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Aflatoxicosis in Dairy Cow: A Review

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ABSTRACT

Aflatoxins are a group of mycotoxins which are secondary metabolites mainly produced by several fungus species. The major members are designed as B1, B2, G1 and G2. B1 and B2 fluorescence blue, while G1 and G2 fluorescence green. In some animal species in dairy cattle, aflatoxin B1 and B2 are partially metabolized to the hydroxylase derivate namely M1 and M2, respectively. Aflatoxins P1 are a urinary metabolite of B1 in monkeys. All aflatoxins absorb ultraviolet light in the range of a characteristic used in prelimanitary identification. Aflatoxicosis is primarily a hepatic disease. The susceptibility of individual animal to aflatoxins varies considerably depending on species, age, sex and nutrition. In fact aflatoxins cause liver damage, decrease milk and egg production, recent infection as results of immunity suppression. The growth of toxigenic molds and elaboration of the toxin occurs if the moisture conditions are ideal following harvest and storage, in domestic animal and human throughout the world. The occurrence of aflatoxins is influenced by certain environment factors; hence the extent of contamination will vary with geographic location, agricultural and agronomic practice, and the susceptibility of commodities to fungal invasion during pre-harvest, storage, and processing periods.

Keywords: Aflatoxin, Contamination, Lethal Dose, Ultraviolet, Carcinogen.

ABBREVIATIONS AND ACRONYMS

AFM1=Aflatoxin M1; AFM2 =Aflatoxin M2; AFB1 =Aflatoxin B1; AFB2 =Aflatoxin B2; AFG1 =Aflatoxin G1; AFG2 =Aflatoxin G1; HBV= Hepatic B virus; PPM = Part per million; LCC=Liver Cell Cancer; LARC=International Agency for research on cancer; TLC =Thin Layer Chromatography; LC= Liquid Chromatography; UV =Ultra Violet; DNA =Deoxyribonucleic Acid

RNA=Ribonucleic Acid; WHO=World Health Organization.

INTRODUCTION

Fungi (Moulds) are filamentous (fuzzy or dusty- appearing fungi) species that commonly occur in feed stuffs, including roughages and concentrates. Fungal growth and production of mycotoxins are usually associated with extremes in weather conditions leading to plant stress or hydration of feedstuffs, insect damage, poor storage practices, low

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feedstuff quality, and inadequate feeding conditions [1]. Fungi can infect animals causing a disease referred to as mycosis. Aflatoxins are a group of mycotoxins which are secondary metabolites mainly produced by several fungus species in the genus *Aspergillus*, it includes *A. flavus* and *A. parasiticus, A. pseudotamarii*, species. Among these species *A.parasiticus* are well known [2]. Aflatoxin contaminated feed is consumed by dairy cow, the animals can be affected by the toxin of *A. flavus* and *A. parasiticus*, *A. pseudotamarii*, species. Furthermore, milk produced when toxic feed is consumed by the cow may contain aflatoxin. The af1atoxin that appears in milk is chemically somewhat different from the aflatoxin that was consumed by the cow, but the milk toxin retains the toxicity and some of the carcinogenicity of primary toxin. Aflatoxin M1 (AFM1) is the principal hydroxylated AFB1 metabolite present in milk of cows feed with a diet contaminated with AFB1 and excreted within 12 hours of administration of contaminated feeds [3].

Aflatoxins occurs worldwide, the recent estimates suggest that there are more than five billion people worldwide at risk of chronic exposure to aflatoxins in tropical countries because of high temperature moisture, and unseasonal rains. That is continued to be problems of significant public health concern as long as people consumed contaminated animal products and considered as public health important. In the developing world seriously affect people's health and livelihoods, as freedom of choice in food is limited for a poor and food-insecure population [4]. Once aflatoxins are produced by the fungi, they are heat, cold, and light stable. They persist to some extent in food even after the inactivation of the fungi by food processing methods, such as ultra-high temperature products, due to their significant chemical stability. Aflatoxins are colorless, odorless, and tasteless because even low concentrations can be important, and with the uneven distribution in commodities, aflatoxins are difficult to detect accurately [5].

