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Afla Toxin B1 Cytotoxicity: A Review

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Abstract

The name Mycotoxins (Aflatoxin) is derived from the name of one of the molds it produces, (Aspergillus flavus). It was discovered in 1960 after being discovered as a cause of Turkey X disease. Aflatoxin is one of the main clusters of Mycotoxin. Afla toxins are toxic carcinogens produced by some molds (Aspergillus flavus and Aspergillus parasiticus) that grow in soils, decomposing vegetables, straws, and grains. It is found naturally in staples stored incorrectly, such as cassava, hot pepper, corn, cottonseed, millet, peanuts, rice, sesame seeds, sorghum, sunflower seeds, nuts, wheat, and a variety of spices. Mycotoxins are present in both contaminated food and pets, especially raw materials provided to farm animals. In turn, animals that feed on contaminated food carry fungal toxins into eggs, dairy products, and meat. For example, in Pakistan, it was found that poultry that feed on fodder contaminated with mycotoxins contains meat and eggs that are high in these toxins. Children are particularly affected by exposure to mycotoxins, which leads to stunted growth, delayed development, liver damage, and liver cancer. For adults, there is a disparity in exposure to fungal toxins, but they are also at risk. No animals have immunity to mycotoxins. Mycotoxins are among the most well known carcinogens. After entering the body, the liver metabolizes it and turns it into a reactive epoxide or hydroxyl, forming the least harmful aflatoxin M1. Aflatoxins are commonly taken with food. However, the most toxic aflatoxin, B1, uses transdermal permeation.

Keywords: Mycotoxins, Chemical methods, physical methods, control, disease.

Introduction

Fungi are a diverse group of living organisms that spread throughout the globe. These organisms differ from each other in their size, strength, nature of life and methods of reproduction. Scientists have been able to diagnose and name about 8000 species of fungi [1]. Fungi have a clearly defined membrane that surrounds the nucleus containing a number of chromosomes. They also need organic carbon compounds in simply different forms or the complexity of their chemical composition

and for all types of fungi except for a limited number of them. A well-formed cell wall in which well must pass through all the nutrients in the form of liquids. Different from animals [2].

The bodies of fungi consist of microscopic micro filaments, each of which is known as hypha. These strands or heifers grow, branch and intertwine together to form mycelium spinning, which is the body or entity of mushrooms and fungi, whatever their size, so that their body will not be formed except from these hems only, so it is not distinguished in their composition by any tissue. The mushroom heifers grow peripherally and extend to the medium or the environment that grows on it and branch by forming branches near the end of the heifers [3]. The method of peripheral growth of heifers is evidenced by the presence of a specific mechanical presence in this region that guides the growth form and adding the necessary material to form the cell wall Ectoplasm to the front to fill the new distance formed by the fungus as a result of growth and extension of heifs, leaving the old parts empty in contents [4]. These parts separate from the modern active parts by forming transverse barriers (septa). Not all fungi are formed by branching fungal strings, but there are fungi that form short haivy threads with limited growth as There is a group of sticky fungi in which the vegetative body is a bare protoplasmic mass without a cell wall called a plasmodium [5]. Also, some fungi are single cells that are linked to and multiply vegetatively by budding method and results in a colony known as budding mycelium [6].

Some fungi have the ability to take different forms of growth. They were, for example, filamentous growth under certain environmental conditions, while under other conditions they can take another form of growth [7]. This condition is known as the dimorphsim property. The fungi get their food either by parasitism or restoration and reproduce [8]. Sexually, by combining two cells, each of which contains half the number of chromosomes, they combine to form the fertilized egg, resulting in the formation of spores and the majority of spores that differ in their creativity, shapes, and structures depending on the type of mushroom they have, and for this, the spores' characteristics for each fungus are among the fixed genetic characteristics that cannot Reliance in identifying mushrooms [9]. Autogenous reproduction, which is the case of vegetative reproduction without the fusion of cells or nuclei, and the most important types 1 - reproduction by fragmentation 2 - fission 3 - budding 4 - the formation of asexual spores [10].

