Animal feeding and food safety

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Introduction

An FAO Expert Consultation on Animal Feeding and Food Safety was held at FAO Headquarters in Rome from 10 to 14 March 1997. The Consultation participants arc listed in Annex 1. The Consultation was opened by Mr. John Lupien, Director of FAO's Food and Nutrition Division, who welcomed the participants on behalf of the Director-General of FAO, Dr. Jacques Diouf.

In welcoming the participants, Mr. Lupien pointed out that FAO has had a long-standing interest in the relationship between animal feeding, trade and food safety[1]. Over the years problems such as *salmonellae* and other pathogenic micro-organisms in feed; aflatoxin contamination in feed affecting poultry and trout and other mycotoxin problems; contamination of feeds with pesticide residues, heavy metals, and industrial chemicals have created concern at national and international levels. Such problems can pose risks to human health and significant difficulties to trade in feed and in food derived from animals. In the past many feed components have been handled in ways that were not designed to assure the quality and safety of the final feed. Most recently the link that has been drawn between bovine spongiform encephalopathy (BSE) and feed ingredients has given additional impetus towards devising and enforcing strict quality and safety control procedures in all steps of producing, processing and utilization of feeds.

1 Throughout this report, 'food' means any substance, whether processed, semi-processed or raw, of animal origin, which is intended for human consumption, and includes milk. The word 'feed' means any substance whether processed, semi-processed or raw, which is intended for consumption by animals from which food is derived from animals, the hazard may originate from a number of these and other sources including the consumption by food production animals of contaminated feed.

Mr. Lupien said that the report of this Consultation will help FAO further develop, at the international level, the overall scientific basis that is essential to the development of improved practices in the feeding of animals for the production of food. A recommended code of practice for good animal feeding would improve overall feeding practices and ensure better quality and safer feeds, and better quality and safer animal products for human consumption. The report of this Consultation will be of vital interest to FAO, its member governments and the Codex Alimentarius Commission.

The Consultation elected Professor David Fraser as Chairman and Dr. John Wilesmith as Vice-Chairman. Dr. Keith Behnke was appointed as Rapporteur. In his opening remarks Professor Fraser pointed out that because the cost of feeding was the major expense in many animal production systems, the animal industries are constantly seeking novel and cheaper feeds, all of which may or may not introduce new contaminants into the food chain. He expressed the hope that the Consultation would lead to the formulation of a code of practice for good animal feeding which would minimise hazards which might arise from feeds during livestock production.

Background

Food production is a complex process, with the ultimate objective of the food industry and food safety regulators being to ensure that food reaching the consumer is safe and wholesome, food generally expected to be safe may become unsafe due to the introduction of hazards during production, processing, storage, transport, or final

preparation for consumption. For food derived from animals, the hazard may originate from a number of these and other sources including the consumption by food production animals of contaminated food.

Examples of hazards in food that can be linked to feed and have long been recognised include salmonellosis, mycotoxicosis, and the ingestion of unacceptable residue levels of veterinary drugs and agricultural and industrial chemicals. In addition, if the postulated link between BSE and the new variant of Creutzfeldt-Jakob Disease (nv-CJD) is established, it would be another example of food contamination originating in feed.

Two papers were commissioned by FAO for the Consultation. The first paper (Annex 3) addresses feed processing and the second paper (Annex 4) addresses infections and intoxications of farm livestock associated with feed and forage.

The Joint FAO/WHO Food Standards Programme, administered by the Codex Alimentarius Commission (CAC), has also done some work in this area in the past. Included in its standards, guidelines and other recommendations are quality and safety standards for meat and various meat products, maximum levels for contaminants, maximum residue levels for residues of veterinary drugs and pesticides and codes of practice ranging from hygienic practices to use and control of veterinary drugs. Annex 5 contains a description and summary of the Codex work.

Scope

The Consultation restricted its considerations to food safety matters that pertained strictly to feeds. It did not consider plant toxins or radionuclides, nor did it consider parasites such as *Taenia saginata* that are spread by human sewage. In addition, the risks to human health from feed or forage contaminated with several other agents such as *Bacillus anthracis, Clostridium botulinum* toxin, *Listeria* spp., *Mycobacterium bovis* and *Yersinia* spp. appear to be negligible or non-existent and were therefore not considered by the Consultation. It also did not consider management practices unrelated to feeding, such as vaccination or other veterinary treatments including the use of injectable agents or drenches. It did not consider spoilage of food products nor did it consider normal feeding practices aimed at maintaining good nutritional status of production animals.

