

Rice Mycotoxins Fate During In vitro Digestion and Intestinal Absorption: the Effect of Individual and Combination Exposures

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Abstract : About half of the world's population eats rice daily, making it the primary food source for billions of people. Besides its nutrition potential, rice can be a significant route of exposure to many contaminants. Mycotoxins are an example of such contaminants that can be present in rice. Among them, ochratoxin (OTA), citrinin (CIT), and zearalenone (ZEN) are frequently reported in rice. During digestion, only a fraction of mycotoxins from food can be absorbed (bioaccessible fraction), influencing their ability to cause toxic effects. Insufficient knowledge of the bioavailability of mycotoxins, alone and in combination, may hinder an accurate risk assessment of contaminants ingested by humans. In this context, two different rice (*Oryza sativa*) varieties, Carolino white and Carolino brown, both with and without turmeric, were boiled and individually spiked with OTA, CIT, and ZEN plus with its combination. Subsequently, samples were submitted to the INFOGEST harmonized in vitro digestion protocol to evaluate the bioaccessibility of mycotoxins. Afterward, the in vitro intestinal transport of the mycotoxins, both alone and in combination, was evaluated in digests of Carolino white rice with and without turmeric. Assays were performed with a monolayers of Caco-2 and HT-29 cells. Bioaccessibility of OTA and ZEN, alone and in combination, were similar in Carolino white and brown rice with or without turmeric. For CIT, when Carolino white rice was used, the bioaccessibility was higher alone than in combination (62.00% vs. 25.00%, without turmeric; 87.56% vs. 53.87%, with turmeric); however, with Carolino brown rice was the opposite (66.38% vs. 75.20%, without turmeric; 43.89% vs. 59.44%, with turmeric). All the mycotoxins, isolated, reached the higher bioaccessibility in the Carolino white rice with turmeric (CIT: 87.56%; OTA: 59.24%; ZEN: 58.05%). When mycotoxins are co-present, the higher bioaccessibility of each one varies with the type of rice. In general, when turmeric is present, bioaccessibility increases, except for CIT, using Carolino brown rice. Concerning the intestinal absorption in vitro, after 3 hours of transport, all mycotoxins were detected in the basolateral compartment being thus transported through the cells monolayer. ZEN presented the highest fraction absorbed isolated and combined, followed by CIT and OTA. These findings highlight that the presence of other components in the complex dietary matrix, like turmeric, and the co-presence of mycotoxins can affect its final bioavailability with obvious implications for health risk. This work provides new insights to qualitatively and quantitatively describe mycotoxin in rice fate during human digestion and intestinal absorption and further contribute to better risk assessment.

Keywords : bioaccessibility, digestion, intestinal absorption, mycotoxins

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