History of Aflatoxins

Aflatoxins were discovered in 1960s' when more than 100,000 young turkeys died in England over the course of a few months from an apparently new disease that was termed "Turkey-X disease". It was soon found that the mortality was not limited to turkeys. Ducklings and young pheasants were also affected. After a careful survey of the outbreaks, the disease was found to be associated with the Brazilian groundnut meal. An intensive study of groundnut meal revealed its toxic nature as it produced typical symptoms of Turkey-X disease when consumed by poultry and ducklings. A study on the nature of the toxin suggested its origin from the fungus *Aspergillus flavus*. Thus, the toxin was named "aflatoxin" by its origin from *A. flavus*. This was the event which stimulated scientific interest and gave rise to modern mycotoxicology. Research on aflatoxins led to a "golden age" of mycotoxin research during which several new mycotoxins were discovered [1]. Other important mycotoxins produced by *Aspergillus, Fusarium* and *Penicillium* include ochratoxin, patulin and among all mycotoxins and polypeptide compounds synthesized by fungal species, aflatoxins (the most potent hepatotoxic and carcinogenic metabolites) continue to receive major attention and are mostintensely studied.

Aflatoxins are secondary fungal metabolites included in the class of mycotoxins. That produced by fungi genus *Aspergillus* species, namely *A. flavus, A. parasiticus, A. ochraceoroseus, A. bombycis, A. nomius, A. fumigitus* and *A. pseudotamarii*. Among these species *A. flavus* and *A. parasiticus* are well known and it produced during their growth under favorable conditions. The relative proportions and amounts of the various aflatoxins in food crops depend on the Aspergillus species present, pest infestation, growing and storage conditions, and other factors [6].

These Aflatoxins are divided into six major toxins according to their fluorescent properties under ultraviolet light and their chromatographic mobility. Both *A. flavus* and *A. parasiticus* produce Aflatoxins B1 and B2 which produce blue fluorescence, while A. parasiticus produces Aflatoxins G1 and G2 which have green fluorescence. The four times hydrated aflatoxinB1 and B2 is converted to *Aflatoxin M1* and *M2* respectively. They are present in the milk of lactating mammals which have consumed *Aflatoxin* contaminated feed. Aflatoxin B1 is the most toxic and the most prevalent [7].

LITRATURE REVIEW

Epidemiology

Aflatoxins can contaminate corn, cereals, sorghum, peanuts and other oil seed crops. Thus, food contamination by this group of mycotoxins has been implicated in both animal and human health. Aflatoxins often occur in crops in crops in the field prior to harvest, post-harvest contaminated can occur if crop drying is delayed and during storage of crop if water is allowed to exceed critical value for the mold growth. Insect or rodent infestation facilities moldy invasion of some stored commodities. Aflatoxicosis is the most important food borne mycotoxins. It has greatest significance in tropical developing countries [8].

Aflatoxins can affect a wide range of commodities including cereals, oilseeds, spices, and tree nuts as well as milk, meat, and dried fruit. Reports from different part of the world indicated incidence of aflatoxins vary from 40 to 92%. Especially developing countries located in the tropical regions have greatest risk. Their climate is favorable to growth of aflatoxin. Where dietary food stuffs and Staple food source commodities is highly contaminated with aflatoxins [9].

Aspergillus flavus and aflatoxin forms sclerotic which allow it to survive in soil for extended periods of time. The sclerotic are the principal sources of primary inoculum. They are also found in foodstuffs and are not destroyed by normal industrial processing or cooking since they are heat stable. Conditions such as high temperature and moisture, unseasonal rains during harvest and flash floods lead to fungal proliferation and production of mycotoxins [10]. Poor harvesting practices, improper storage and less than optimal conditions during transportation, marketing and processing can also contribute fungal growth and increase the risk of mycotoxins production. Some of their metabolites are still toxic and may be involved in human diseases. The toxic effects of aflatoxins on organs like liver, kidney and mainly their carcinogenic effects are mostly known causes of morbidity and mortality [11].

