

## Important Safety Issues on Mycotoxins

John Chen, PhD, PharmD, OMD, LAc

A mycotoxin is a toxic secondary metabolite produced by an organism of the fungus kingdom, including mushrooms, molds and yeasts. While there are several different groups of mycotoxins, this article will focus on aflatoxins and ochratoxins.

Aflatoxins are produced by the *Aspergillus flavus* and *A. parasiticus* fungi. These fungi will grow in/on foods and animal feeds during preharvest, storage, and/or processing periods under favorable conditions of warm temperature and high humidity. Those items most likely to be affected include corn and corn products, peanuts and peanut products, cottonseed, grains, tree nuts, milk, cheese, figs and spices. Aflatoxins will remain indefinitely, since these toxins are very stable and cannot be destroyed by cooking or freezing.<sup>1,2</sup>

The major aflatoxins of concern are designated B1, B2, G1 and G2. Aflatoxins are designated as "B's" and "G's" because when they are analyzed by thin-layer chromatography and viewed under ultraviolet light, B1 and B2 appear blue, and G1 and G2 appear green.<sup>3</sup> Aflatoxins B1, B2, G1, and G2 are hepatotoxic and carcinogenic. Aflatoxin B1 is the most predominate and the most toxic (Figure 1). They cause acute necrosis, cirrhosis and carcinoma of the liver. No animal species is resistant to the acute toxic effects of aflatoxins. The toxicity can be influenced by environmental factors, exposure level and duration, age, health and nutritional status.<sup>4</sup>

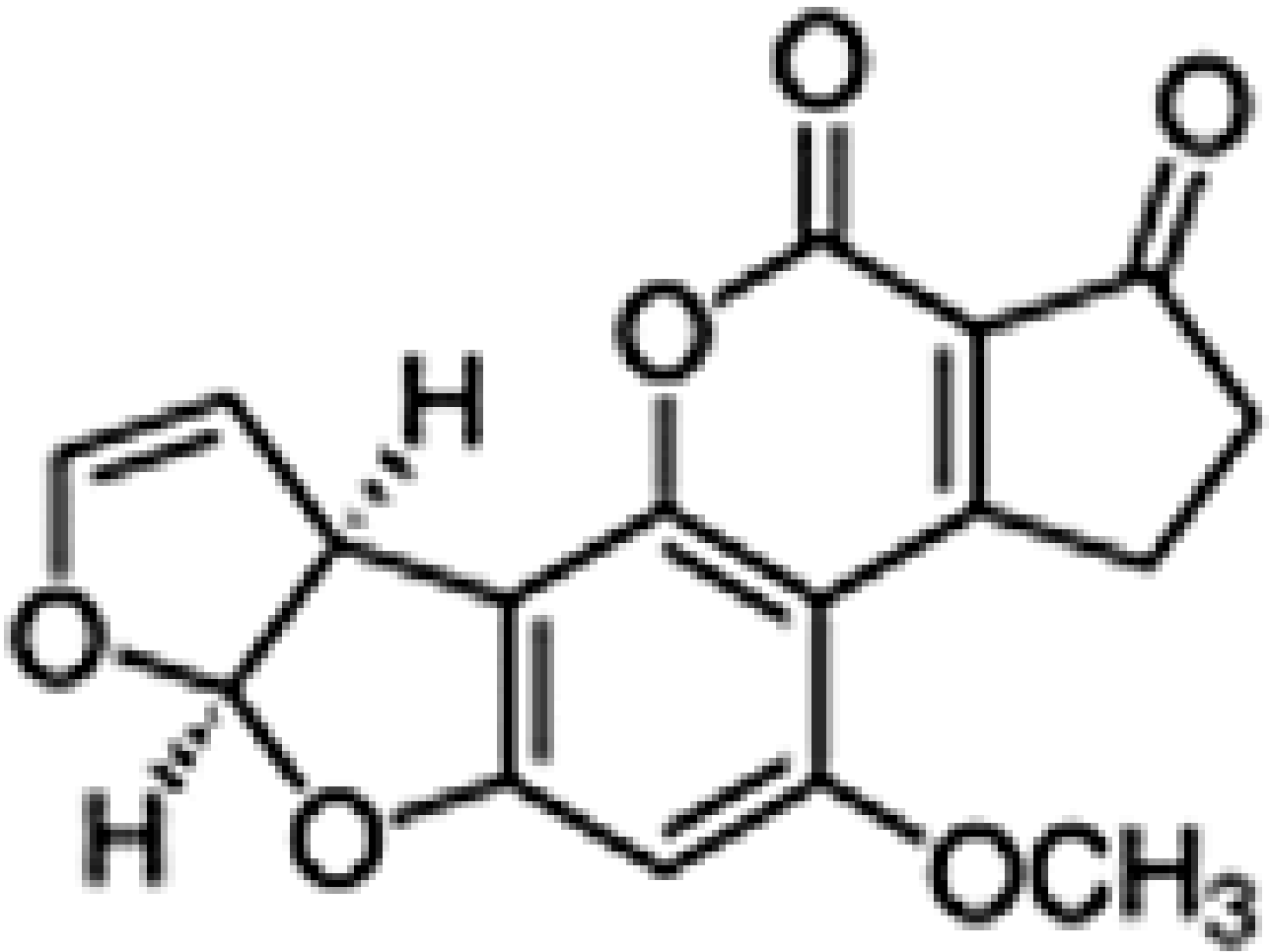


Figure 1. Aflatoxin B1

Aflatoxicosis is poisoning caused by consumption of aflatoxins. Aflatoxicosis is common among animals, such as birds, fish and cattle that consume contaminated animal feed. Acute aflatoxicosis is characterized by hemorrhage, acute liver damage, edema, alteration in digestion, absorption and/or metabolism of nutrients, and possibly death. Chronic aflatoxicosis is usually subclinical and difficult to recognize, but may include **common symptoms** such as immune deficiency, increased susceptibility to infections, impaired food conversion, slower rates of growth and in severe cases, liver cirrhosis and liver cancer.<sup>5,6</sup>