Aflatoxins (AFs)

Aflatoxins produced from the fungus called Aspergillus flavus [11]. These toxins are among the most poisonous to carcinogens because their toxicity may be in the range of 1.2 parts per billion [12]. Aflatoxin B1 is one of the most prevalent, and this pollutant B1 gives a blue color under ultraviolet rays. This indicator is an indication of the presence of aflatoxin, but this also requires further analysis to confirm the type and concentration of the pollutant (poison) [13]. This mushroom is found in most grains, especially yellow and white corn, and for the fungi species, its growth is weak when the seed moisture is less than 15% [14]. Aflatoxins affect the liver and destroy parts of it, as liver function begins to decrease, leading to a decrease in growth and then animal death [15].

The effect of aflatoxin is accelerated by the presence of other toxins such as T2, and the acratoxin and the effect of these aflatoxin becomes more severe if there is a deficiency of protein or in the amino methionine acid or whether the mixture is alone with riboflavin, folic acid and vitamin D3 [16]. There is no treatment for so-called

mycotoxins and the occurrence of Aflatoxicosis, but increased vitamin E and selenium may reduce the severity of infection and may lead to recovery if the substance in which aflatoxin are removed [17]. There are effective ways to prevent contamination with aflatoxin, but these methods may not be economical [18]. These methods can be summarized either by treating grains with ammonia, hexane, or hydrogen peroxide, all of which reduce the level of aflatoxin [19]. Other materials can also be added to the grains to attach to the aflatoxin, where Allumionsilicates or Bentonite clay can be added at a rate of 10 - 15 kg per ton, which reduces the level of aflatoxin, especially in broiler mixtures or turkey chicks, but the effectiveness of these substances is not effective for other fungi toxins other than aflatoxin [20].

The main species and their metabolites

There are 14 different types of mycotoxins that are produced in nature [21]. Aflatoxin B1 is considered the most toxic and is produced by Aspergillus flavus and Aspergillus parasiticus [22]. Aflatoxin M1 is found in the yeast broth Aspergillus parasiticus, but it is aflatoxin M2 produced when the affected liver produces B1 and B2. Aflatoxin B1 and B2, produced by Aspergillus flavus and A. parasiticus .Aflatoxin G1 and G2, produced by A. flavus and Aspergillus parasiticus [23]. Aflatoxin M1, a metabolism of aflatoxin B1 in humans and animals (exposure to ng levels may come from breast milk) [24]. Aflatoxin M2, the aflatoxin metabolite B2 in livestock milk fed with contaminated feed Aflatoxicol [25]. Aflatoxin Q1 (AFQ1), a major metabolite of AFB1 in vitro hepatic preparations with other higher vertebrates [26].

Metabolism and aflatoxin B1

Aflatoxins are highly toxic mycotoxins that are produced by some types of fungi through metabolism and cause damage to parts of the human body that grow on nuts, grains and legumes [27]. And because food contamination with aflatoxin toxins cannot be avoided even by using high nutritional processing techniques and there is practically no reliable way to transfer these toxins into our food for this reason, the U.S. Food and Drug Administration has allowed the Federal Drug Administration to obtain levels of food toxins a quarter of the world's food pollutants contaminated with acceptable levels of aflatoxin of this poison in foods are: twenty parts per billion (20 parts per inch) is the maximum total toxicity of aflatoxin [28]. It is possible to convert an integrated chemical into a series of enzymatic reactions, byproducts, or metabolites resulting from this transformation, which are mainly removed by renal excretion.

Biotransformation plays an important protective role in the extraction of toxic microorganisms and the disposal of other body waste as it is converted into less harmful compounds and easily excreted [29]. This process is done in several stages to get rid of this waste as shown in the figure(1) A and B :Phase 1 metabolism of AFs is mediated by the effectiveness of the CYP450 enzyme system [30]. CYP450s is a family of huge binding enzymes involved in the metabolism of internal matter in addition to Xenobiotics such as aflatoxin and Phase II Metabolism of AFs. This process is performed by the GSTs enzyme system, which is responsible for stimulating coupling reactions [31].

Glutathione (GSH) acts as the body's main antioxidant. It can be found in almost all cells of the body to play a critical role in the body's detoxification mechanisms so it is the primary employee of the body's natural defense system [32]. Cells begin to detoxify by binding to GSH, lowering their levels and inhibiting AFB1-DNA configurations that reduce mutations [33].

