ISSN 2350-1049

International Journal of Recent Research in Interdisciplinary Sciences (IJRRIS)
Vol. 5, Issue 2, pp: (1-4), Month: April - June 2018, Available at: www.paperpublications.org

ANIMAL FEED SAFETY: AN OVERVIEW

Boradiya, P.C[1]. Savsani, H. H[1]. Odedra, M. D[2]. Patil, S. S[1]. Gohil, B.C[1]. Trivedi, S. P[1.] Patel, J. A.[3]

[1] Dept. of Animal Nutrition, [2] Dept. of Livestock Production Management, [3] Dept. of Veterinary Parasitology. CVS & AH, JAU, Junagadh-362001

Abstract: **The global food system is experiencing profound changes in consumption patterns, especially in the increasing demand for livestock products, leading to worldwide growth in intensive livestock production. There is an increasing need for adequate feed materials which need to be wholesome and safe for the animal as well as free of undesirable or toxic substances that could compromise the quality and safety of animal-derived foods. The most common biological hazards are zoonotic bacterial pathogens that enter the food chain via contaminated feeds and poor hygienic conditions at the farm level. Potential contaminants in feedstuffs include residues of persistent pesticides, brominated compounds or other environmental contaminants such as the polychlorinated biphenyls (PCBs), and dioxins as well as heavy metals including mercury, lead, or cadmium and natural toxins, such as mycotoxins. Various factors: biological, chemical, and physical hazards need to be evaluated regarding their impact on animal health and productivity as well consumer safety. Advancement in feed safety assessment can be achieved only through multidisciplinary approaches involving agriculture, feed processing and technology, animal nutrition, microbiology, toxicology, veterinary medicine and related disciplines.**

Keywords: **Global food system, hazards, animal feed safety, safe food and human health.**

1. INTRODUCTION

The global food system is experiencing profound changes in consumption patterns, especially in the increasing demand for livestock products, leading to worldwide growth in intensive livestock production. In turn, there is an increasing need for adequate feed materials which need to be wholesome and safe for the animal as well as free of undesirable or toxic substances that could compromise the quality and safety of animal-derived foods (Fink-Gremmels, 2012; Sharma *et al*., 2015).

The system is based on the setting of 'feed safety objectives', which make use of principles that relate to animal health and welfare and environmental and legal aspects, as well as the safety criteria set for human foods of animal origin, the so-called 'food safety objectives'. To set feed safety objectives, the principles of risk analysis must be used**.** (Dorne and Fink- Gremmels, 2013).

1) Biological hazards in feed

The most common biological hazards are zoonotic bacterial pathogens that enter the food chain via contaminated feeds and poor hygienic conditions at the farm level. The animal may experience clinical disease conditions, but in many cases remain a silent carrier of such pathogens (such *as Campylobacter).* When hygienic barriers are incomplete during slaughter and processing, the pathogen is transferred to meat, where they can proliferate under certain conditions. Eggs can be infected by horizontal transmission of pathogens in layer units and milk may be contaminated by mastitis pathogens prior or during the milking process. Typical examples for such zoonotic pathogens are *Campylobacter spp. in poultry, Salmonella spp.E.coli O157, Enterococci, and Staphylococcus spp.* (Crump *et al*., 2002).

2) Feed borne animal diseases

Feed ingredients are regularly subject to contamination from diverse sources, including environmental pollution and the activities of insects and micro-organisms. This is in addition to endogenous toxins associated with some of the plant

materials used. Many of these contaminants cause adverse health effects such as infections and intoxications in the animals and may be transmissible to humans.

BSE **(Bovine Spongiform Encephalopathy)** is a disease of cattle which was first recognized in Great Britain in 1986. Cases have since occurred in many other countries. It is believed now that the disease is caused by a natural protein which folds in the wrong way and then causes other similar proteins to adopt a similar shape. The new form gradually accumulates and spreads. It can transmit disease from animal to animal at least experimentally and from contaminated animal tissue to humans (Bruce *et al.*, 1997a: Bruce *et al.*, 1997b).

3) Chemical hazards in feed

Potential contaminants in feedstuffs include residues of persistent pesticides, brominated compounds or other environmental contaminants such as the polychlorinated biphenyls (PCBs), and dioxins as well as heavy metals including mercury, lead, or cadmium and natural toxins, such as mycotoxins. Feeds may also contain intentionally applied veterinary drugs, such as coccidiostats and antimicrobial growth promoters. Considering the recent concerns about the global emergence of antimicrobial resistance, antimicrobial growth promoters are banned in many regions (such as Europe) already since 2006 and phasing out strategies have been recommended to all countries by WHO in their recent documents on combating antimicrobial resistance (Sharma *et al*., 2016).