	US FDA <sup>9</sup>	AHPA <sup>10</sup>	EUP <sup>11</sup>
Aflatoxins B1		5 ppb	2 ppb
Aflatoxins B1, B2, G1, G2	20 ppb	20 ppb	4 ppb
<i>*ppb = parts per billion</i>			

To avoid aflatoxicosis, countries around the world have established safety limits of aflatoxins in foods (Table 1). With such strict guidelines for food safety, aflatoxicosis in human rarely occurs. Most reports of aflatoxicosis occur in Third-World countries where food safety guidelines are not as

stringent. Signs and symptoms of aflatoxicosis in humans include vomiting, abdominal pain, pulmonary edema, convulsions, coma and death with cerebral edema and fatty involvement of the liver, kidneys and heart.<sup>7,8</sup>

Ochratoxins are produced by certain the *Aspergillus ochraceus*, *Aspergillus alliaceus* and *Penicillium verrucosum* fungi. These fungi are present virtually everywhere, and will grow under optimal condition of warm temperature and high humidity. As a result of **fungal growth**, ochratoxins are produced and the foods and feeds become contaminated.<sup>12</sup> Ochratoxins are commonly **found in foods** such as grape juice, coffee, wine, beer, cereals, dried vine fruit (e.g., raisins and currants), corn, peanuts, grains, cottonseeds, rice and beans.<sup>13,14</sup>

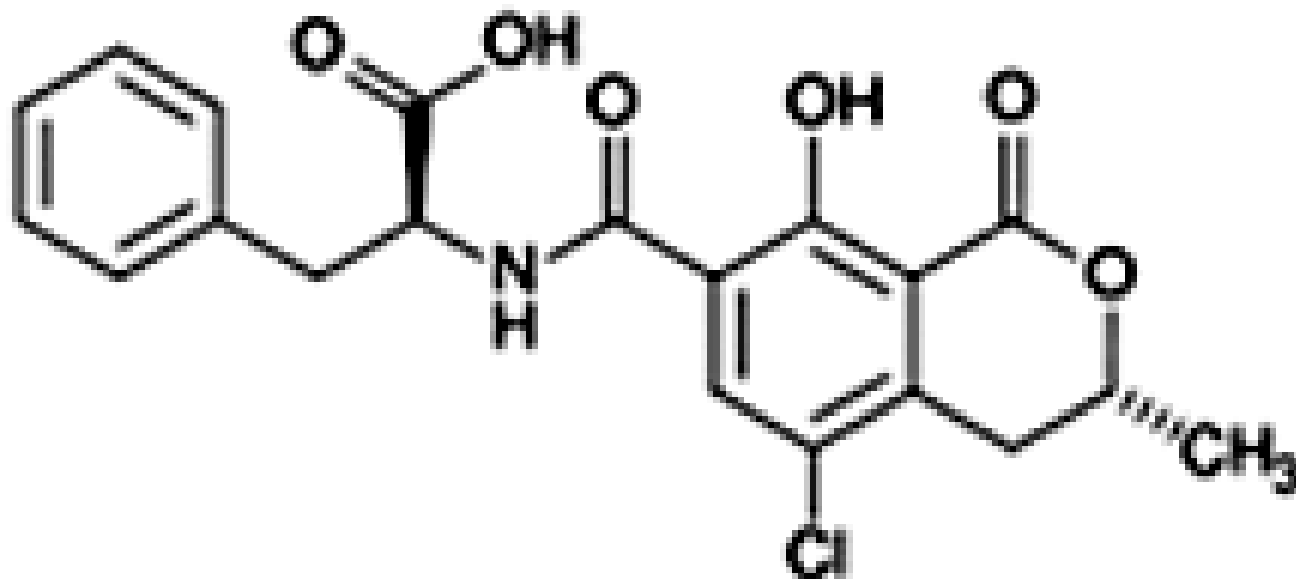


Figure 2. Ochratoxin A

There are two types of ochratoxins: ochratoxin A and ochratoxin B. Ochratoxin A (Figure 2) is the predominate form and the most toxic. Ochratoxin B is much less toxic and rarely found as a natural contaminate. High levels of ochratoxin A (> 200 ppb) or prolonged exposure has been linked to serious animal illnesses, such as hepatocellular tumor, renal-cell tumors, hepatomas and hyperplastic hepatic nodules. Fortunately, low levels of ochratoxin A (<20 ppb) does not pose risks to human health at all. Overall, reports of ochratoxin A toxicity in humans are very rare.

Table 2. Safety Limits of Ochratoxin A			
	US FDA <sup>16</sup>	AHPA <sup>17</sup>	EUP <sup>18</sup>
Ochratoxin A	n/a	n/a	3-10 ppb
*ppb = parts per billion			

Aflatoxins and ochratoxins are undesirable toxic metabolites of certain fungal strains. Unfortunately, even with good manufacturing practice, their presence in trace amounts is considered unavoidable. To ensure minimum impact on human and animal health, proper precautions must be observed. Furthermore, in products commonly affected by aflatoxins and ochratoxins, laboratory exams must be performed to ensure their presence do not exceed the established safety limits. Fortunately, a trace amount of mycotoxins does not pose health risks, as the body can normally detoxify small amounts.

Nonetheless, it is best to refrain from long-term consumption of products that contain aflatoxins and ochratoxins to avoid a cumulative effect.

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