While there are a great many foods that are of animal origin, the Consultation restricted its consideration to those foods from common domestic animals which have significance in international trade. These include meat and meat products, milk and milk products, eggs and egg products, and products of aquatic animals derived from aquaculture. All animal feeds were considered other than natural unrestricted grazing. The Consultation limited its considerations to food that complies with CAC recommendations, for example meat judged to be fit for human consumption in accordance with the Recommended International Code for Ante-mortem and Post-mortem Inspection of Slaughter Animals and for ante-mortem and post-mortem Judgement of Slaughter Animals and Meat (CAC/RCP 41-1993). As one example, this excluded consideration of foodborne anthrax.

Aquaculture products are a major source of food protein in developing countries and one of the fastest growing systems of food production. There are two broad categories of aquatic animal production. One involves the production of carnivorous/omnivorous fish using intensive farming systems and is largely dependent upon the use of compounded feed, while the other is based on the mass production of herbivorous/filter feeding fish

species within semi-intensive/extensive farming systems based on the use of agricultural and other by-products, including animal manure, as fertilizer or supplementary feed inputs. Intensive fish farming using compounded feed therefore clearly fell within the scope of the Consultation. However, as semi-intensive/extensive systems arc being considered by the WHO/FAO/NACA[1] Study Group on Food Safety Issues associated with Products from Aquaculture, this was not considered.

1 NACA is the Network of Aquaculture Centres in the Asia-Pacific Region.

International trade

The Uruguay Round of Multilateral Trade Negotiations established a new World Trade Organization (WTO) and included negotiations on reducing non-tariff barriers to international trade. Included in the Final Act were the Agreements on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement) and on Technical Barriers to Trade (the TBT Agreement). Both Agreements have implications for the work of the Codex Alimentarius Commission.

The SPS Agreement confirms the right of WTO member countries to apply measures necessary to protect human, animal and plant life and health provided that "such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade"[2].

2 The SPS Agreement defines SPS Measures as those measures applied:
- to protect animal or plant life or health within (a country's) territory from risks arising from the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms;

- to protect human or animal life or health within the territory of (a country) from risks arising from additives, contaminants, toxins or disease-causing organisms in foods, beverages or feedstuffs;

- to protect human life or health within the territory of (a country) from risks arising from diseases carried by animals, plants or products thereof, or from the entry, establishment or spread of pests; or

- to prevent or limit other damage within the territory of (a country) from the entry, establishment or spread of pests.

With respect to food safety, the SPS references the standards, guidelines and recommendations established by the CAC relating to food additives, residues of veterinary drugs and pesticides, contaminants, methods of sampling and analysis, and codes and guidelines of hygienic practice.

Therefore, measures need to be taken with respect to feeds to ensure adherence in food of animal origin to the Codex maximum levels or guideline levels for contaminants, and to the Codex maximum residue limits (MRLs) for pesticide and veterinary drugs. Measures also need to be taken to ensure that appropriate hygienic practices are

followed at all stages of the animal feeding chain to prevent, eliminate or reduce potential hazards in the food.

The objective of the TBT Agreement is to prevent the use of national or regional technical requirements, or standards in general, as unjustified technical barriers to trade. It covers all types of standards, including all aspects of food standards other than those related to SPS measures, and includes a very large number of measures designed to protect the consumer against deception and economic fraud. The aspects of food standards it covers relate specifically to quality provisions, nutritional requirements, labelling and methods of analysis. The TBT Agreement basically provides that all technical requirements and regulations must have a legitimate purpose and that the impact or cost of implementing the measure must be proportional to the purpose of the measure. It also places emphasis on international standards.

The Consultation recognised that increased scientific, legal and political demands are being made on the standards, guidelines and recommendations elaborated by Codex. This is in part due to increased consumer interest in food safety, the WTO's SPS and TBT Agreements, harmonization initiatives, calls for increased scientific rigour, the need for transparency, and shrinking national regulatory resources. Therefore, a code of practice for good animal feeding was drafted by the Consultation which would facilitate international trade in animal feedstuffs and animal food products.

Potential hazards associated with feed[1]

[1] The order of appearance of categories of hazards listed (mycotoxins etc.) is not intended to indicate any ranking of relative importance.

