Food Science and Quality Management
ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online)
Vol.50, 2016 

# Review on the Impact of Aflatoxine in Dairy Industry: Occurrence and Control the Case of Ethiopia

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**Abstract**
Livestock is vital to the livelihood of people and to the economics of many developing countries like Ethiopia. This review paper attempts to identify the impact of aflatoxine in dairy industry by determining its occurrence and control methods. Aflatoxin is one of the most common mycotoxins which can be found in milk and are generally produced in animal feed by toxigenic fungi such as *Aspergillus flavus, Aspergillus parasiticus* and the rare *Aspergillus nomius*. Aflatoxins have been found in a variety of agricultural commodities, but the most pronounced contamination has been encountered in maize, peanuts, cottonseed and tree nuts. Aflatoxins are also toxic fungal metabolites found in foods and feeds. When ruminants eat AFB (1)-feedstuffs, they metabolise the toxin and excrete AFM (1) in milk. Most importantly aflatoxine have a great social, economic, health impact and should be given greater attention. Moreover it is now becoming a concern issue for the country Ethiopia as well as for the individual nations. In addition to this the aflatoxin occurrence results a higher health problem in the developing countries like Ethiopia. Even though, the occurrence of aflatoxin in the world varies from one place to place the majority milk samples indicated that they are contaminated with aflatoxin beyond the recommended level. Through promotion of the effect of aflatoxine on dairy industry and its impact on the health of the consumer, it would trigger the global effort to reduce its impact on the economic, social and health.
**Keywords:** aflatoxine, dairy industry, health impact, Aspergillus parasiticus and Aspergillus flavus

## Introduction

Livestock is vital to the livelihood of people and to the economics of many developing countries like Ethiopia. Besides to this, animals are the main source of protein particularly for human diets. Moreover, consumption of livestock and livestock products in Ethiopia is increasing due to the increased level of livelihood and income of the people. Milk and milk products are important sources of different nutrients mainly like calcium and phosphorus. These are generally the main dietary requirements for human being mainly both mothers and infants. Consequently, the contamination of these products by a carcinogenic toxin like aflatoxin is a great health concern. Therefore, milk and milk products have to be inspected and controlled continuously for aflatoxin contamination.

This will in turn increase the issues of public health that come from animal origin food especially milk and milk products. There are many human health concern related to milk. Among these, Aflatoxins is getting a higher concern in Ethiopian condition due to the lack of awareness of the milk producer as well as consumers. Aflatoxins in foods used as staples such as maize assume considerable significance. Aflatoxins are a far greater problem in the tropics than in temperate zones of the world. However, because of the movement of agricultural commodities around the globe, no region of the world is free of aflatoxins (IARC, 2002).

Aflatoxin is one of the most common mycotoxins which can be found in milk and are generally produced in animal feed by toxigenic fungi such as *Aspergillus flavus, Aspergillus parasiticus* and the rare *Aspergillus nomius*. Aflatoxins are also toxic fungal metabolites found in foods and feeds. Therefore, 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 (Prandini *et al*., 2009). There are fungi spores in the environment and poor storage of commodities after harvest allows the growth of fungi. Some studies have shown that various foods, peanuts and corns can be contaminated by Aspergillus fungi.

Aflatoxin B1 (AFB1) is a highly toxic metabolite of Aspegillus fungi that can contaminate animal feed. Cows that consume AFB1-contaminated feed excrete aflatoxin M1 (AFM1) in their milk (Dawit *et al*., 2016). Animals are exposed to mycotoxins such as the aflatoxins by consumption of feeds contaminated by mycotoxin-producing molds during growth, harvest and/or storage. When lactating cows consume aflatoxin B1 contaminated feed, aflatoxin B1 is metabolized to form the monohydroxy derivative, AFM1, which is expressed in the cow's milk. The sources of aflatoxin contamination in feed vary from country to country (Maria *et al*., 2013).