Different kinds of pesticides are commonly used in agriculture for various purposes. Among those, organophosphates, pyrethroids and carbamates are comparatively rapidly degraded and consequently found in lesser amounts in feed and food, while persistent organochlorine pesticides (POPs) and even banned pesticides such as dichlorodiphenyltrichloroethane (DDT), aldrin, dieldrin, endrin, heptachlor, and hexachlorobenzene (HCB) may still be present as undesirable chemical residues in animal feed due to their low bio-degradability **(**Havelaar *et al.*, 2015, WHO Global Survey).

4) Heavy metals contamination

Toxic heavy metals (cadmium, lead and mercury) and other chemical elements (arsenic, chromium, copper and zinc) occur naturally in the environment, but industrial processes may increase their concentration in distinct geographic regions, leading to their accumulation in plants that are consumed by animals or harvested as feed **(**Fink-Gremmels, 2012). Subsequently, the ubiquitous presence of some metal pollutants, especially cadmium (Cd), chromium (Cr), arsenic (As), nickel (Ni), mercury (Hg) and lead (Pb), facilitates their bioaccumulation, leading to elevated levels in certain animal tissues and to a potential public health hazards (Clifton, 2007).

5) Natural toxins

Among the natural toxins, mycotoxins have a significant impact on human and animal health, resulting also in economic and international trade implications **(**Marroquín-Cardona *et al*., 2014).

Aflatoxin B1, B2, G1 and G2 (AFB1, AFB2, AFG1 and AFG2, respectively). In addition, aflatoxin M1 (AFM1) has been identified in the milk of dairy cows consuming AFB1contaminated feeds. The aflatoxigenic *Aspergilli* are generally regarded as storage fungi, proliferating under conditions of relatively high moisture/humidity and temperature. Aflatoxin contamination is, therefore, almost exclusively confined to tropical feeds such as oilseed by-products derived from groundnuts, cottonseed and palm kernel. Aflatoxin contamination of maize is also an important problem in warm humid regions where *A. flavus* may infect the crop prior to harvest and remain viable during storage **(**D'Mello, 2001).

6) Plant Toxins

Many plant components have the potential to precipitate adverse effects on the productivity of farm livestock (D'Mello, 2000). These compounds are present in the foliage and/or seeds of virtually every plant that is used in practical feeding.

Plant toxins may be divided into a heat-labile group, comprising lectins, proteinase inhibitors and cyanogens, which are sensitive to standard processing temperatures, and a heat-stable group including, among many others, antigenic proteins, condensed tannins, quinolizidine alkaloids, glucosinolates, gossypol, saponins, the non-protein amino acids S-methyl cysteine sulphoxide and mimosine, and phyto-oestrogens. The role of these substances as antinutritional factors has been considered at length by D'Mello (2000), but the salient points are worth reiterating.

7) Veterinary drug residues

Veterinary drug residues may be found in animal products as a result of their use in animals without taking into account the prescribed withdrawal (drug withholding) times.

Veterinary drug residues may be found in animal products as a result of their use in animals without taking into account of prescribed withdrawal (drug withholding) times. The drug residues are development of drug resistance, hypersensitivity reaction, carcinogenicity, mutagenicity, teratogenicity and disruption of intestinal normal flora (Lynas *et al.*, 1998).

8) Radionuclides and Nano materials

Radionuclides including caesium-134, caesium-137, strontium-90 and iodine-131 present in animal feed and forages may get transferred to edible products. Major sources are contaminated soil, water and forage. Transfer of radioiodine to milk, radio strontium to bone, and radio-cesium to milk, eggs and meat has been demonstrated (FAO/WHO, 2013).

Some suggestions for improving feed safety

- Each country should adopt the FAO/WHO Codex Alimentarius standards for producing safe feed, and national guidelines should be issued in line with these guidance documents.
- Awareness and capacity building programmes need to be implemented for feed manufacturers and livestock farmers.
- Hazard Analysis and Critical Control Points (HACCP) protocols need to be established for the feed industry to guarantee compliance with good manufacturing practice.
- Regular screening of feed ingredients and final feed for various undesirable substances by national governmental institutions should be implemented.

2. CONCLUSIONS

Changing food habits and food pattern requires a thorough surveillance to establish SAFE FOOD chain from farm to fork. In the multiple steps to achieve this, surveillance of animal feed comes as first critical control point for delivering safe animal products.