Properties of *Aflatoxins*

The aflatoxins have closely related structures and form a unique group of highly oxygenated, heterocyclic compounds. The two major types of afflation were named aflatoxins B and G (blue and green) after the color of their fluorescence under long wave ultraviolet light. This intense fluorescence forms the basis of most assay techniques for aflatoxins [12].

Physical and Chemical Properties of Aflatoxins: Aflatoxins are colorless to pale yellow crystals, exhibiting fluorescence under UV light. They are slightly soluble in water (10-20μg/ml) and freely soluble in moderately polar solvents such as chloroform, menthol and dimethyl sulfoxide. They are unstable in UV light in presence of oxygen, unstable in extreme pH (<3 or >10). The lactone ring opens under alkaline conditions and the aflatoxins are destroyed, but this reaction is reversible on acidification. Ammoniation results in the opening of lactone ring at high temperature, causes decarboxylation of aflatoxins and this reaction is irreversible (Physical and chemical properties of aflatoxins). Some important physical and chemical properties of major Aflatoxins are as follow as:

Table 1. Physical and Chemical Properties of Major Aflatoxins (Kumar,2018)

Aflatoxin Type	Molecular Formula	Molecular Weight	Melting point (°C)	UV absorption (e)		Fluorescence Emission (nm)
				Amax (nm)	€(L. mol^{1}.Cm^{1}) x 10^{3}	
B1	C17H12O6	312	268-269	223	25.6	
				265	13.4	425
				362	21.8	
B2	C17H14O6	314	286-289	265	11.7	425
				363	23.4	
G1	C17H12O7	328	244-246	243	11.5	
				257	9.9	450
				264	10	
				362	16.1	
G2	C17H14O7	330	237-240	265	9.7	450
				363	21	

Intoxication

Aflatoxins, like any other mycotoxins, are a sub-class of substances which originated as a result of secondary metabolism of fungi. Unlike primary metabolites, these secondary metabolites are not essential for the growth of the fungi but have survival functions in nature. The usual routes for aflatoxins exposure are ingestion of afflation contaminated foods and feeds. Diet is the major way through which humans as well as animals are exposed to aflatoxins. Apart from this, exposure to aflatoxin can be through ingestion of contaminated milk M1 (metabolite of AflatoxinB1). Moreover species susceptibility to aflatoxin mainly depends on its liver detoxification systems, genetic makeup, age and other nutritional factors [13].

Wide variations of LD50 values had been obtained in animal species tested with simple doses of aflatoxins for most species. The LD50 values ranges from 0.5 to 10mg/kg body weight. The toxic properties of the aflatoxins also manifest themselves differently depending on the test system, dose and duration of exposure. Thus, they have been shown to be lethal to animals and animal cells in culture, when administered acutely in sufficiently large doses and to cause histological changes in animals when smaller doses were administered sub acutely. Chronic exposure for extended periods has resulted in tumor induction in several animal species [14].

Aflatoxin and Aflatoxicosis on Human and Livestock Health

Decrease performance (i.e. rate of gain milk production) is one of the most sensitive indicators of aflatoxicosis. The ultimate cause of this effect is probably multifactorial, involving not only nutritional interaction, but also the compounding influences of anorexia, deranged hepatic protein and lipid metabolism and disturbance in hormonal metabolism. Aflatoxin have shown to affect rumen mobility and rumen function by decreasing cellulose digestion,volatile fatty acid production and production and proteolysis[15]. In 1988, international agency for research on cancer (IARC) classified the afflation B1 as human carcinogen. Aflatoxin B1 present in livestock feed causes serious problems in genital, digestive and respiratory tracts through different mechanisms such as interference in metabolism of carbohydrates, fats and nucleic acids. Hepatotoxicity and Nephrotoxicity effects on humans [16].

Effects of Aflatoxin on Animal Health

Aflatoxin has both acute and chronic toxicity in animal, and produce quite different effects. Acute liver damage, liver damage, liver cirrhosis, induction of tumors and teratogenicity and other genic effect. Aflatoxicosis is primary a hepatic disease, the susceptibility of individual animal to aflatoxin varies considerable depending on species, age, sex and nutrition. In fact aflatoxins cause liver damage, decrease milk and egg production, recent infection as results of immunity suppression. While the young species are most susceptible, all ages are affected but in different degrees for different species. Clinical signs of aflatoxicosis in animal include gastrointestinal dysfunction, reduce reproductively, reduce feed utilization and efficiency, anemia and jaundice. Nursing animal may be affected as result of the conservation of aflatoxin B1 to the metabolite aflatoxin M1 excreted in milk of dairy cattle [17].