Oxidative stress of AFs

Also known as oxidative stress, it plays a major role in various diseases in humans and over their lives and can be defined as a state of imbalance in the oxidative system and antioxidants toward the production of more oxidizing agents. For example, active oxygen compounds, reactive oxygen types, and oxidized glutathione [36]. Oxidative stress has a major role in the fungal toxicity that results from the direct adverse effect of AFs or metabolites [37]. This imbalance results from low levels of auto-antioxidants, low consumption of natural food antioxidants, increased free radicals, and the formation of reactive types [38]. It is important to conclude that the genetic toxicity of AFB1 is concerned with gathering, interpreting, and storing information about genes and protein activity within a specific cell or tissue Inside organisms in response to toxic substances [39]. Hence, toxic genetics combines the study of both toxicology, genomics, or other highly productive molecular profiling techniques such as transcription, proteomics, and metabolites [40].

Toxic genetics seeks to clarify the molecular mechanisms involved in the expression of poisoning, in addition to its quest to derive molecular expression models (including, for example, molecular biomarkers) that predict poisoning or the genetic susceptibility to its occurrence [41]. It is defined more broadly and more generally as the study of individual internal variations in the genome as a whole or polymorphic maps of individual gene nucleotides, individual pattern markers, and changes and shifts in gene expression that may be associated with drug responses [42].

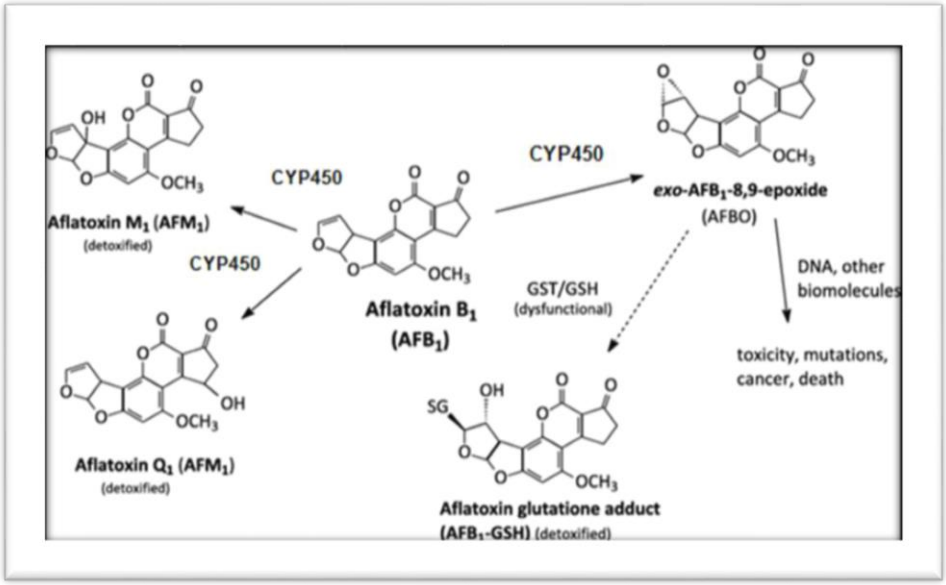

Figure (1) A: Phase 1 metabolism of AFs [34].