Various factors: biological, chemical, and physical hazards need to be evaluated regarding their impact on animal health and productivity as well consumer safety. Considering the enormous importance of the issue for food safety and human health, further initiative/mission should be initiated by international organizations (FAO/WHO/OIE) to encourage the creation of a database on the occurrence of undesirable substances in animal feeds and to simultaneously build capacities of stakeholders involved in feed manufacturing/regulation/quality control to control this occurrence.

Advancement in feed safety assessment can be achieved only through multidisciplinary approaches involving agriculture, feed processing and technology, animal nutrition, microbiology, toxicology, veterinary medicine and related disciplines. The United Nation's Millennium Development Goals (MGD's) and Sustainable Development Goals (SDG's), both, realized the importance of environmental sustainability and good health and safeguarding human health through feeding safe feed to livestock is an important step towards fulfilling those goals and objectives and to attain sustainable food supplies.

3. FUTURE PROSPECTS

- Identification and prioritization of potential hazards for animal feed in specific agro-climatic zone.
- Development of simple and rapid screening methods for laboratories to manage large number of samples.
- Exposure assessment through the collation of large sets of data on the occurrence of feed contaminants at the global level.
- Assessment of undetected or emerging hazards from newer feedstuffs viz. biofuel by-products, insects, aquatic plants and marine products, which may be used as feed materials. The assessment can support the increasing need for safe feed materials.

REFERENCES

[1] Bruce M E, Will R G, Ironside J W, McConnell I, Drummond D, Suttie A (1997a), 'Transmissions to mice indicate that `new variant' CJD is caused by the BSE agent' Nature 389, 498-501.

[2] Bruce M E, Will R G, Ironside J W, McConnell I, Drummond D, Suttie A (1997b), 'Transmissions to mice indicate that `new variant' CJD is caused by the BSE agent' Nature 389, 498-501.

[3] Crump, J. A.; Griffin, P. M. and Angulo, F. J. 2002. Bacterial contamination of animal feed and its relationship to human foodborne illness. *Clinical Infe. Diseases*. 35: 859-865.

[4] D'Mello, J.P.F. 2000. Antinutritional factors and mycotoxins. *In* J.P.F. D'Mello, ed. *Farm animal metabolism and nutrition*, pp. 383-403. Wallingford, UK, CAB International.

[5] D'Mello, J.P.F. 2001. Mycotoxins in plant products. *In* J.P.F. D'Mello, ed. *Food safety*. Wallingford, UK, CABI Publishing. (In press)

[6] Dorne, J. L. C. Mand Fink-Gremmels, J. 2013. Human & animal health risk assessment of chemicals in the food chain: comparative aspects and future perspectives. Toxicology and applied Pharmacology. 270:187-195.

[7] FAO/WHO 2013. Report of the seventh session of the Ad-hoc intergovernmental codex task force on animal feeding. Thirty sixth sessions, Rome, Italy

[8] Fink-Gremmels, J. 2012. Animal feed contamination: effects on livestock and food safety Woodhead Publishing Ltd.; Cambridge, UK. Pages: 672

[9] Havelaar, A. H.; Kirk, M. D.; Torgerson, P. R.; Gibb, H. J.; Hald, T.; Lake, R.J .; Praet, N.; Bellinger, D. C.; de Silva, N. R.; Gargouri, N.; Speybroeck, N.; Cawthorne, A.; Mathers, C.; Stein, C.; Angulo, F. J.; Devleesschauwer, B., 2015. World Health Organization Global estimates and regional comparisons of the burden of foodborne disease in 2010. PLoS Med 12: e1001923

[10] Lynas, L., Currie, D., McCaughey, W.J., McEvoy, J.D.G. & Kennedy, D.G. 1998. Contamination of animal feedingstuffs with undeclared antimicrobial additives. *Food Additives and Contaminants*, 15: 162-170.

[11] Marroquín-Cardona, A. G.; Johnson, N. M.; Phillips, T. D.; Hayes, A. 2014. Mycotoxins in a changing global environment–a review. *Food Chem Toxicol* 69:220230.

[12] Sharma, V.; Sharma, S.; Datt, C. 2015. Potential Hazards in Animal Feeds: Safety and Regulation- Review. *Indian J. Anim. Nutr.* 32 (3): 242-262.

[13] Sharma. S.; Sharma. V.; Jain. J.; Agarwal. S.; Dahiya. D. K.; Khan, A. 2016. Organochlorine, organophosphate, synthetic pyrethroids assessment in bovine milk and water samples of Jaipur, Rajasthan, *Indian J.Anim.Sci.* 86 (3): 288–293.