Domestic animal (pets and agriculture), monkeys and laboratory rats and mice have been the subject of a large body of research on the adverse effect of aflatoxins (particularly) B1). These effect include adducts and mutation, cancer, immune suppression, lung injury and birth defects. Also, aflatoxin have been shown to interact with DNA nuclear and mitochondrial adducts) and polymers responsible for DNA and RNA synthesis [18]

Among other domestic animal aflatoxicosis in cows is also described, as a result of acute toxicity, calves develop a disease that features blindness, circling, failing down twitching of ears, grinding of heath and spasm of the rectum is seen in most cases. Death usually follows within two days of onset of server clinical sign. Postmortem finding relevant pale, firm and fibroses liver. The kidneys are yellow and surrounded by wet fat [19].

Other pathological features in cattle are blood coagulation defects, which may involve impairment of prothormbin, factors VII and X and possible factor IX. A single dose of aflatoxin cause increase in plasma enzymes (aspirate aminotransferase, lactate dehydrogenase gamma-glutamyl transferase and alkaline phosphate) and in bilirubin, probably reflecting liver damage. Other abnormal clinical findings are proteinuria ketouria, glycosuria and hematuria. The induction of cancer by aflatoxins has been extensively studied. Aflatoxin B1, M1, and G1 have been shown to cause various types cancer in different animals species however, only aflatoxin B1 is considered as having as having produced sufficient evidence of carcinogenetic in experimental animal to be identify as a carcinogen [20].

Dairy Cows

The sign most commonly reported with acute toxicosis in cattle include anorexia, depression, dramatic drop in milk production,weight loss, lethargy, ascites, icterus, abdominal pain (animal may streach or kick at their abdomen) bloody diarrhea, abortion, photosensitization and bleeding. In addition, chronic aflatoxicosis may impair reproductive efficiency including abnormal estrous cycle (too short and too long) and abortion, induce immunosuppression and increase susceptibility to disease the immunotoxic effect of AFB1 was expressed via the cell mediated immune system [21].

Other symptoms including decrease milk production, diarrhea, acute mastitis, and respiratory disorder proposed rectum and hair loss are also observed in chronically exposed dairy to cattle (Cassel et al., 1988). High aflatoxin levels (4ppm) can caused milk production to drop within one week while. Lower (o.4 ppm) can cause production drop in 3 to 4 weeks. Another character of aflatoxin exposure in dairy cattle is conversion to AFMI in milk experiment have shown that milk will be free of aflatoxin after 96 hours of feeding non contaminated feed. The level of aflatoxin in the feed and milk appears to increase rapid when milk yield is reduce as result of high toxin in take [22].

Rate of metabolism by the liver and rate of excretion by other routs (urine and feces) are also likely to influence to toxin level in milk. Feed refusal, reduce growth rate, decreased milk production and decreased feed efficiency are the predominate sign of chronic aflatoxin poisoning. In addition, decrease weight loss, rough hair coat and mild diarrhea may occur. Anemia along with bruises and subcutaneous hemorrhage are symptoms of aflatoxicosis. The disease may also impair reproductive efficiency, including abnormal estrous cycles (too short or to log) and abortions..other symptoms include impaired immune, response, increased susceptibility to other disease and rectal prolapse. In dairy cattle, aflatoxin metabolism appears in the milk before any of the sign develop [23].

Effects of Aflatoxin on Human Health

Concerns about human health arise when food groups are found to contain unsafe chemicals, additives, or other contaminants. Among the different contaminants afflation now a days is getting a major human health problem. Humans are exposed to aflatoxins by consuming foods contaminated with products of fungal growth. Conditions increasing the likelihood of acute aflatoxicosis in humans include limited availability of food, environmental conditions that favor fungal development in crops and commodities, and lack of regulatory systems for aflatoxin monitoring and control [24].

