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FEED SAFETY AND ITS IMPACT ON FOOD SAFETY THROUGH THE CONCEPT OF ONE HEALTH

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Abstract

Animal feed is essential in the global food industry for sustainable production of safe food from animals. Feed safety directly affects food safety and human health, through the health and well-being of animals. It serves as a component of access to trade and competitiveness, income generation and foreign exchange earnings as well as economic development and sustainability along the livestock value chain. Feed is an important part of the food chain and feed safety. Therefore attention must also be on feed production like we have in food production, under the concept of one health.

Ensuring food safety remains a significant challenge in both developing and developed countries because it relates to public health and economic development. Various food related diseases originating from animal feeding include Bovine spongiform encephalopathy and Foot-and-Mouth Disease (FMD). Related problems include the development of resistance in humans to antimicrobials. Salmonellosis with very high chances of cross infection from infected animals. Globally, about 93 million cases of non-typhoidal Salmonella and 155,000 deaths have been reported. Annual antimicrobial resistance cases of 4,375,000; 4,125,000; 375,000, and 315,000, in Asia, Africa, Europe, and USA, respectively have been reported.

Presently, the different challenges confronting the industry will require global solutions, including the emergence or re-emerge of infectious diseases through cross contamination between animals, humans, and the ecosystems. Other challenges are lack of know-how to regulate operators to ensure feed safety along the livestock value chain, absence of structure control systems, introduction of unconventional feed ingredients into the production chain like insect meal, by-products of food processing and further foods. Thus, the possibility of additional safety risks in the use of these feed sources for animals exist.

In Nigeria, The Nigerian Institute of Animal Science (NIAS), has regulations for the feed milling industry in Nigeria in line with *Codex Alimentarius* and other international standards, through the concept of 'One health' with the sole objective to lower the global impact of diseases of animal origin and zoonoses.

Key words: Feed and food safety, food animals, one health
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Introduction

The role of animal feed in the production of safe food takes precedence in the global food industry, being the largest and most important component for sustainable production of safe and affordable animal proteins.

The world population is projected to increase by 1.2 percent annually and the next century will represent a period of exponential growth. With increasing urbanization and income, the demand and consumption of animal products is expected to increase by 70% in 2050. The increase will result in increased animal production, which will require an additional amount of feed to be produced. However, the challenge is not only to meet the growing demand for feed but to ensure its safe feeds.

Feed safety is important for animal health and welfare. It is a prerequisite for food safety and human health. It is essential to market access, trade and competitiveness, income generation and economic productivity and sustainability. Feed safety is an essential part of the food chain. It plays roles in feed and food security and in the reduction of feed losses. However ensuring safe, accessible, affordable, and nutritious food is increasingly difficult globally. Central to this challenge is the development of a One Health strategy, which recognizes feed safety as a shared value and responsibility, through the concept of one health with collaborative efforts of multiple disciplines working both locally and internationally for the health and wellbeing of the people, animal and the environment. In this light feed production must therefore receive adequate attention, in a similar manner as food production, to the quality assurance of integrated food safety systems.

Feed safety

Feed safety deals with the sourcing, handling and storage of raw materials, processing, and storage of finished feed in such a manner to prevent contamination from both biological and chemical agents and from causing illness in and injury to animals and food-borne illness in the consumer. The concept of animal feed safety with the overall aim of achieving food safety for all, impacts not just the health of animals but also that of producers, handlers and consumers. Over the years the Food and Agricultural Organization has worked substantially to provide scientific and technical advice, standards, guidelines, capacity development and partnership with relevant stakeholders in the feed and food sectors. The increase in livestock production resulting from increasing demand, has led to the rise in the use of demand for selected grains and fodder seed, mostly grown with various fertilizers and pesticides as well as the use of some new unconventional materials such as by-products from biofuel and several agro industrial by-products in the production of feed. Consequently, there have been several reported cases of food contamination from animal origin (Morton, 2002). This has led to the need to prevent and control the presence of old and new hazards, such as, aflatoxins and other agents. The approach is to reduce and prevent the entry of hazards at the primary production chain and the recognition of the link between safe feed and safe food

Food safety

Food safety is defined as the assurance that food will not cause harm to the consumers, when it is prepared or eaten according to its intended use (FAO, 1997). Food safety is ensuring food is safe to consume and free of contaminants such as infectious microbes, toxic chemicals, and foreign bodies. It entails handling, preparation, and storage of food in such a manner to prevent food-borne illness in the consumer, as a good number of microbes survive in our environment, on grains, pasture and in water (Pal, 2013). Globalization and industrialization gave room to the emergence, re-emergence, and spread of food-borne pathogens. In 1997, the National Food Safety Policy was announced by the United States with the main objective being to reduce food-borne illness (IOM, 2012). However, many food-borne pathogens still pose significant threat to human health worldwide with one out of every three persons suffering from food-borne illnesses annually due to re-emergence and other factors related to lifestyle, political, economic, and ecological changes.

One Health

The scope of one health is all encompassing and still expanding. It entails the collaborative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for the people, animals, and our environment (King *et al.*, 2008). The nature and complexity of food safety issues demand that scientists, researchers, and stakeholders collaborate with other professionals to explore new models of interdisciplinary work. The concept of One Health, clearly embraces environmental and ecosystem health, social sciences, ecology, noninfectious diseases and chronic diseases, wildlife, land use, antimicrobial resistance, biodiversity, and more. However, there may be concerns on the precise definition of One

Health, with the understanding that a new framework for prevention rather than reactive response to food-borne diseases is the way forward.

