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Evaluating the Role of Animal Feed in Food Safety: Perspectives for Action

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Abstract

Although the primary effect of animal feed is to contribute to animal health, defects in its composition can at times negatively influence the sanitary quality of animal products consumed by humans. A range of factors make the management of these problems more difficult in developing countries: climate more favorable to microbial and fungal contamination, less structured supply chains (with fewer in-built incentives for quality assurance), limited resources to conduct monitoring and testing. This article reviews some of the major potential hazards in feed – aflatoxins, feed additives, and feed-borne microbial contamination – and explores potential solutions in the context of developing country supply chains, such as the use of non-toxic and inexpensive additives. There is a pressing need for objective and original research in this area.

Introduction

There is a close relationship between the quality of livestock feed and that of animal products offered for human consumption. This quality is primarily nutritional, but it is also technological, organoleptic, and sanitary. Although feed is mainly a factor contributing to animal health (to prevent dietary deficiencies, optimize animal functioning, etc.), it can also lead to dysfunctions and negatively influence the sanitary quality of animal products if it is not properly balanced or composed.

The relationship between animal feed and “health risks” can be quite direct, and has recently been the subject of much media attention regarding the use of animal-based meal, the presence of dioxins in poultry feed, and the role of food in the transmission of bacteria such as salmonella. These three aspects illustrate the breadth of the topic: toxic substances, disease-causing bacteria and hazardous raw materials. The fields of investigation are immense, and do not all lead to the same conclusions.

The case of developing countries requires a particular approach to these issues. The structures of the supply chains are different, the climate heightens risks and renders monitoring measures extremely costly, particularly through the infrastructures that they require. It naturally follows that setting priorities among problems and solutions to be implemented is different in these regions.

Potential Dangers in Feed

Sources of contamination can be identified at several levels: raw materials and by-products used (natural compounds, pesticide residues, residues resulting from industrial treatment, dangerous substances such as feeds including medicines), the process of feed production (over-dosage, processing, contamination of machines, cross-contamination) and storage, distribution and feeding methods.

Feed has a primarily positive effect. In the case of contamination, the animal is often affected without any consequence to its products (we speak of animals functioning as a "biological filter"). The effects can be unnoticeable in the animal or affect its performance or health, but in many cases the farm animal does not live long enough to manifest the effects. However, chemical or biological hazards can at times be accumulated by the animal and transmitted to through its own products (milk, eggs) with a short incubation period and the meat products derived after slaughter (meat and offal). Depending on the type of contaminant, there is a risk of the food product transmitting bacteria to humans. The nature of this potential danger conditions the preventive measures to be taken upstream (production of the feed) or at the level of farming practices (elimination of contaminated products).

Contamination by Aflatoxins

Aflatoxins are substances produced by molds (Aspergillus ssp). They mainly develop in hot and humid conditions, particularly on products rich in fats and protein, such as groundnuts, oilseed meal, etc. They can also be found in complete feeds. Aflatoxins can cause decreases in growth or even hepatic toxemia in commercial animals. They have a carcinogenic effect on humans. Their presence in feed, even in tiny amounts, can diminish performance and increase the risks of illness in farm animals. These toxins can also migrate into animal products (milk, eggs, meat and offal) and threaten human health. Thus this is a typical problem linking animal feed with the safety of food products.

A feed product's contamination can stem from several origins: contaminated raw materials (contaminated in the field or during storage); contamination during storage of the feed product; contamination during the distribution phase. The problems linked to contamination by storage must be treated first and foremost by improving the storage conditions. In addition, mold development inhibitors can be used in some cases.