A human carcinogen such as aflatoxin B1 (AFB1), the carcinogenic potency used in calculating the population cancer risk is greater in developing countries. This is a consequence of AFB1 being synergistic with hepatitis B virus (HBV) infection, which has a greater prevalence in the developing world. In the studies reported in the medical literature aflatoxin B1 has been linked to hepatocellular carcinoma in human. Exposure to aflatoxin been implicated in hepatocellular carcinoma. The hepatic failure, encephalopathy and rye's syndrome, such exposure human health hazards by aflatoxin were mainly due to people eating aflatoxin contaminated food. For the operation of this pollution is very difficult, the reason is due to fungi in the food or food material in the presence of a very common [25].

The state health department has been heavily polluted enterprise to use against the grain food production and supervision of enterprise to develop the implementation of the relevant standards, but with lower consumption of aflatoxin contaminated food and incidence of cancer was positively correlated., Asian and African research institution, disease research showed that aflatoxin in food and liver cell cancer (liver cell cancer,LCC) showed positive correlation for a long time with low concentrations of aflatoxin consumption of food was the leading cause liver cancer, stomach cancer, colon cancer and other diseases. In 1988, International agency for research on cancer (IARC) classified the aflatoxin B1 as human carcinogen. The median lethal dose of aflatoxin B, 0.36 MG /kg bloody weight is a special range of highly toxic poison (Aflatoxin animal half of the lethal dose is found in the strongest carcinogens). Its carcinogenicity is 900 time more than dimethyl nitrosamine induced liver cancer in the large capacity 75 times higher than the 3.4- benzopyrene, a large 4000 fold. It is mainly to induct liver cancer in animal,can also induce cancer,real cancer,colonial cancer and breast, ovary, small intestine and other sites of cancer [26].

Aflatoxins in Dairy Product

In Milk

Mammals that ingest AFB1-contaminated diets eliminate into milk amounts of the main hepatic 4-hydroxylated metabolite known as "milk toxin" or AFM 1. AFM1 residues in milk are a variable percentage (0.3-6%) of AFB1 ingested. AFM1 is usually considered to be detoxification product of AFB 1, however its acute toxicity is nearly equal to that of AFB 1; as regards the potential carcinogenic hazard, it is about one order of magnitude less than that of AFB 1. The International Agency for Research on Cancer classified AFM1 as a possible human carcinogen (group 2B). Maize grain is normally utilized in the feed rations for dairy cows at the rate of 5-6 kg per cow per day. The feeding of dairy cows with contaminated maize led to the severe widespread contamination of milk with AFM 1.The problem was immediately identified by manufacturers of milk for human consumption and by health inspectors [27].

Stability and Reduction of AFM1 in Milk and Dairy Products

AFM1 is very stable at high temperatures. Several studies have investigated the distribution (stability) of AFM1 from milk to milk products [28], found that AFM1 was stable in kashar cheese for over 60 days and in traditional white pickled cheese for over 90 days. Their results showed that the toxin was stable during cheese storage and ripening. In another study, [29] found the stability of AFM1 in yoghurt artificially contaminated with concentrations of 0.050 and 0.100 mg/L during storage for 4 weeks at 4 0C and at pH values of 4.0 and 4.6. Decrease in AFM1 levels may be attributed to factors such as low pH, the formation of organic acids or other fermentation byproducts, and even the presence of *Lactobacillus sp*.

Permitted Levels of Aflatoxin

Some countries have set permitted levels of aflatoxins in food to control and reduce detrimental effects of these toxins. These levels are variable and depend on economic and developing status of the countries. In US, Food and Drug Administration (FDA) has permitted a total amount of 20 ng/g in livestock feed and 0.5g/kg or 50 ng/l in milk. In European countries, permitted levels of aflatoxin M1 in milk, milk products and baby food are 0.005mg/kg. Also, different countries have set different regulations for permitted levels of aflatoxin in livestock feed. For instance, European Union (EU) has set permitted levels of aflatoxin from 0.05 to 0.5µg/kg. Factors such as weather conditions are also effective in determining permitted levels of aflatoxin. Permitted levels of this toxin in tropical countries are higher compared to mild and cold countries [30].

