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Mycotoxin Bioavailability in Sparus Aurata Muscle After Human Digestion and Intestinal Transport (Caco-2/HT-29 Cells) Simulation

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Abstract : The increasing world population brings several concerns, one of which is food security and sustainability. To meet this challenge, aquaculture, the farming of aquatic animals and plants, including fish, mollusks, bivalves, and algae, has experienced sustained growth and development in recent years. Recent advances in this industry have focused on reducing its economic and environmental costs, for example, the substitution of protein sources in fish feed. Plant-based proteins are now a common approach, and while it is a greener alternative to animal-based proteins, there are some disadvantages, such as their putative content and intoxicants such as mycotoxins. These are naturally occurring plant contaminants, and their exposure in fish can cause health problems, stunted growth or even death, resulting in economic losses for the producers and health concerns for the consumers. Different works have demonstrated the presence of both AFB1 (aflatoxin B1) and ENNB1 (enniatin B1) in fish feed and their capacity to be absorbed and bioaccumulate in the fish organism after digestion, further reaching humans through fish ingestion. The aim of this work was to evaluate the bioaccessibility of both mycotoxins in samples of Sparus aurata muscle using a static digestion model based on the INFOGEST protocol. The samples were subjected to different cooking procedures – raw, grilled and fried – and different seasonings – none, thyme and ginger – in order to evaluate their potential reduction effect on mycotoxins bioaccessibility, followed by the evaluation of the intestinal transport of both compounds with an in vitro cell model composed of Caco-2/HT-29 co-culture monolayers, simulating the human intestinal epithelium. The bioaccessible fractions obtained in the digestion studies were used in the transport studies for a more realistic approach to bioavailability evaluation. Results demonstrated the effect of the use of different cooking procedures and seasoning on the toxin's bioavailability. Sparus aurata was chosen in this study for its large production in aquaculture and high consumption in Europe. Also, with the continued evolution of fish farming practices and more common usage of novel feed ingredients based on plants, there is a growing concern about less studied contaminants in aquaculture and their consequences for human health. In pair with greener advances in this industry, there is a convergence towards alternative research methods, such as in vitro applications. In the case of bioavailability studies, both in vitro digestion protocols and intestinal transport assessment are excellent alternatives to in vivo studies. These methods provide fast, reliable and comparable results without ethical restraints.

Keywords : AFB1, aquaculture, bioaccessibility, ENNB1, intestinal transport.
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