**ADVERSE HEALTH EFFECTS ASSOCIATED WITH AFLATOXIN**

INTRODUCTION

A family of toxins known as Aflatoxins is created by specific fungus that can be found on crops like maize(corn), peanuts, cottonseed and tree nuts. *Aspergillus Flavus* and *Aspergillus* *parasiticus* which are common in warm, humid climates around the world and are the primary fungi that create aflatoxins. Fungi that produce aflatoxin can infect crops in the field, during harvest and while they are being stored. Humans are adversely affected by aflatoxins if they ingest it. There are various heath complications that are caused by aflatoxin in the human body. The impact that climate change has on agriculture is wide and of varying effects. Research shows that climate change is a huge contributor to the growth, spread and toxin production of mycotoxigenic fungi on economically important crops[[1]](#_ftn1). One of the major toxins affecting crops is the aflatoxin. Aflatoxin production has become such a major safety issue over the years that it is now a threat world over. Due to increased extreme weather conditions that bring about global warming, the world has become warm and humid creating a favorable situation for aflatoxin.

According to the Food and agricultural Organizations of the United Nations study of 2004, Myotoxins have affected at least 25% of the global food crop. This makes it a global food safety health concern. This issue is seen to mostly affect Africa and Asia because the conditions responsible for aflatoxin production such as, grain and environmental humidity, temperature, damage by insects, rodents and genetic inheritance are prevalent in these two continents.

The uncontrollable nature of the spread of aflatoxin has caused the world health organization to partner with the governments of affected states to ensure that measures regarding management of aflatoxins are upheld because if you look at Africa for example, the crops mostly affected by aflatoxins such as groundnuts, rice and maize are important in African household. Maize for example is the staple food in Kenya and huge losses have been witnessed in instances when the government has been forced to ban the distribution of certain brands of maize flour due to the possibility of them containing toxins.

Health effects of aflatoxins on the human body

a) AFLATOXIN B1(AFB1)-INDUCED DNA DAMAGE

Scientific findings showed that AFB1 severely decreased the germline apoptosis(worms) ability to grow and reproduce in a concentration-dependent manner hence causing DNA damage. In comparison to the wild-type N2 strain, exposure toAFB1 more effectively prevented growth and or reproduction in the DNA repair-deficient xpa-1 worms. Human beings and animals are exposed to aflatoxins through either Inhalation of aflatoxin affected dust particles mostly AFB1 or through direct ingestion of aflatoxin infected foods or those carried over by feeds from milk or milk products. The aflatoxins are then absorbed across the cell membranes where they reach the blood stream. [[2]](#_ftn3).They are the metabolized by cytochrome then converted to a very reactive form that bind with the DNA and to albumin in the blood serum forming adducts and consequently causing damage to the DNA.

b) IMPAIRED CHILD GROWTH

The WHO have defined stunting as a height-for-age Z-score (HAZ), of <-2, being underweight as a weight-for-age Z-score (WAZ), of <-2, and wasting as a weight-for-height Z-score (WHZ), of <-2.[[3]](#_ftn4)

Studies show that aflatoxin exposure can occur in utero through a transplacental pathway. A direct correlation has been found between the utero exposure and birth weights, meaning, the higher the exposure the lower the body weight. A recent study by Hernandez -Vargas et al shows that differential methylation of genes, including some growth and immune function related genes, was observed to be associated with AF-alb exposure although it is not clear whether such changes are associated with impaired growth.

Similarly, exposure to aflatoxin during weening has been named as one other cause of growth impairment as study from a cross section of 480 children from Benin and Togo shows. In this areas36% to 42% of children are reported to have stunted growth. Aflatoxin-contaminated food affects about 4.5 billion people worldwide, mostly in developing countries with poor incomes.

c) AFLATOXIN B1-INDUCED HEPATOCELLULAR CARCINOMA(H.C.C)

Aflatoxin B2, a genotoxic hepatocarcinogen, is suspected of being the cause of cancer by causing DNA adducts that modify the genetic makeup of the target liver cells. H.C.C is a form of cancer that is mainly identified with less developed regions. It is reported to be the sixth most prevalent cancer worldwide. Aflatoxins have mutagenic and carcinogenic properties which make it a major risk factor alongside the hepatitis B virus (HBV) and the hepatitis C virus (HCV). It has been shown that aflatoxin and hepatitis B, which is also highly prevalent in Africa and South Asia, can synergistically interact, resulting in an increased risk of H.C.C[[4]](#_ftn5) Aflatoxin-contaminated food affects about 4.5 billion people worldwide, mostly in developing countries with poor incomes.