With regard to human health concern, aflatoxin has got worldwide controlling and monitoring activities to regulate the toxin in various commodities. Delia *et al*., (2015) indicated that the health problems related to agriculture include fungal toxins (mycotoxins) in crops and animal source foods; plant toxins; use of wastewater for agriculture; misuse of agricultural chemicals and antibiotics; occupational hazards of working in food value chains; contribution of agriculture to climate change and impacts of this on disease; and health impacts of agricultural alteration of ecosystems (such as irrigation practices that promote malaria). The economic impacts of aflatoxin may be explained by resulting loss in crops, livestock, and dairy products like milk. Therefore, the present work will try to review the existing aflatoxin and related health problem as well as controlling methods in Ethiopian case.

**History of Aflatoxin**

Aflatoxins were first identified in 1961 in animal feed responsible for the deaths of 100 000 turkeys in the United Kingdom (Sargeant *et al*., 1961 as cited in IARC, 2002). Mycotoxins and mycotoxicises have been problems of the past and the present, but scientific attention for mycotoxins did not start until the early 1960's. Nowadays, many mycotoxins are known, and their occurrence in food and animal feed may cause various adverse effects on human and animal health, including carcinogenic, hepatotoxic, immunotoxic, nephrotoxic, neurotoxic, oestrogenic and teratogenic effects. Some important mycotoxins include the aflatoxins, ochratoxin A, the fumonisins and the trichothecenes. Aflatoxin B1 is found worldwide and the most notorious of the aflatoxins, feared for its high toxicity and carcinogenicity to humans and animals (Hans and Egmond, 2013). The two major Aspergillus species that produce aflatoxins are A. flavus, which produces only B aflatoxins, and A. parasiticus, which produces both B and G aflatoxins. Aflatoxins M1 and M2 are oxidative metabolic products of aflatoxins B1 and B2 produced by animals following ingestion, and somappear in milk (both animal and human), urine and faeces. Aflatoxicol is a reductive metabolite of aflatoxin B1 (Peraica *et al.,* 1999).

**Aflatoxin contamination of milk in world wide**

The occurrence of aflatoxin in the world varies from one place to the other. Different literature has come with different results and findings. For instance, a research carried out by Maria et *al*. (2013) in Brazil, the occurrence of AFM1 does not appear to be a serious public health hazard under Brazilian legislation. In this study, the effects on AFM1 of cheese and yoghurt storage are minimal and the fermentation process of yoghurt manufacture has no effect on AFM1. However, the other study conducted in the same country by Shundo and Sabino (2006) indicated that from 107 milk samples analyzed 73.8% were contaminated with AFM1. AFM1 was detected at low levels (<0.050 µg/L) in 67.3% of the samples, while 6.5%samples had the highest value of >0.05 µg/L and none of the samples exceeded the Brazilian legislation (0.5 µg/L for fluid milk). However, aflatoxins are recurrent and their formation in foods and feeds may sometimes be difficult to avoid. For this reason, specific regulations to control AFB1 in feeds and a systematic AFM1 monitoring program performed by accurate and reliable analytical techniques constitutes an important strategy for protecting milk consumers.