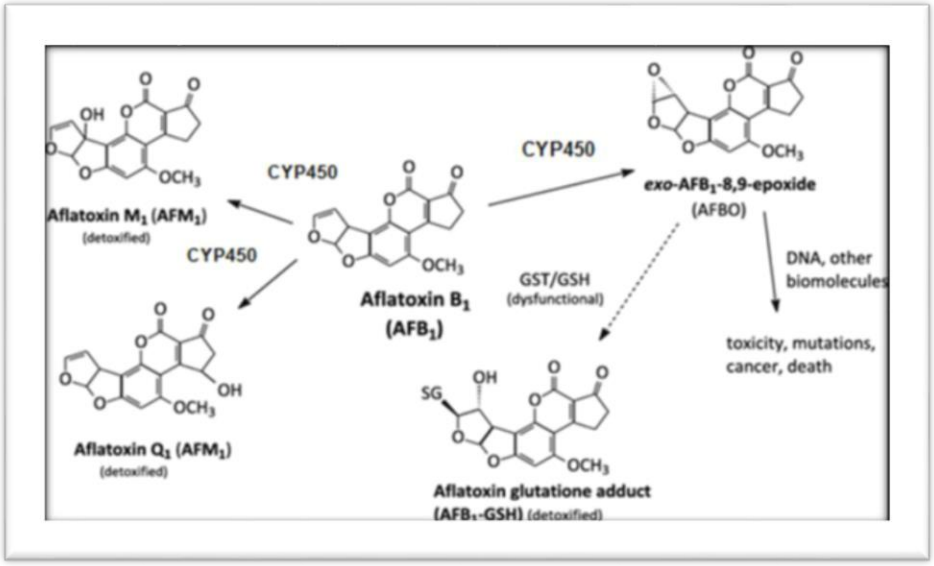

Figure (1) B:Phase II Metabolism of AFs [35].

The damage caused by aflatoxin B1 and its health effects on humans and animals

Aflatoxin toxins are natural toxic compounds produced by some molds that cause mold [43]. These fungi contaminate crops and cause serious health damage to humans and livestock, and they also constitute a major economic burden. Not only does it grow on its surface, and milk can also be contaminated with aflatoxin when livestock feed on crops contaminated with these fungi. Insufficient storage in hot and humid conditions contributes to increased levels of contamination with these fungi, which makes the said food very vulnerable to aflatoxin toxins. Crop damage resulting from harvesting or infestation with insects and rodents greatly increases the presence of these fungi.

The danger of aflatoxin toxins is that they are carcinogenic, and cause poisoning that can sometimes lead to death [44]. Long exposure to these toxins has many consequences for human health in general, and the liver and kidneys in particular, because they cause kidney poisoning and liver cancer, because they are linked to other types of cancer. Therefore, exposure to mycotoxins must be kept as low as possible in order to protect the consumer [45].as for the animal, rotting feed leads to less weight, less reproductive performance and less production. In addition, rotting fodder is unpalatable by the animal and thus the amount consumed by the animal decreases. The different types differ in their degree of sensitivity to aflatoxin acute poisoning and the half-lethal dose values range from 0.3 to 17.9 mg / kg body weight, depending on the animal type. The liver is the most affected [46]. Studies on farm animals have shown cirrhosis with fatty masses and gallbladder enlargement in both chickens and ducks. As for pigs, purulent foci in the liver occur with fatty degeneration and fibrosis. Some other studies have shown that they have an effect on the spleen, kidneys and lungs where they have bleeding and spotting. all research has combined the occurrence of liver cancer for all farm animals

Chemical methods to control the growth of fungi

When the results of applying the physical methods are useless, it is necessary to resort to the use of chemical methods, and it is possible to achieve the prevention of fungi growth or limit them by using some chemical compounds that are added to agricultural crops at the harvest stage, which reduces the need to direct special

attention to reduce the percentage of moisture in these crops and is available Many preservative chemical compounds that suit various categories of foodstuffs, and such substances are widely used today and in practice, preservatives are substances that work to prevent the growth of fungi and other microorganisms. The use of these substances is governed by many laws that differ from one country to another [47]. There are special tables set by the international food, agriculture and health organizations of the United Nations. Perhaps the most important conditions to be met in these toxins are that they are free of any toxic effects for humans and agricultural animals and do not have a high degree of the activity against microbial activity should last for a very long time, and the mechanics by which these substances operate are either by blocking enzymatic activity inside the fungal cell such as sorbic acid and propionic or by destroying the cell wall such as natamycin in the form of p Meh these preservatives levels internationally approved working to prevent the growth and not to kill her [48]. Often used organic acids preserved in the form of their salts, especially calcium, potassium or sodium salts, because they have a higher solubility in water compared to what is the case when using free acids [49].

Conclusions

Aflatoxin is a highly toxic compound produced by the fungus Aspergillus flavus. The consumption of aflatoxin with lethal dose leads to death, and that the lethal dose for it is very small, as the LD50 value of aflatoxin is 0.5 mg / kg of the animal's body weight, and this dose led to the death of some animals within 72 hours, and exposed them to liver cells and intestinal bleeding. If it is consumed with less than a lethal dose, it leads to cancer, especially liver cancer. Human lymphocytes exhibit poor cellular respiration and affect the mycotoxins immunity in humans exposed to these natural mycotoxins [50].

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