Mycotoxins

Mycotoxins are secondary metabolites produced by fungi of various genera when they grow on agricultural products before or after harvest or during transportation or storage. Some fungi such as *Fusarium* spp. typically infest grains before harvest, others such as *Penicillium* spp. can invade grain after harvest, while *Aspergillus* spp. can grow on grains both before and after harvest. It must be emphasised that the presence of the fungi does not necessarily imply that mycotoxins can be found. Conversely, the absence of fungi does not necessarily mean the absence of mycotoxins.

Both intrinsic and extrinsic factors influence fungal growth and mycotoxin production on a given substrate. The intrinsic factors include water activity, pH, and redox potential whereas extrinsic factors which influence mycotoxin production are relative humidity, temperature and availability of oxygen.

Many mycotoxins, with different chemical structures and biological activities, have been identified. Mycotoxins may be carcinogenic (e.g. aflatoxin B_1, ochratoxin A, fumonisin B_1), oestrogenic (zearalenone and I and J zearalenols), neurotoxic (fumonisin B_1), nephrotoxic (ochratoxins, citrinin, oosporeine), dermonecrotic (trichothecenes) or immunosuppressive (aflatoxin B_1, ochratoxin A, and T-2 toxin). Much of the published information on toxicity concerns studies in experimental animals and these may not reflect their effects in humans and other animals. In addition, the significance of the presence of most mycotoxins in foods of animal origin is not completely understood.

Mycotoxins are regularly found in feed ingredients such as maize, sorghum grain, barley, wheat, rice meal, cottonseed meal, groundnuts and other legumes. Most are relatively stable compounds and are not destroyed by processing of feed and may even be concentrated in screenings.

Different animal species metabolise mycotoxins in different ways. For example in pigs, ochratoxin A can undergo entero-hepatic circulation and is eliminated very slowly while it is rapidly excreted by poultry species. The polar mycotoxins, such as fumonisins, tend to be excreted rapidly.

Mycotoxins, or their metabolites, can be detected in meat, visceral organs, milk and eggs. Their concentration in food is usually considerably lower than the levels present in the feed consumed by the animals and unlikely to cause acute intoxications in humans. However residues of carcinogenic mycotoxins, such as aflatoxin $B_1$and M_1, and ochratoxin A, when present in animal products pose a threat to human health, and their levels should be monitored and controlled.

In most instances the principal source of mycotoxins for humans is contaminated cereals and legumes rather than animal products. This means that the exposure to mycotoxins may be greater in developing countries in which cereal grains and legumes form the staple diet and the intake of animal products, including meat, is low.

There is little information available regarding the occurrence of mycotoxin residues in animal products intended for human consumption. Some examples are summarised in Table 1. Examples of maximum levels in force in various countries include 0.05-1 ppb for aflatoxin M_1, 5 ppb for aflatoxin B_1, 25 ppb and 50 ppb ochratoxin A in porcine kidneys and cereals respectively and, depending on the country, 30-1,000 ppb for zearalenone in corn and foods (1). The levels of mycotoxins detected are usually below the maximum levels accepted in most countries.

Table 1. Examples of food of animal origin which may be naturally contaminated with mycotoxins

Mycotoxin	Potential effects on humans	Occurrence	Maximum level reported	Reference
Aflatoxin B_1	Hepatic cancer	Eggs	0.4 ppb	(2)
		Pig liver	0.5 ppb	(3)
		Pig muscle	1.04 ppb	(4)
		Pig kidney	1.02 ppb	(4)
Aflatoxin M_1 [1]		Cow's milk	0.33 ppb	(5)
Ochratoxin A	Renal damage	Pig liver	98 ppb	(6)
		Kidney	89 ppb	(7)
		Sausages	3.4 ppb	(7)
Zeralenone	Oestrogenic	Pig liver	10 ppb	(8)
		Pig muscle	10 ppb	(8)

[1] There is insufficient evidence to describe aflatoxin M1 as a human carcinogen although it is a potent carcinogen in rodents.

Infectious agents

Transmissible spongiform encephalopathies in ruminants

The transmissible spongiform encephalopathies (TSEs) are non-febrile neurological diseases. They have a long incubation period and are ultimately fatal. TSEs are associated with incompletely defined agents currently termed prions which are resistant to normal heat treatments of feed and food. The TSEs recognised in food producing animals are BSE and scrapie. Sheep scrapie has been recognised for over 250 years. BSE was first recognised in the UK during 1986. The BSE infectious agent enters feed primarily through infected tissues (notably the central nervous system and the reticuloendothelial system) rendered under conditions of insufficient heat treatment to reduce the concentration of the infectious agent to an ineffective dose.