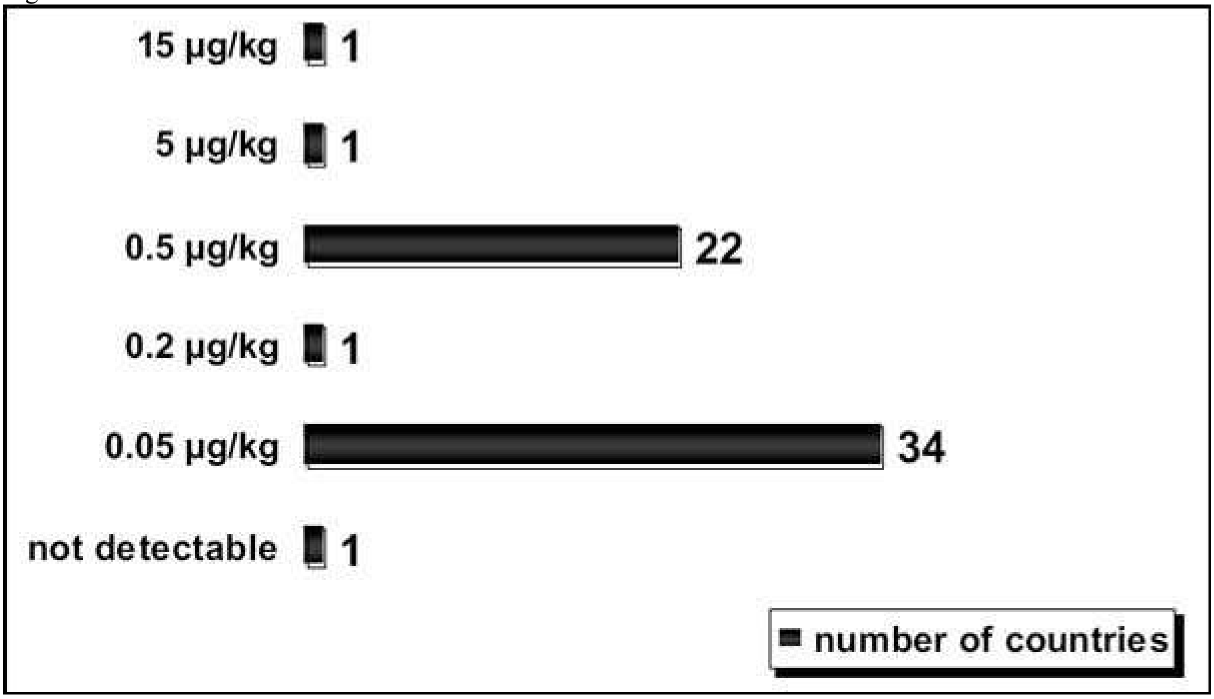
According to (Kamakar *et al.,* 2011) the occurrence of aflatoxin M1 at such low levels in European countries may be the result of stringent regulations of aflatoxin B1 in complementary feedstuffs for dairy cattle. In many Asian countries and in Iran no severe control method for aflatoxin M1 in milk and milk products has been applied. According to results obtained in this study, aflatoxin M1 was found in 100% of raw milk samples with 14.75% of the samples were higher than the permissible level of 50 ng/L. Whereas the aflatoxins were not found in Europe until the turn of the millennium, they were detected in maize in Northern Italy a decade ago, and subsequently in milk from dairy cattle fed with this maize. Since then their occurrence gradually spread over south-eastern Europe, a phenomenon which is possibly due to climate change (Hans and Egmond, 2013*)*. Also in the Balkan, where a lot of maize is produced, the occurrence of aflatoxins has become an issue of concern, including problems with exports to the EU in 2013.

The level of AFM1 in the milk of cows was higher in Kayseri province Turkey; this must be seen as a significant public health problem. AFM1 was found in 100% of the examined milk samples. The AFM1 levels ranged from 5 ng/L to 80 ng/L in the milk samples. The overall mean level of AFM1 was 59.9 ng/L (Hikmet *et al.,* 2011). Similarly, the research conducted lately by Deniz *et al.,* (2015). in same country indicated that, 83 percent of the milk samples, 92.6% of the cheese samples and 89.5% of the yoghurt samples were contaminated with AFM1. The levels of AFM1 in the samples ranged from 7.3 to 107.2 ng/kg. Only 5 yoghurt samples and none of the milk or cheese samples exceeded the safety limits established by the Turkish Food Codex of 50 ng/kg for milk and yoghurt and 250 ng/kg for cheese

There was a widespread occurrence of AFM1 in milk samples which were considered to be possible hazards for public health especially children. In 56 of the 90 raw milk samples examined (65.55%), the presence of AFM1 was detected in concentrations between 2.1–131 ng/l in Iran. AFM1 levels in 28 samples (31.11%) were higher than the maximum tolerance limit (50 ng/l) accepted by the European countries (Mahdiyeh, 2013). In the same manner, AFM1 was detected in 33% of locally manufactured raw milk samples in concentrations ranging from 13.1 ng/L to 84.5 ng/L with a mean level of 40.2 ng/L in Sri Lanka. Percentage of contaminated samples (9.2%) exceeded the European Communities/Codex Alimentarius recommended limit of 50 ng/L. None of the milk samples from Western, Uva & Sothern provinces were contaminated at a detectable level of AFM1 (Pathirana *et al.,* 2010).