Methods for Analysis of Aflatoxins in Food, Feed and Techniques for Assessing Human Exposure

Mainly used method for analysis of aflatoxins in food and feed are the thin layer chromatography (TLC), liquid chromatography (LC) and immunochemical method. TLC is one of the most widely used separation technique in aflatoxin analysis. Usually TLC is used as a preliminary work for optimization of LC separation conditions. TLC and LC methods for determining aflatoxins in food are laborious and time consuming often, these techniques requires knowledge and experience of chromatography techniques to solve separation and interference problems. Though advance in biotechnology, highly specific antibody based test are now commercial available that Vulcan identify of the monoclonal or polyclonal antibodies for aflatoxin.In the last few years new technologies have been developed that more accurate monitor individual exposures to aflatoxin. The analysis of aflatoxin DNA adducts and albumin adducts as surrogates for genotoxicity in people [31].

Economic Significance of Aflatoxicosis

The economic consequences of aflatoxicosis are the major areas of concern. Aflatoxins have negative impact on human health, animal productivity and trade. Generally, when susceptible animals are fed contaminated feeds it results in reduced growth rates, illness, and death; moreover, their meat and milk may contain toxic biotransformation products. Livestock owners often take farmers and feed companies to court legal battles can involve considerable amounts of money. The direct economic impact of aflatoxin contamination in crops results mainly from a reduction in marketable by rejection of products from the international market and losses incurred from livestock disease, consequential morbidity and mortality which leads to volume and value loss in the national markets which is huge economic loss. Recommended sanitary and phyto-sanitary standards set for aflatoxins adversely affect grain trade in developing countries, specifically in the international market, products that do not meet the afflation standards are either rejected at the border, rejected in channels of distribution, assigned a reduced price [7].

The crops contaminated with high levels of aflatoxins are sometimes diverted to animal feed, which resulting in reduced growth rates and illness of animals consuming toxic contaminated feeds. Many countries have established regulations to limit exposure to aflatoxin, typically expressed in parts per billion (ppb). These regulations can result in foregone trade revenues arising from increased cost of meeting the standards including cost of testing, rejection of shipments and even eventual loss of admissibility into foreign markets. Toxigenic fungal pathogens are important constraints to the production of the crop, affecting the quality of the seeds through spoilage, however, aflatoxin contamination is the most important quality problem in Ethiopia with serious health consequences for human and livestock for example groundnut plays an important role as a food as well as a cash crop in Ethiopia. Currently the crop is becoming one of the high value crops that are growing in the dry land areas of the Tigray region, Northern Ethiopia, but the groundnut production highly attack by aflatoxicosis [32].

In addition to financial losses and economic damage to agricultural and animal husbandry industries, losses due to aflatoxin contamination of foods include major pharmaceutical and health costs to treat food poisoning. Based on Food and Agriculture Organization (FAO) reports, annually, about 20% of the foods produced in the world are contaminated by mycotoxins; in which aflatoxins have a greater share than the others. Prevalence of cancer and livestock disease in farms, weakening of livestock immune system, reduction in milk production and productivity are a few examples of damages to food and livestock industry. Considering huge economic losses and public health protection, prevention and neutralization of the toxins in livestock feed and food products of animal origin such as milk is essential [33].

Symptoms and Diagnosis of Aflatoxicosis

A. Symptoms of Aflatoxicosis

Aflatoxicosis is the disease caused by the consumption of aflatoxins. For most producers, no visual symptoms of aflatoxicosis will be observed in the animals. However, high concentrations of aflatoxins or prolonged exposition may cause visual symptoms in cattle, especially young calves. Beef and dairy cattle are more susceptible to aflatoxicosis than sheep and horses, although other mycotoxicosis occurs in these species, such as facial eczema in sheep and leukoencephalomalacia in horses. Young animals of all species are more susceptible than mature animals to the effects of afflation. Pregnant and growing animals are less susceptible than young animals, but more susceptible than mature animals. Feed refusal, reduced growth rate and decreased feed efficiency are the predominant signs of chronic aflatoxin poisoning. In addition, listlessness, weight loss, rough hair coat and mild diarrhea may occur; anemia along with bruises and subcutaneous hemorrhages are also symptoms of aflatoxicosis. The disease may also impair reproductive efficiency, including abnormal estrous cycles (too short and too long) and abortions. Other symptoms include impaired immune system response, increased susceptibility to disease and rectal prolapse [34].

