

Research Note

Occurrence of Multiple Mycotoxins in Various Types of Rice and Barley Samples in Thailand

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ABSTRACT

The prevalence of mycotoxins is often increased by climatic conditions prevailing in tropical regions. Therefore, consumers in tropical countries such as Thailand have a higher risk of mycotoxin exposure. Existing reports have revealed mycotoxin contamination in rice. This study was conducted to determine the occurrence of multiple mycotoxins in barley and nine types of rice sold in Thailand and to assess consumer health risk. A total of 300 samples collected from various markets in Thailand were analyzed for the presence of 16 mycotoxins using a QuEChERS (quick, easy, cheap, effective, rugged, and safe) procedure and a triple quadrupole mass spectrometer equipped with an electrospray ionization source. Of the 300 samples, 124 (41.33%) were contaminated with at least one mycotoxin, and 38.71% of the mycotoxin-positive samples were simultaneously contaminated with more than one toxin. The incidence of mycotoxin contamination differed among the rice and barley samples. Beauvericin, diacetoxyscirpenol, zearalenone, and aflatoxins were the most frequently found mycotoxins. However, the concentrations of regulated mycotoxins were below the regulatory limits. The assessed mycotoxin exposure does not represent a health risk for Thai consumers because the estimated exposure concentrations were lower than the tolerable daily intake values established by the Joint FAO/WHO Expert Committee on Food Additives. However, our findings suggest that continued monitoring of mycotoxin contamination in rice and barley and concomitant risk assessments are warranted.

HIGHLIGHTS

- Contamination with multiple mycotoxins was found in rice and barley.
- BEA, DAS, ZEA, and aflatoxins were the mycotoxins most frequently found in samples.
- The assessed mycotoxin exposure does not represent a health risk for consumers.

Key words: Barley; Liquid chromatography–tandem mass spectrometry; Mycotoxins; QuEChERS; Rice

Mycotoxins are toxic substances produced by certain species of fungi. Contamination of agricultural commodities with mycotoxins during pre- and postharvest processing is a global problem that leads to serious risks to human and animal health. Environmental conditions, especially high humidity and temperature, can favor fungal proliferation, resulting in such contamination (3). Consumers in tropical countries such as Thailand encounter high risk of mycotoxin exposure. Mycotoxin contamination occurs in a wide variety of agricultural products, especially seeds and grains such as rice (*Oryza sativa*), which is one of the most important staple foods for the world's population. In Thailand, rice is the most important food crop and plays an important role in the economic system. Thailand is one of the world's most important rice producers, producing rice for both domestic consumption and export, and is ranked

among the top five Asian rice exporters (8). However, rice is relatively susceptible to fungal contamination, which can produce mycotoxins (17, 24, 25). Mycotoxins are very persistent in food and cannot be completely eliminated during food processing (18). Human health risks are usually associated with the direct consumption of food products contaminated with mycotoxins.

To date, several reports of mycotoxin contamination in rice from various countries have been published (2, 22, 26, 29, 32). Some studies have revealed the occurrence of aflatoxin B₁ (AFB₁) in Thailand (4, 11, 21, 28). Considering the health impact of mycotoxin consumption, data on contamination of rice by multiple mycotoxins are required to better estimate the potential problem. The main aim of this study was to evaluate barley and nine types of rice consumed in Thailand for the occurrence of various mycotoxins: AFB₁, aflatoxin B₂ (AFB₂), aflatoxin G₁ (AFG₁), aflatoxin G₂ (AFG₂), ochratoxin A (OTA), citrinin (CTN), nivalenol (NIV), deoxynivalenol (DON), diacetox-

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