In the case of sheep scrapie, infection is naturally maintained by transmission between sheep. It is likely that humans have been exposed to the scrapie agent by eating brain and other tissues from infected sheep although there is no evidence that the occurrence of either CJD or nv-CJD has been associated with scrapie. With respect to BSE, humans can potentially be exposed through consumption of the infected tissues. The occurrence in humans of nv-CJD has raised the possibility of an association with the BSE agent. At present, with the limited number of diagnosed cases, there is no proven link between nv-CJD and the possible transmission of the infective agent from bovine tissue to humans.

Salmonella enterica

There are over 2,000 salmonella serotypes and these can be divided arbitrarily into three unequally sized groups. These include:

1) the species specific serotypes such as *S. dublin* (cattle) and *S. gallinarum* and *S. pullorum* (poultry);

2) the invasive serotypes which may cause septicaemic disease in several animal species (e.g. *S. enteritidis* and *S. typhimurium);* and

3) the non-invasive serotypes which tend not to result in septicaemia. Members of the first group are not recognised as feedborne pathogens.

The third group is by far the largest and may be associated with subclinical infections in farm livestock. Occasionally they can cause disease and are associated with food poisoning in humans. The principal manifestation of human salmonellosis is gastroenteritis. Septicaemia occurs in a proportion of patients. The case mortality rate is low with the young, old or immunocompromised being most susceptible.

Salmonellae arc widely distributed in nature, and feed is only one of many sources for farm animals. Feed ingredients, of both animal and plant origin, are frequently contaminated with salmonellae although the most common serotypes isolated are rarely the most prevalent in animals including man. The two most important serotypes associated with human disease, *S. enteritidis* and *S. typhimurium,* are rarely isolated from feed. Feed can be contaminated by contact with raw ingredients after processing.

Toxoplasma gondii

The protozoan *Toxoplasma gondii* is found in cats, and based on serological surveys, in birds, and in domesticated species including sheep, pigs, goats, and horses. The primary source of infection for animals is feeds contaminated with cat faeces.

Cats are an important source of infection for humans, with the handling or consumption of raw meat also being implicated. Pregnant women who become infected may abort or give birth prematurely, and infants often develop central nervous system disorders and ocular disease. Immunocompromised patients are at particular risk.

Trichinella spiralis

Trichinella spiralis is a nematode which parasitises the intestinal tract of mammals, particularly pigs. The larvae encyst in the tissues, particularly the muscles, which act as a source of infection for humans who consume raw or undercooked meat. The clinical manifestations include fever, muscle pain, encephalitis, meningitis, myocarditis and very occasionally, death.

The cysts can be killed by freezing infected carcasses at -18°C for 20 days. They are also heat sensitive and are killed by traditional rendering temperatures. Effective cooking of raw meat and table scraps before feeding to farm animals will eliminate this hazard.

Veterinary drugs and agricultural and other chemicals

Veterinary drugs

Veterinary drugs may be administered in animal feeds. If the concentration used results in foods of animal origin with residues exceeding the established Maximum Residue Limits (MRLs) such as those established by Codex, there may be a potential risk to human health. Codex MRLs should not be exceeded if concentrations used are correct, withholding times are observed and Good Agricultural Practices (GAP) and Good Veterinary Practices (GVP) are applied.

Agricultural and other chemicals

The potential hazards may include excessive residue levels of herbicides, pesticides, and fungicides and industrial/environmental or other extraneous contaminants such as the polychlorinated biphenyls (PCBs) and heavy metals including mercury, lead, or cadmium. Cereals and treated seeds are the most likely source of these contaminants. The most significant hazards to human health are those chemicals that accumulate in animal tissues or are excreted in milk or become incorporated in eggs at levels in excess of established limits such as the Codex MRLs for pesticides or maximum levels for contaminants in a food or feed.

Assessment of the risk

The risk analysis approach has been adopted within the Codex system and used as the fundamental method underlying the development of food safety standards. The

Consultation therefore saw one of its tasks as to provide an assessment of the risk of foodborne hazards that enter the food chain via feeds.