Regulations for aflatoxin M1 existed in 60 countries at the end of 2003, a more than three-fold increase as compared to 1995. It is again the European Union countries that contribute in major part to the largest peak seen in Figure 1 at 0.05 µg/kg, but some other countries in Africa, Asia and Latin America also apply this limit. The other peaking limit is at 0.5 µg/kg. This higher regulatory level is applied in the United States (FAO, 2004).

Figure 1. Worldwide limits for aflatoxin M1 in milk




*Source:* FAO, 2004

**Aflatoxin contamination of milk in Africa**

The occurrence of aflatoxin M1 in milk have also recently caused a serious global health problem, particularly in developing countries and many countries have set threshold limit for milk used by adults and infants. For instance, human aflatoxicosis has occurred several times in Kenya in the last decade, due to human consumption of aflatoxin-contaminated maize, leading to more than 100 fatalities in 2004, including many children (Hans and Egmond, 2013). In Nigeria, despite a considerable progress in food industry, there is little or no data available on contamination levels of milk and other dairy products with aflatoxin M1 (Henry and Ikpeme, 2014). However, a research conducted in Kenya by Kang and Lang (2009) showed that seventy two percent of the milk from dairy farmers, 84% from large and medium scale farmers and 99% of the pasteurized marketed milk were positive for aflatoxin M1, and 20%, 35% and 31% of positive milk from dairy farmers, medium and large scale farmers and market outlets respectively, exceeded the WHO/FAO levels of 0.05µ g/Kg-1. Sixty seven percent of the urban smallholder dairy farmers had no knowledge that milk could be contaminated with aflatoxin M1 and neither knew how they could mitigate against this exposure.

Aflatoxin M1 (AFM1) was found in 100 percent of all the milk samples that were analyzed in this study. The contamination levels ranged from 0.06µg/l to 0.07mg/l, while the mean value was 0.07µg/l. All the different milk samples (100%) exceeded the European Union maximum acceptable levels (0.05µg/l). None of the milk samples exceeded the Nigerian permissible limit (0.5µg/l) (Henry and Ikpeme, 2014). Aflatoxin M1 was detected in 23 (28.75%) out of the 80 samples analyzed in Egypt in which the levels of AFM1 of the samples were found to exceed the limits (0 ng/kg) allowed by Egyptian regulation. Results of yoghurt examination showed that 3 (12%) of the local processed type contain AFM1 and exceeding Egyptian permissible limits, with a mean value 0.803 ± 0.1322 ng/kg, while processed cheese results also exceeded Egyptian permissible limits in 11 (44%) of examined samples and ranged from 23.2 to 47.1 ng/kg. Of the analyzed Infant formula milk powder samples, 2 (13.3%).samples were contaminated by AFM1. 7 (46.67%) of the UHT milk samples exceeded the permissible limit where the highest recorded level was 33.4 ng/kg (Magdy and El-Fatah, 2015).

