Perhaps most significant was the decision of the 23rd Session of CAC (28 June–3 July 1999) to establish a Codex *Ad Hoc* Intergovernmental Task Force on Good Animal Feeding which would address all issues relating to animal feeding. Three sessions of this task force have been held so far in Copenhagen, in 2000, 2001 and 2002.

## **Code of practice for good animal feed production, handling and storage**

THE FAO Expert Consultation on Animal Feeding and Food Safety held in 1997 (FAO 1998) noted that quality assurance (QA) begins with the concept of what the feed product is to be, in terms of the species being fed and the results being sought. Ingredient specifications are important to QA in defining the quality of the feedstuffs to be accepted by the processor when the raw materials are received for processing. The formulation of the finished feed, including any added medications, should meet the regulatory requirements of the government as well as satisfy the animal production objectives of the customer. Other QA factors involve the manufacture and distribution of the feed. Key elements in effective QA at the feed production facility should include proper sampling, laboratory testing and microscopy, in-plant quality control, control of drug carry-over, plant sanitation and integrated pest management, plant cleanliness, the receiving area, and storage. QA procedures must be clearly documented and records maintained.

Clear guidance from governments to industry regarding required features of feed QA programs constitutes an important preventative approach to feed safety. Such guidance can be provided through codes of practice for the animal feed and livestock sectors, covering all stages of feed production, handling and storage, to its ultimate use. The code could cover such issues as: production of feed materials; sourcing of feed materials; use of additives and veterinary medicinal substances; structures, equipment and materials used in feed manufacture, packaging, handling or storage; product and personnel flows through the facilities; processing operations; labeling requirements; transport and storage of finished product; traceability mechanisms; and appropriate record-keeping.

Applying hazard analysis and critical control point (HACCP) principles ensures that all potential safety hazards are thoroughly analyzed and assessed, that critical limits are established for all points along the chain that must be controlled to avoid occurrence of safety hazards, that effective systems for monitoring the critical control points are in place, and that plans for corrective action are established in the event of problems within the production chain. Processors and handlers of animal feed must further ensure that adequate documentation is maintained to demonstrate their adherence to HACCP principles.

The work currently being undertaken at the international level to establish a code of practice for good animal feeding will be instrumental in ensuring a uniform approach to assuring the quality of feed, including that produced on-farm, and its use.

## **National programs to prevent food-borne hazards related to animal feed**

A basic component of the national controls necessary to guarantee the quality and safety of feeds and foods includes legislation and regulations. The legislation defines responsibilities and designates authority with respect to the wide spectrum of activities involved, establishes basic procedures to be followed in enforcing the legislation, and provides standards, guidelines and other recommendations to be respected by the industry in the production of animal feed.

Legislation and regulations concerning the production, manufacture, handling, storage and use of animal feed should be coherent and complementary parts of national food legislation. The development and implementation of food law is a political process, which is dynamic and evolutionary and often reflects changing public and political concerns. Unless governments undertake periodic review of food/feed legislation to ensure its coherency, it may become a patchwork of additions and revisions leading to overlapping, redundant and conflicting jurisdictions for government agencies, and gaps that could give rise to public health problems. Recent public health problems involving unsafe feed have demonstrated certain weaknesses and gaps in existing legislation in force in many countries.

Some countries may wish to update policies in line with today's food and feed safety issues. For example, given the current possibilities of modern biotechnology, it may be necessary to establish regulations and procedures for the evaluation, authorization and labeling of foods and feeds produced from biotechnology. Measures instituted should not be more restrictive than necessary to meet legitimate food/feed quality and safety objectives.

The WTO SPS Agreement calls upon members to harmonize food safety measures internationally. Recent food safety crises linked to feed contamination have heightened international awareness of existing disparity among national legal limits for maximum levels of contaminants that could be associated with animal feedstuffs. This raises questions about the appropriate level of consumer protection and also constitutes a barrier to trade. Current work by relevant international organizations to determine appropriate guidelines for levels of contaminants is necessary to facilitate eventual harmonization of regulations without compromising public safety.

Enforcement of legislation and regulations depends on effective administration of feed control programs, the existence of an inspection service whose staff is well trained in feed production and manufacture and related safety issues, and analytical services adequately

equipped and with sufficient capacity and the required technical expertise to carry out the volume and types of analyses necessary to support monitoring and surveillance programs as well as routine regulatory testing.

There is agreement throughout the international community that food safety measures should be scientifically justified. This highlights the need for research on feed-related safety hazards in foods of animal origin. The establishment of research networks could be a useful strategy to promote sharing of scientific information and hence improve the chances of building more rapidly on scientific developments to arrive at reliable answers to questions regarding feed safety and quality.

Where potential problems associated with feed are not effectively covered by existing rapid alert systems for food safety, governments should take the necessary steps to ensure the implementation of swift action to contain and eliminate any feed safety problems with the potential to cause public health risk. In the case of feed in international trade, Codex provides guidelines for the Exchange of Information in Food Control Emergency Situations (CAC/GL 19-1995).