B. Diagnosis of Aflatoxicosis

Diagnosis of aflatoxicosis in milking cows is readily evident from milk samples. However, diagnosis in non-lactating cattle is more difficult because of the variation in clinical signs, gross pathology, and presence of other diseases due to suppression of the immune system. Records should be maintained for all feeds, feeding practices, milk contamination and animal health and performance for all cases of aflatoxin contamination of milk. There are simple, fast, semi-quantitative tests which can be performed to test for aflatoxin. Kits using ELISA (enzyme-linked immunosorbent assay) technology are available to test on the farm as well as commercially. The detection and quantification of aflatoxins by using ELISA has proven to be efficient, easy to use and able to detect very low levels of aflatoxin. But it has the disadvantage of requiring well equipped laboratories, well trained professional, harmful solvents and several hours to complete an assay. Rapid detection techniques are optical fiber, electrochemical transduction, low injection monitoring and biosensors [31].

Treatment

Aflatoxicosis is typically a herd rather than an individual animal problem. If aflatoxin is suspected, analyze the ratio immediately. Eliminate the source at once, if aflatoxin are present increase levels of protein and vitamins A,D,E and K is the ration are the toxic binds vitamins and affects protein synthesis. Practice good management to alternative stress, reducing the risk of secondary infection. Provide immediate attention and treatment for secondary infection [35].

Control and prevention of aflatoxins

Aflatoxins occurring naturally in foods and feeds may be reduced by a variety of procedures. Improved farm management practices, more rapid drying and controlled storage are now defined within GAP (Good Agricultural Practice) or HACCP (Hazard Analysis: Critical Control Point) (IARC, 2002). By segregation of contaminated lots after aflatoxin analyses and by sorting out contaminated nuts or grains by electronic sorters, contaminated lots of peanuts or maize can be cleaned up to produce food grade products. Decontamination by ammoniation or other chemical procedures can be used for rendering highly contaminated commodities suitable as animal feeds. The best control is the prevention of mycotoxins in the field, which is supported by proper crop rotation and fungicide administration at the right time. In the case of toxin manifestation, measures are required that act specifically against certain types and groups of toxins [36].

Adsorptive compounds can be used for reduction of potency of mycotoxins in general. While adsorbents have proved to be efficient against some mycotoxin-induced toxicosis, alternative strategies such as enzymatic or microbial detoxification, have been used recently for counteracting impacts of certain fungal toxins. To control AFM 1 in foods it is necessary to reduce AFB 1 contamination of feeds for dairy cattle by preventing fungal growth and AFB 1 formation in agricultural commodities intended for animal use. Corn and corn based products are one of the most contaminated feedstuffs; therefore risk factor analysis of AFB 1 contamination in corn is necessary to evaluate risk of AFM 1 contamination in milk and milk products [37]. During the corn silage production, the aflatoxins production is mostly influenced by: harvest time; fertilization; irrigation; pest control; silage moisture; and storage practices. Due to the lower moisture at harvest and to the conservation methods, the corn grain is mostly exposed to the contamination by Aspergillus species. Therefore, it is necessary to reduce the probability of this contaminant through choice of: hybrids; seeding time and density; suitable ploughing and fertirrigation; and chemical or biological control. Grains harvested with the lowest possible moisture and conservation moisture close to or less than 14% are necessary to reduce contamination risks, as is maintaining mass to homogeneous moisture. Kernel mechanical damage, grain cleaning practices and conservation temperature are also factors, which need to be carefully controlled. Generally [38], discussed that potentially successful measures to combat and control mycotoxins include (but are not limited to) the following:

Pre-harvest

Apply crop rotation, to reduce infection pressure; Remove crop residues from field, for instance by deep plough, to reduce infection pressure; Use seed varieties developed for resistance to fungal infections; Apply fertilization in conformity to crop demand, to avoid plant stress; Apply good agronomic practices (irrigation, weed control, plant spacing) and avoid plant stress from high temperatures and drought; Apply proper phytosanitary measures on seeds and crops, to avoid insect damage and fungal infections; Minimize mechanical damage, to avoid plant stress and fungal infections.