Risk analysis is composed of three separate but integrated elements, namely risk assessment, risk management and risk communication. Risk assessment has been defined by Codex as being the scientific evaluation of known or potential adverse effects resulting from human exposure to foodborne hazards. The risk assessment process consists of the following steps: (i) hazard identification, (ii) hazard characterization, (iii) exposure assessment, and, (iv) risk characterization. The definition includes quantitative risk assessment, which emphasises reliance on numerical expressions of risk, as well as an indication of the attendant uncertainties. Hazard identification is defined as the identification of known or potential health effects associated with a particular agent. Exposure assessment is the qualitative and/or quantitative evaluation of the degree of intake likely to occur. Risk characterization is the integration of hazard identification, hazard characterization and exposure assessment into an estimation of the adverse effects likely to occur in a given population, including attendant uncertainties. For chemical agents, a dose/response assessment should be performed. For biological or physical agents, a dose-response assessment for hazards should be performed if the data are available or obtainable.

In general terms, the Consultation recognised that there are risks arising from foodborne hazards that enter the food chain via feeds. However, on balance, the judgement was that the risk of these hazards was low in comparison to foodborne hazards that originate from other sources. The risks from *Salmonellae* for example, may be considerably greater during processing of carcasses and subsequent animal product processing. The exposure to mycotoxins is far greater from eating contaminated cereal grains than from eating foods derived from animals fed contaminated grains.

Sources of feedborne hazards

Feeds can be of animal, plant, microbial or mineral origin. The following tables set out potential hazards and the stage at which they may enter the food chain.

Table 2. Feed of plant origin

	Pre-harvest	Post-harvest	Post-processing
Grains and their by-products	A, B, D	A	A
Oilseeds and their by-products	A, B, D	A, B, D	A, B, C, D
Molasses	B, D	-	A (possible)
Roots and tubers	B, D	A	A
Forages	A, B, C, D	A, C	A, B
Roughages	-	A, B, C	-
Fats and oils	-	-	B

Key: A = mycotoxins B = agricultural chemicals C = microbial pathogens D = metals

Table 3. Feed of animal origin

	Raw materials	Post-processing
Mammalian protein meals	B, C, D, E, F	C
Poultry meals	B, C, D, E	C

Aquatic animal meals	B, C, D	A, C
Fats and oils	B	-

Key: A = mycotoxins B = agricultural chemicals C = microbial pathogens D = metals E = drug residues F = TSEs

Table 4. Miscellaneous feed ingredients

	Raw material	Post-processing
MINERAL ORIGIN		
Phosphate, calcium and sodium sources	D	-
Trace element premixes	D	-
Non-nutritive adsorbents	D	-
MICROBIAL ORIGIN		
Yeast and single cell protein	C, D	D
MISCELLANEOUS ORIGIN		
Food waste	A, C	A, C
Animal manure	B, C, D	C

Key: A = mycotoxins B = agricultural chemicals C = microbial pathogens D = metals

Control of feedborne hazards

Feed and feed ingredients should be obtained and preserved in a stable condition so as to prevent hazardous effects due to contamination or deterioration. When received, feeds should be in good condition and meet generally accepted quality standards. Preservation can be facilitated by low temperature storage, ensiling, dehydration or the addition of appropriate chemicals (e.g. propionic acid). Furthermore, pasteurization reduces the numbers of most pathogens. Maintaining low water activity (i.e. A_w <0.65) will minimise bacterial and fungal growth.

Good Manufacturing Practices (GMPs) should be followed at all times. Specific control measures for identified hazards are listed below.

Transmissible spongiform encephalopathies

⇒ All tissues from cattle with clinical BSE should be incinerated so that they are eliminated from all feed and food chains.

⇒ In countries where BSE has occurred, depending on its incidence [1], consideration should be given to placing restrictions on the use of meat and bone meal derived from specific bovine tissues in ruminant feeds. A similar consideration should be made in countries where a risk assessment indicates that the cattle population has been exposed to infection.

[1] As determined by a competent authority using an appropriately structured surveillance programme.

⇒ In countries where BSE and sheep scrapie have occurred, consideration should be given to placing restrictions on the use of ruminant derived protein from the feeds of ruminants.

⇒ In countries where BSE has not occurred, but where sheep scrapie is present, consideration should be given, dependent on the incidence of scrapie and the time/temperature processes used for the rendering of ovine carcasses and tissues, to placing restrictions on the feeding of ovine derived protein to ruminants.

⇒ The measures listed above may require re-evaluation in the light of future research findings on the inactivation of TSE agents during rendering.