**Aflatoxin contamination of milk in Ethiopian**

The determination of aflatoxin level of milk in Ethiopian case is too little so far. The research work conducted and documented in the country is only around Addis Ababa which is the capital city of the country. The findings of the research work may not represent the whole country. However, the limited research work conducted indicated that there was high amount of alfaltoxin both in dairy feeds as well as in milk. For instance, a study conducted by Dawit *et al.* (2016) indicated that from 100 raw milk samples collected from milk producers in

Addis Ababa and its surrounding areas, all the milk samples were contaminated with AFM1 with a median value of 0.092 mg/L. In this study the highest AFM1 content was 4.98 mg/L from Debre Zeit, and the lowest was 0.028 mg/L from Addis Ababa. In addition, ten raw milk samples. All of the ten samples collected from milk collectors located in Addis Ababa, Debre Zeit and Sululta were contaminated with AFM1 that exceeded 0.05 mg/L. The sample with the highest level of aflatoxin contamination was 2.24 mg/L and was obtained from Sululta. Overall, only nine (8.2%) out of a total of 110 milk samples contained less than or equal to 0.05 mg/L of AFM1. Furthermore, 29 (26.3%) milk samples exceeded 0.5 mg/L.

**Prevalence of Aflatoxin in dairy feeds**

Mycotoxin-contaminated feeds impair farm operations as well as feed production in various ways: mycotoxins are invisible, odourless and cannot be detected by smell or taste, but can reduce performance in animal production significantly. Due to the complex nature of these naturally occurring contaminants and their elaborate analytics a risk-management concept has to be adopted in order to reduce the risk encounter to a defined and acceptable level (Binder, 2007). Developing countries are facing a greater problem associated with alfatoxine than delveloped one. *A. flavus* is especially abundant in the tropics. Levels of *A. flavus* in warm temperate climates such as in the USA and Australia are generally much lower, while the occurrence of *A. flavus* is uncommon in cool temperate climates except in foods and feeds imported from tropical countries (IARC, 2002). According to Rostami *et al*., (2009) aflatoxins often occur in crops in the field prior to harvest. Postharvest contamination can occur if crop drying is delayed and during storage of the crop if water is allowed to exceed critical values for the mold growth. Insect or rodent infestations facilitate mold invasion of some stored commodities. Different food products such as corn, wheat and peanut have shown high potential to be contaminated in suitable environmental conditions, such as temperature and humidity. Some fungi can produce toxins, like Aflatoxin, and some of them are carcinogen.

According to FAO (2004) many aflatoxin regulations exist for feedstuffs. Those that are applied for feed for dairy cattle are summarized in Figure 2. Whereas many more countries regulate aflatoxin B1 inbfeedstuffs for dairy cattle in 2003 than in 1995 (39 in 2003 versus 25 in 1995), the increase is only slightly visible for the countries that regulate the sum of the naturally occurring aflatoxins (21 in 2003 versus 17 in 1995). This is understandable and logical from the point of view that it is aflatoxin M1, the metabolite of aflatoxin B1, which causes health concern.