d)CAUSES RAPID PROGRESSION OF HIV/TB

Aflatoxin exposure increases the spread of HIV in that it causes rapid progression of HIV since aflatoxin increases risk of infection. Recent investigations of the interaction of aflatoxin exposure and HIV infection in Ghana show that viral load is higher in HIV-infected adults exposed to higher levels of aflatoxin[[5]](#_ftn6). Aflatoxin inhibits the immunity in the cells and intensifies T-cells and B-cell phenotypic alterations brought on by HIV. As we all know, Human Immunodeficiency Virus (HIV) is a virus that viciously attacks and cripples the body’s immune system. So when aflatoxin decreases the immunity in cells for a HIV infected person, it paths the way for increased HIV infection since the cells are weakened further and their reaction rate are slowed.

e) CAUSES AFLATOXIN-INDUCED ENTEROPATHY

Since aflatoxin interferes with intestinal integrity and hepatic metabolism in a human being’s body, it brings about this intestinal inflammation. Any pathology of the intestine is referred to as Enteropathy. It is also known as Tropical enteropathy. So with this in mind, we can define enteropathy as an intestinal inflammation brought about by frequent fecal-oral contamination as a result of poor living conditions. It may be characterized by diarrhea. It can also cause malnutrition which then leads to stunted growth I children. Research shows that there may be connection between Enteropathy and Aflatoxin in that the intestine may be capable of metabolizing aflatoxin into toxic metabolites, which damage large molecules such as the intestinal junction proteins or epithelial nutrient transporters[[6]](#_ftn7)

Aflatoxin also causes intestinal damage when *fumonisin* and deoxynivalenol (DON) are present. The mycotoxin *fumonisin* is made by the *fungus Fusarium Verticillioides .* One of the mycotoxins made by some Fusarium species that regularly infect corn, wheat, oats and barley in the field or during storage is deoxynivalenol (DON). Point to note is that deoxynivalenol is associated with aflatoxin because they are both mycotoxins that affect agricultural produce such as corn.

Health effects of aflatoxins in animals

The exposure of animals to aflatoxins may trigger biological reactions that could be classified as acute, overt diseases with high morbidity and mortality, or, as it is usually the case, chronic, insidious disorders that impairs animal productivity[[7]](#_ftn8). Aflatoxin contamination in feed can have a number of harmful impacts on farm animals including; **increased mortality, increased susceptibility to infectious diseases, weight loss, subpar performance and decreased reproductive** **capacity**. Animals metabolize and bio-transform aflatoxins in diverse ways after ingesting contaminated food. Aflatoxicosis risk is exacerbated because animals such as a swine have metabolism that is ineffective in detoxifying and excreting aflatoxins. Sever effects are as follows;

a) Renal damage

This is a result of long-term administration of aflatoxins. This is characterized by toxicosis, cell necrosis and inflammation which may increase the weight of the kidneys and induce congestion in renal siunosoids. In broilers, aflatoxin increases the relative weight of the spleen and kidney. A chicken cannot bear the weight of increased body parts since its body constituent is small. This causes the failure of kidneys and the overworking of the renal functions in the end causing severe damage.

b) Immune suppression

Evidence shows that exposure to aflatoxins may alter the proportions of specific cell types involved in the immune response in animals. The inhibition of cell proliferation, immunosuppression, lipid peroxidation and DNA damage are among the effects of AFB1 on cells and tissues that cause pathological lesions in the swine.

**REFERENCES**

[[1]](#_ftnref1) Magan N., Medina A., Aldred D. (2011). Possible climate change effects on mycotoxin contamination of food crops pre- and postharvest. Plant Pathol. 60 150–163.

[[2]](#_ftnref3) Wild.C.P.Montesano.R.2009.A Model of interaction: Aflatoxins and hepatitis viruses in liver cancer aetiology and prevention. Cancer letter 286

[[3]](#_ftnref4) WHO (2006) WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development. Geneva: World Health Organization

[[4]](#_ftnref5) . Qian GS, Ross RK, Yu MC, et al. A follow-up study of urinary markers of aflatoxin exposure and liver cancer risk in Shanghai, People’s Republic of China. Cancer Epi Biom Prev. 1994; 3: 3–10.

[[5]](#_ftnref6) Jolly et.al. 2013

[[6]](#_ftnref7) Yun Gong, Institute for Global Food Security, Queen’s University Belfast, United Kingdom

Michael Routledge, School of Medicine, University of Leeds, Leeds, United Kingdom, Alex Bombana, Ministry of Agriculture, Animal Industry and Fisheries, Uganda; Building an Aflatoxin Safe

East African Community

[[7]](#_ftnref8) , [Bryden, 2012](https://www.frontiersin.org/articles/10.3389/fmicb.2019.02861/full#B32); [Pierron et al. , as it is usually the case, chronic, insidious disorders that impairs animal productivity (Bryden, 2012; Pierron et al., 2016)., 2016](https://www.frontiersin.org/articles/10.3389/fmicb.2019.02861/full#B205)).