⇒ Cross contamination of cattle feeds with meat and bone meal produced from the rendering of potentially infected cattle tissues should be prevented.

Biological agents

⇒ *Salmonella enterica, Toxoplasma gondii, Trichinella spiralis* are sensitive to heat and are readily killed if the manufacture of feed involves pasteurization.

⇒ Protocols developed for GMP must include measures which prevent recontamination of heat treated feed by these agents.

Veterinary drugs

⇒ Only products licensed for administration to food producing animals should be used and the withholding time should be observed before milk or eggs are used for food or animals are sent for slaughter. Adherence to the Codex Code of Practice and Guidelines for Control of the Use of Veterinary Drugs and of Veterinary Drug Residues in Foods (CAC/RCP 38-1993) will ensure animal feeds do not contribute to excessive veterinary drug residues in foods.

Agricultural chemicals

⇒ It is essential that the levels of agricultural chemicals in feed are sufficiently low that their concentration in food is consistently below the established maximum residue limits such as those limits established by Codex.

Mycotoxins

⇒ Feeds contaminated with mycotoxins in excess of established national maximum levels or international established maximum levels such as those established by Codex, should not be fed to animals producing milk, eggs or other tissues used for human consumption.

⇒ Grain and cereals should be stored under conditions of low moisture. Mould inhibitors can be added to reduce fungal growth.

⇒ Mycotoxin contaminated grains can be used for alternative purposes such as alcohol production, but by-products that result should not be fed to food producing animals.

Conclusions

- Certain chemical substances and biological agents incorporated into feed, either intentionally or unintentionally, can result in hazards in food of animal origin and may enter feed at any stage of production up to the point of feeding.

- The risks to human health associated with hazards involved in animal feeding are relatively low in comparison the risks arising from to foodborne hazards from other sources.

- Where foodborne hazards originate in feed, the hazard should be adequately controlled.

- Feed ingredients which do not pose any foodborne risk or for which any foodborne risk can be adequately controlled should not be prohibited from use in feed on the basis of food safety concerns.

- Changes in feed or in the formulation of feed, as well as changes in feed processing methods, may result in changes in the risk from foodborne hazards which originate in feed. It is important that this be recognised and that potential risks be evaluated before any change is made.

- The management of risk from foodborne hazards which originate in feed needs to be weighed against the potentially greater risks that would result from an inadequate or overly expensive food supply as well as the environmental risk that would result from the failure to recycle nutrients.

- There is a need for collaboration between all parties involved in feed and animal production, especially those in a position to provide veterinary clinical and epidemiological information, to establish the linkage between any identified or potential hazard and the level of risk. Such information is essential for the development and maintenance of appropriate risk management options and safe feeding practices.

- Regulatory programmes should be established which ensure that foods of animal origin produced for human consumption are both safe and wholesome. In this context, the hazards which have been identified by the Consultation are well recognised, and suitable and appropriate control measures are in place in many countries. Examples include ante- and post-mortem inspection of slaughter stock, the control of the manufacture and use of veterinary drugs and agricultural chemicals, as well as residue monitoring programmes.

- Though no conclusive evidence has yet been published, the Consultation determined it to be prudent not to exclude BSE as a potential foodborne hazard. It concluded that the risk that arises from this should be assessed and managed in exactly the same way as other foodborne hazards. This may necessitate the exclusion of certain material from feed for particular circumstances.

- The disciplines that apply to international trade in both food and feed, as well as in feed ingredients were agreed to during the Uruguay Round of Multilateral Trade Negotiations and set out in the SPS Agreement. The code of practice for good animal feeding that has been developed by the Consultation is intended to provide guidance which will minimise

foodborne risks associated with feeds in a manner which is consistent with the principles of the SPS Agreement. The Consultation was of the view that adherence to this code should obviate the need for any trade restrictions on food or feed based on feed related human health concerns.

- With respect to the production of food from aquatic animals using formulated feed, the food safety issues are the same as those applying to the production of food from terrestrial animals and no special issues apply. The Consultation concluded, however, that there may be food safety issues associated with the feeding of aquatic species through the fertilization of ponds by animal manure, agricultural by-products and other wastes. It noted that this issue is to be considered by the WHO/FAO/NACA Study Group on Food Safety Issues on Food Safety Issues associated with Products from Aquaculture and concluded that was the appropriate forum for this issue to be addressed.