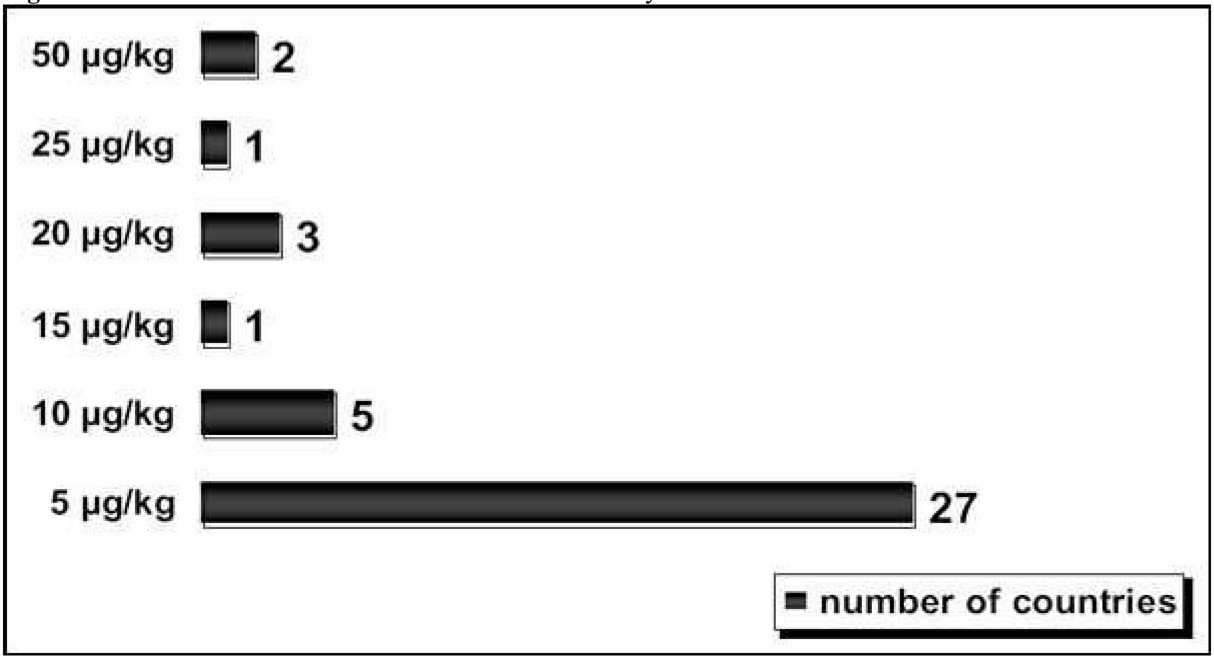
Consequently limiting aflatoxin B1 in animal feeds is the most effective means of controlling aflatoxin M1 in milk. Figure 17 illustrates that a limit of 5 μg/kg dominates the distribution pattern of aflatoxin B1 regulations. This limit is applied by countries in the European Union, and

is also followed in many of the candidate European Union countries, and is only sporadically seen outside Europe. Strict application will normally be effective to prevent that aflatoxin M1 levels in milk remain below 0.05 μg/kg for dairy feed (where these countries have set their corresponding limit for aflatoxin M1 in milk).

The research conducted in Ethiopia by Dawit *et al*. (2016) revealed that the contamination level of AFB1 for wheat bran was 9-31 mg/kg. By far the highest level of contamination was observed in the noug cake, ranging between 290 and 397 mg/kg, while all other feed (maize grain and four Brewer's dry yeast) components had relatively low levels of AFB1. Amare *et al*., (2006) The levels of aflatoxins in barley, sorghum, teff and wheat in the present study agree with previous reports that the incidence of aflatoxins in grains other than maize is generally low AFB1 was detected in 8.8% of the 352 samples analyzed at concentrations ranging from trace to 26 g /kg. However, a research conducted in Kenya by Kang and Lang (2009) showed that 86 % of the feed samples from farmers were positive for aflatoxin B1 and 67% of these exceeded the FAO/WHO level of 5μ gKg-1. Eighty one percent of the feed samples from feed millers and 87% from agrochemical shops were positive, while 58% and 66% of the positive samples exceeded the FAO/WHO limits respectively. Feed millers knew about aflatoxin B1 in grains and excretion of aflatoxin M1 in milk, but were not alleviating exposure to animals. The levels of contaminated animal feeds and milk reported with AFB1 and AFM1 should be a wakeup call for stringent monitoring of raw materials and feed samples to prevent cattle exposure to aflatoxins contaminated feeds which would lead to excretion of AFM1 in milk and eventually causing human exposure through consumption of contaminated milk.

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. 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 (Prandini *et al*., 2009).

**Figure 2:** Worldwide limits for aflatoxin B1 in feed for dairy cattle




*Source:* FAO, 2004

**Factors affecting formation of aflatoxins in feeds**

Hans and Egmond (2013) illustrated that a contemporary issue that also has a potential influence on mycotoxins is climate change. Due to this phenomenon changes, may occur in the latitudes where certain fungi are able to compete. Climate change may also lead to drought and flooding, which may result in the occurrence of more mycotoxins and changed toxin profiles. For example, since about 10 years ago aflatoxins have been found in south-eastern Europa in particular in maize, and the affected areas are becoming larger. Increases of plant diseases and insect manifestations are also expected as a result of climate change, and these may have a significant effect on mycotoxins as well.