In seeking to address the weaknesses in feed control that have become apparent in recent years, governments must pay considerable attention to the inter-relationships that exist between different agencies and the need to establish cooperative and coordinating mechanisms to ensure the best possible implementation of all programs, while giving privilege to public health concerns when these arise. The composition and safety of feed have important food safety implications, but are also critical considerations in animal health and husbandry. It is fitting, therefore, that governments establish suitable mechanisms for food safety agencies, agriculture departments and veterinary services to work together in determining the best policies and actions with regard to animal feed. It must be emphasized that an important aspect of control lies in training. Poor practices within the animal feed industry are often linked to lack of knowledge of associated hazards and how these should be managed. The development of relevant training and extension programs for people involved in the feed industry or in animal feeding at the farm level is an important aspect of control of animal feed.

The control of BSE offers a clear illustration of the need for close collaboration among food control and other concerned agencies. Measures that have been established in Europe and elsewhere center around surveillance and notification of BSE in live animals, establishment of processing conditions for mammalian tissues to be used in animal feed, and prevention of the use of mammalian tissues in feedstuffs for ruminants. The first of these activities would fall under the responsibility of veterinary services. The complexity of the

flows of raw material, animal meal and compounds containing animal meal highlights the need for close cooperation between various agencies in order to achieve public health objectives.

## **Bovine spongiform encephalopathy**

BSE was first confirmed in the United Kingdom (UK) in November 1986 and was made a notifiable disease in June 1988. There have been over 180,000 confirmed cases to date. In the UK, the epidemic in cattle peaked at an annual total of over 36,000 cases in 1992/93 and the number of new cases is currently at the lowest level since recording started in 1988 (about 1200 confirmed cases in 2001). At its peak, the epidemic affected approximately 1% of adult breeding cows per year. It has been estimated that over 900,000 animals were infected between 1974 and 1995, of which approximately 750,000 entered the food chain.

In 1996, a new variant of Creutzfeldt-Jakob disease (vCJD) was detected in humans. The vCJD, which is caused by a prion, had characteristics very similar to BSE, generating the suspicion that the disease was being transmitted to humans. In addition, a slight elevation in the incidence of CJD was observed in the UK.

Both BSE and vCJD are diseases characterized by the appearance of abnormal prion protein in neural tissues and are probably transmitted through the ingestion of nervous or lymphatic tissues from an infected animal or from contaminated meat and bone meal.

There is considerable evidence that in BSE-infected cattle the abnormal prion is confined almost entirely to the (central) nervous system, unlike the situation in scrapie in sheep.

The importance of eliminating the disease intensified in 1996 when the BSE prion was implicated as being responsible for vCJD in humans. Evidence suggested that BSE was being transmitted to humans through tissues from infected animals. In particular, the spinal cord and brain of infected animals were identified as specified risk material (SRM) and strict measures were implemented to ensure that these tissues were removed following slaughter of all bovines and that they were effectively destroyed.

On the basis of the existing knowledge, various measures have been introduced to control BSE in the UK. These included the slaughter of, and compensation for, affected animals and the culling of their cohorts (born between 1989 and 1993) and offspring (born after 1 August 1996), to diminish the risk of the disease spreading. The causal agent has proved to be very resistant to normal methods of sterilization and safe rendering of infected tissues. Laboratory identification of this problem in 1989 led to the recognition that the disease was being transmitted to animals by the use of concentrated feed incorporating meat and bone meal

(MBM) from infected animals. Consequently, the use of MBM in feed preparation was prohibited in the European Union states. However, such feeds had been exported (until 2001) to other countries and, together with exported animals and other animal products, could represent a means of cross-boundary spread of BSE.

Although control measures were put in place as a greater understanding of BSE was gained, the disease spread throughout the UK and into other European countries—at present, 24 countries have confirmed cases of BSE, including Japan and Israel.

The risk analyses and strict control measures employed have reduced the incidence of BSE but as yet it has not been eliminated. Meanwhile the spread of BSE to other countries has revealed that any country that has imported live animals and MBM from European countries may now have BSE. In the case of these countries, it is to their great advantage to carry out risk analyses and preventive measures against BSE, before confirmation of cases of BSE, as several years (5 years or more) can be required before the effects of some measures are reflected in a fall in the incidence of BSE (Matthews 2001).

The possibility of BSE existing within a country is not only a problem for animal health but a grave concern due to the potential transmission of the disease to humans. In addition, the confirmation of BSE has severe implications for the beef industry at all levels, with severe economic consequences.

FAO issued a press briefing on 26 January 2001 that urged countries around the world, not just those in Western Europe, to be concerned about BSE and its human form, the new variant CJD. In a statement issued in Rome, FAO called for action to protect the human population, as well as the livestock, feed and meat industries. It suggested that all countries that have imported cattle or MBM from Western Europe, especially the UK, during and since the 1980s, can be considered at risk from the disease.

The FAO statement added that countries at risk should implement effective surveillance for BSE in cattle and controls on the animal feed and meat indus-

tries. At present, this means laboratory testing of samples from slaughtered cattle, correct disposal of fallen stock and SRM, and improved processing of by-products. Within countries, FAO recommended applying the HACCP system, which aims at identifying potential problems and taking corrective measures throughout the food chain. Some of the issues include the production of animal feed, the raw materials used, cross-contamination in the feed mill, labeling of manufactured feeds, the feed transport system, monitoring imported live animals, slaughtering methods, the rendering industry and the disposal of waste materials. Legislation to control the industry, and its effective implementation, are required, including capacity building and the training of operatives and government officials.

FAO Animal Production and Health Division is currently putting in place regional and national projects to assist with capacity building for surveillance and prevention of BSE and other zoonotic diseases.

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