Contaminated raw materials present a more serious problem: it is difficult to determine whether or not a shipment is contaminated. Testing is costly, and the means are not always available. The possible strategies to deal with this problem are :

- Avoiding the use of risky raw materials (poor quality peanuts and oil meal). This solution is not very realistic in the context of a generalized lack of raw materials for animal feed.
- Chemical detoxification of the risky raw materials. This treatment is expensive and difficult (pressurized ammonia), but it is effective. It can only be used by large industries that wish to be able to export oil meal that meets the standards of Western countries.
- Attempting to efficiently manage the supply of raw materials according to knowledge of contamination risk factors. This solution is difficult to implement in developing countries (poorly structured supply chains, small-scale producers). Furthermore, "risky" raw materials will always be used in some way, which does not resolve the public health problem.
- Using additives that supposedly absorb aflatoxins and thus prevent their absorption by the animal. Such additives (specific types of clay, activated carbon) exist on the

market, but there have been no “objective” scientific studies to precisely define their true effect, the appropriate amounts to use and their possible negative effects on the digestibility of the rest of the ration. Nevertheless, this method could be appropriate and effective in the context of the developing world as an “insurance” measure, and the presence of these additives could easily be monitored in laboratories.

Contamination by Feed Additives

Monogastric animal farms (pork and particularly poultry) use large amounts of additives, including coccidiostatics and antibiotics used in small quantities. These additives are particularly important in the control of certain types of contamination (coccidiosis) that can have a serious impact on floor pen farms in hot climates. However, excessive dosages and inappropriate use of these additives can pose a serious risk to public health through the development of resistances to certain antibiotics and the intrinsic toxicity of certain products. In Western countries, many of these additives are now illegal, and others require a minimum period of non-medicating feed before the products are consumed: meat-producing poultry are given a non-supplemented “weaning ration” a few days before they are slaughtered. On laying-hen farms, some substances are forbidden unless the eggs are not offered for sale for a certain period of time.

It is difficult to ensure that these rules are followed, and it is only made possible in Western countries by the high level of integration in the sector: the feed provider is also the poultry seller, and thus responsible for their quality.

In the framework of less integrated and/or less monitored supply chains, this measure is impossible. While one can prohibit certain substances, it is difficult to monitor all product flows. One possible measure is the training of the supply chain players. Another is the implementation of specific pre-slaughter feed practices: without using a weaning ration (non-enforceable), a required period could be imposed of feeding on ground maize-based feed, for example, which could be checked at the slaughterhouse simply by an observation of the digestive tract.

Feed-borne Microbial Contamination

The presence of disease-causing bacteria (mainly Salmonella and Listeria) in animal feed can result in either healthy carriage or disease in animals. Human consumption of animal products infected in this way can cause infection or food poisoning. Animal feed does not generally cause the microbial contamination of animal products. Nevertheless, in the case of salmonella, for example, there is often a correlation between the sero-types isolated in the feed and those carried by the animals. The presence of these bacteria in certain raw materials can thus warrant taking precautionary measures at this level, particularly as most salmonella contamination in feed seems to occur upstream in the chain, prior to heat treatment of either the raw materials or storage.

The raw materials most affected in this way are meat and fish meal. The risks are serious, and are particularly linked to the post-processing phase (bone meal) and drying (fish meal). Storage can also lead to contamination. Apart from improving processing, choosing appropriate raw materials and storage methods, these sensitive products can be preventively protected by the use of specific additives that limit the development of salmonella (organic acids, for example).

It should be noted that in hot countries, oil meal can also be at risk, as contamination can occur in the oilseed-crushing plant during the oil meal cooling phase.

Conclusions

Countries with hot climates are more exposed to microbial and fungal contamination. Furthermore, there are often residues (pesticides, etc.) in raw vegetable matter. For countries with less structured supply chains, it is also difficult to prevent contamination via inappropriate additives.

Furthermore, in developing countries, it is difficult to undertake the monitoring and testing necessary to protect the population: these measures are often difficult and costly to implement for small-scale farmers.

It is pointless to enact laws and regulations if the country does not have the means to enforce them. Thus the approach called for is completely different from the entirely regulatory-based system of countries in the North. In addition to preventive measures that are as effective as possible, these countries should implement safety practices that entail the use of non-toxic and inexpensive additives (clays, organic acids, etc.) that can significantly reduce risks. Objective and original research must be carried out in this area, with appropriate prioritization of the problems according to the frequency and gravity of contamination.

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