Harvest

Plan to harvest at full maturity, unless extreme plant stress conditions are anticipated; Avoid delayed harvesting, to reduce risk of mycotoxin accumulation; Avoid mechanical damage of grain kernels, to avoid fungal infections during storage; Where applicable dry to moisture level required to prevent mold growth during storage as quickly as possible; Remove foreign matter and visibly infected material where applicable.

Storage

Use clean, dry, and well-vented storage facilities that are protected from entry of rain, rodents, and birds; Store at as low a temperature as low as possible. Where possible aerate by circulation of air to maintain uniform temperature and moisture; minimize the levels of insects and molds in the storage facility by appropriate approved methods; where applicable use appropriate approved preservatives to prevent mold growth.

Transport

Ensure that transport containers are dry and free of insects, molds, and contaminated material; Protect shipments from moisture entry and avoid temperature fluctuations that may cause condensations.

When prevention fails

Because preventing aflatoxin contaminated is not always 100 % effective. Here are few facts to remember when dealing with contaminated feeds.

1. The recommended aflatoxin feeding levels is zero parts per billion (PPB).
2. The levels of aflatoxin an animal can tolerate depend on age and sex of animal, its health status, and overall management on the farm.
3. To avoid contamination of milk, do not exceed 20 ppb aflatoxin in the total ration of lactating cows.
4. Do no feed calves milk from cow fed in exceed of 20 ppb aflatoxin. Do not feed beef cattle more than 300 ppb aflatoxin in the total ration. The maximum for young stock is 100 ppb in their total rations.
5. Aflatoxins level can increase if gain is stored improperly.

CONCLUSIONS AND RECOMMENDATION

Food has always played an extra-ordinarily vital role in the growth or fall of a nation. Consumption of unsafe contaminated food leads to food borne diseases, which cause considerable morbidity and mortality. Aflatoxins contamination of foods and feeds is a serious worldwide problem resulting either from improper storage of commodities or pre harvest contamination. Therefore, its contamination is a global food security issue, especially in developing countries as limit freedom of choice food.

It is limited for a poor and food insecure population. Its presence in food products and animal feeds is an important problem concerned with food and feed safety. Significant economic losses are associated with their impact ton human and animal health. The contamination in food commodities threat does follow the rules of dosage to response and association with health risks in both animals and humans. They also have greater attention than any other mycotoxins because of their potent acute toxicological and carcinogenic effect in susceptible animals and humans, as well as the economic impact drive directly from crops, livestock and their product losses, and indirectly from the cost of regulatory programs designed to reduce risks of animals and humans health. Lacks of sanitary measures on food commodities usually contaminated with aflatoxins moulds growth is an unavoidable and may pass through manufactures and cooking processes. Aflatoxins are highly toxic to livestock and people. Even fed at non-lethal level. Aflatoxins can serious impair animal health and productivity, for lactating cows do not exceed 20 ppb aflatoxin in the ration to avoid exceeding the food and drug administration level of 0.5 ppb in milk.

Based on the above conclusion, the following recommendations are forwarded:

- Natural contaminants of food chain with afflation should be reduced by using sanitary measures and a society awareness approach.
- Primary products such as cereals and animal products should be screened routinely for aflatoxins.
- During crop production, irrigation and pest management help reduce stress on plant that can leave them more vulnerable to Aspergillus growth and contamination.
- Agricultural practice such as crop rotation and appropriate harvest timing could be useful. It is important to assure proper pre harvest drying and post-harvest sorting in a controlled environment.
- Dietary modification can help in prevention of aflatoxin certain food preparation techniques such as

fermentation may reduce the intestinal absorption of aflatoxins.

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