Feed and food safety challenges

As the human populations increases the demand for animal protein will increase and a deficiency can lead to public health problem. The world production of food animals has decreased by more than 20% due to disease, implying that even non-zoonotic diseases in the animal can lead to serious public health problems (Vallet, 2009).

Food safety problems may result in various health challenges. Research has shown that about, 75% of emerging diseases, 80% of the pathogens (Pal, 2013) and generally 62% of human illness are of animal origin. Diarrheal often caused by microbial contamination in food and water is the leading causes of various illness and death in most developing countries. In China, the consumption of contaminated calms, resulted in the outbreak of Hepatitis A in 1998, with over 300,000 individuals affected and 1.8 million deaths globally on a yearly basis (Pal, 2013), while in developed countries, up to one-third of the population are affected by microbial food-borne diseases annually (Mead *et al*., 1999).

Achieving feed and food safety still remains an important challenge to public health and economic development in both developing and developed countries. Food related diseases originating from animal feeding include Bovine spongiform encephalopathy (BSE or CMD) which can be transmitted by the addition of infected animal products like bone meal to livestock feed and has been associated with variant Creutzfeldt-Jakob (vCJD) disease in humans (Pal, 2013); Foot-and-Mouth Disease (FMD), *L. monocytogenes* considered as one of the most important agents of food-borne zoonotic disease, with about 25000 cases globally out of which 5000 deaths are recorded annually, and *E. coli* first reported in beef production chain (Rhoades *et al*., 2009), records 73000 cases and 61 deaths occurring every year in the United States. Campylobacteriosis has been identified as one of the principal causes of human acute gastroenteritis worldwide (Allos, 2001; Pal, 2005), with *C. jejuni* and *C. coli* mainly responsible for human enterocolitis (Pal, 2007), accounting for 80-90% of enteric diseases with about 400 million cases every year. Salmonellosis, implicated as the most common cause of food poisoning associated with the *S. Enteritidis*. Many outbreaks are attributed to contaminated poultry, chicken eggs, and the products that contain eggs (Rhoades *et al.,* 2009) with very high chances of cross infection from infected animals (Pal, 2007). About 93 million cases of non-typhoidal Salmonella with 155,000 deaths is recorded globally, and annual antimicrobial resistance cases of 4,375,000 in Asia; 4,125,000 in Africa; 375,000 in Europe, and 315,000 in the United States, respectively. Related problems include the development of resistance to antimicrobials in humans resulting from the addition of low concentration of antibiotic and antimicrobial agents to animal feed as growth promoter and unconventional agents causing diseases like the indiscriminate introduction of various unconventional materials into feed for livestock without sufficient research. Inadequate know-how and sufficient awareness on feed safety among all operators along the entire value chain also pose great concern to feed and food safety.

Confronting feed safety challenges

Feed regulatory frameworks should be established to implement feed regulations that have been harmonized with the Codex Alimentarius and other international standards. The role of animal feed regulators should go beyond the application of the risk analysis framework to facilitating further understanding of the role of animal feed safety on public health and the importance of risk-based measures to prevent and control hazards.

Adequate know-how and sufficient awareness should be put in place to ensure feed safety among all operators along the entire value chain. Even where more knowledge is available, structured control systems must be put in place to screen new and unconventional feed ingredients entering the production chain which may possibly pose new safety risks. For these to be achieved, feed and food safety programs have to be put in place, with a new way of thinking channeled towards self-regulation, with strict adherence to Good Manufacturing Practice (GMP). Standard operating procedures (SOPs) must be developed for all activity in the production chain including cleaning and sanitation to ensure the production of safe and wholesome food. The aforementioned are essential for Hazard Analysis Critical Control Point (HACCP), a systematic and scientific food safety management strategy, which cuts across the entire food chain (Nguyen *et al*., 2004; Domenech *et al*., 2008). The HACCCP involves the control of biological, chemical, and physical hazards, from raw material production, procurement and handling to manufacturing, distribution and consumption of the finished product (Jadav and Pal, 2001; Pal, 2013).

The use of antimicrobial agents on food animals must be banned especially as growth promoters and may be replaced with prebiotics and probiotics, except in special cases where medicated feed is required to address special conditions and such medicated feed must be recommended by a professional and approved by the relevant regulatory body to minimize antimicrobial resistance in humans. Feed grade enzymes may be used to replace antimicrobial used as growth promoters.

In cases where antibiotics are used, the recommended withdrawal period must be strictly adhered to avoid residual effects of drugs in food of animal origin and such animal must not be slaughtered for food before the withdrawal period elapses.

Conclusion

Feed and food safety systems are vital to maintain consumer confidence in the food system, to strengthen the regulatory system, to improve market access, trade and competitiveness for local and international trade and economic development. The implementation of the One Health approach through proactive measures involving bringing together various disciplines, skills, and knowledge, is a challenge which may require a paradigm shift in the organizational structure especially in many developing nations, to achieve a functional and effective multidisciplinary, and One Health approach. Therefore, developing nations must start now to initiate the establishment of National Food and Feed Safety Policies. Regulatory Councils for feed and livestock industry driven by the Animal Scientists like the Nigerian Institute of Animal Science (NIAS) in Nigeria should come up with regulations and guidelines in line with *Codex Alimentarius* and other international standards, develop database for the feed industry through registration of premises for traceability, trainings and sensitization of target audience on GMP, GHP (Good Hygiene Practice), HACCP and the development of SOPs for their operations for effective inspection, surveillance and enforcement.

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