A fundamental distinction must be made between aflatoxin formation in crops before (or immediately after) harvest, and that occurring in stored foods. Peanuts, maize and cottonseed are associated with A. flavus, and in the case of peanuts, also with A. parasiticus, so that invasion of plants and developing seed or nut may occur before harvest. This close association results in the potential for high levels of aflatoxins in these commodities and is the reason for the continuing difficulty in eliminating aflatoxins from these products. In contrast, A. flavus lacks this affinity for other crops, so it is not normally present at harvest. Prevention of the formation of aflatoxins therefore relies mainly on avoidance of contamination after harvest, using rapid drying and good storage practice (IARC, 2002).

Temperature and humidity influence which fungi infect damaged crops. Aflatoxin producers are favoured by warm conditions; thus, global warming, particularly in currently temperate climates, poses a potential problem is this regard. Developing crops are frequently very resistant to infection by *A. flavus* and subsequent aflatoxin contamination, unless environmental conditions favour fungal growth and crop susceptibility. Wounding by insects, mammals, birds, mechanical processes and/or the stress of hot dry conditions all result in significant infections during the pre-harvest period. Furthermore, climate directly influences host susceptibility. The aflatoxin group is carcinogenic and thus contamination results in significant economic impact. In ground nuts drought can lead to cracking of the pods and ingress by *A. flavus* and *A. parasiticus* resulting in significant aflatoxin accumulation. Delayed harvest, late irrigation and rain and dew during warm periods are associated with increased aflatoxin levels (Milani, 2013).

**Aflatoxin and human health concern**

Aflatoxins are acutely toxic, immunosuppressive, mutagenic, teratogenic and carcinogenic compounds. The main target organ for toxicity and carcinogenicity is the liver. (Peraica *et al*., 1999).Adverse human health effects from the consumption of mycotoxins have occurred for many centuries. Although mycotoxin contamination of agricultural products still occurs in the developed world, the application of modern agricultural practices and the presence of a legislatively regulated food processing and marketing system have greatly reduced mycotoxin exposure in these populations. At the mycotoxin contamination levels generally found in food products traded in these market economies, adverse human health effects have largely been overcome. However, in the developing world, where climatic and crop storage conditions are frequently conducive to fungal growth and mycotoxin production, much of the population relies on subsistence farming or on unregulated local markets. The extent to which mycotoxins affect human health is difficult to investigate in countries whose health systems lack capacity and in which resources are limited (Shephard, 2008).

Concerns about human health arise when food groups are found to contain unsafe chemicals, additives, or other contaminants. Among the different contaminants aflatoxin 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. According to Hans and Egmond (2013) human aflatoxicosis has occurred several times in Kenya in the last decade, due to human consumption of aflatoxin-contaminated maize, leading to more than 100 fatalities in 2004, including many children. 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 (Shephard 2008).

The most tragic recent outbreaks of human mycotoxicosis have happened in Keny, where deaths due to Aflatoxin exposure have occurred over a number of years (Shephard 2008). However, the improvements in food safety in developed countries have eliminated acute human mycotoxicoses such as ergotism, which was previously well known in the middle Ages in Western Europe. However, such outbreaks still occur in rural communities in the developing world, as evidenced by documented cases in Ethiopia, East Africa, where there were outbreaks of gangrenous ergotism in 1978 after consumption of grain contaminated with Claviceps purpurea (Demeke *et al*. 1979 as cited in Shephard, 2008).

**Worldwide regulation for Aflatoxin**

The first food regulation was probably promulgated approximately 3500 years ago by a king of the Hittites in what is now Turkey. That law already focused on the two goals of modern food laws: the protection of health and the prevention of fraud. In the early days of food legislation the protection of health was mostly a local affair, and municipal ordinances were promulgated for the purpose. But in the beginning of the 20th century this situation changed and national statutory food legislation was enacted, thanks to the development of auxiliary sciences such as chemistry, bacteriology and microscopy. Specific mycotoxin regulations did not appear until the late 1960s, approx. Ten years after the discovery of the aflatoxins. Around the turn of the millennium regional harmonization of mycotoxin regulations in food and feed started to take place in the EU (European Union), Australia/New Zealand, GCC (Gulf Cooperation Council), ASEAN (Association of South East Asian Nations) and COMESA (Common Market of Eastern and Southern Africa) (Hans and Egmond, 2013).

According to FAO (2004) the number of countries regulating aflatoxin has significantly increased over the years. The aflatoxin regulations are often detailed and specific for various foodstuffs, for dairy products and for feedstuffs. Some countries have many regulations specifying different tolerated levels for individual foods and feeds, while others have set only one tolerated level for instance for "all foods" or for "all feeds". Finally, as for aflatoxins in animal feedstuffs, some countries have many limits often dictated by the destination of the feedstuff. To compare the limits between countries for aflatoxin B1 and total aflatoxins respectively in animal feedstuffs, those were selected that were known or assumed to be relevant for feedstuffs for dairy cattle. These are often the most stringent from the point of view of human health, because of the carry-over of aflatoxin B1 into aflatoxin M1 in milk and dairy products. Most of these countries (76 countries in 2003) have regulations on total level of four predominant types of aflatoxin (B1, B2, G1 and G2), sometimes in combination with specific limit for aflatoxin B1 (61 countries in 2003),

**Control and prevention of Aflatoxin in animal feed and milk**

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) (FAO, 1995 ac cited in 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. 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 (Binder, 2007).

(Prandini *et al*., 2009) concluded that 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. 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, (Hans and Egmond, 2013) discussed that potentially successful measures to combat and control mycotoxins include (but are not limited to) the following:

**Preharvest**

- Apply crop rotation, to reduce infection pressure;
- Remove crop residues from field, for instance by deep ploughing, 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 mould 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 moulds in the storage facility by appropriate approved methods;
- Where applicable use appropriate approved preservatives to prevent mould growth.

**Transport**

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

**Conclusion and Recommendations**

flatoxins are highly toxic that can seriously impair health and productivity of both livestock and human beings world-wide. In addition to health risk, aflatoxin results great economic losses. Specifically countries found in the tropics like Ethiopia where climatic conditions (high moisture and temperature) encourage the growth of molds are enormously influenced. Aflatoxins are produced mainly by mold growth due to poor storage and unsuitable temperature. Consumption of contaminated milk results a great health problem for the consumer sepecially for infants and children. Consequently, to prevent the problem it is recommended to control aflatoxin B1. Controlling mould growth production is therefore very important and can be based only on application of recommended preventive measures and decontamination of aflatoxin-contaminated foods and feeds. Among the different measures, control of moisture and temperature, which in turn control mould growth in feeds, keeping feed fresh, keeping equipment used on-farm clean. Even though, the occurrence of aflatoxin varies throughout the world, it seems a great concern for the developing countries. Based on the present study conducted in Ethiopia, it seems difficult to conclude all the milk of Ethiopia is contaminated with aflatoxin since the study was only focused on the Addis Ababa milk shed. In addition to this, the standard level of aflatoxin was compared based on European standard. Therefore, further study that will be representative for the country should be conducted to generalize the present searched out results. Efforts should also be made in creating awareness to the producer as well as consumer. Agricultural experts/workers need to demonstrate improved methods of feed utilization to dairy farm households and aware them against poor practices that encourage aflatoxin contamination of food and feeds on-farm. Further and extensive scientific researches should be conducted in the nationally by taking a representative sample to conclude at the country level. The impact of aflatoxin on human health should also be assessed. There has to be regulatory standard under national level which could be used to determine the limits for aflatoxin. Therefore extensive and periodic surveys and monitoring should be performed in the incidence and occurrence of AFM1 in milk and milk products.

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