

Evaluation of the In Vitro and In Vivo Efficacy of a Novel Yeast Cell Wall-Based Product as a Multi-Mycotoxin Binder: Potential Role in Preventing Gastrointestinal Disorders

D'Ascanio V¹, Greco D¹, Maquod F², Tricarico D³, Abbasciano M^{1,3}, Orlando A², Zizzo N⁴, Russo F², and **Avantaggiato G¹**

¹Institute of Sciences of Food Production, National Research Council (CNR-ISPA), Italy.

²Functional Gastrointestinal Disorders Research Group (IRCCS "Saverio de Bellis"), Italy.

³Section of Pharmacology, Department of Pharmacy-Pharmaceutical Sciences, University of Bari "Aldo Moro", Bari, Italy

⁴Section of Veterinary Pathology and Comparative Oncology, Department of Veterinary Medicine, University of Bari "Aldo Moro", Valenzano, Italy.

Abstract (300-word limit)

Mycotoxins, toxic compounds produced by fungi such as *Fusarium*, *Aspergillus*, and *Penicillium*, are prevalent across the feed and food chain and pose significant public health risks due to their carcinogenic, immunosuppressive, and hormone-disrupting effects. Strategies to mitigate these risks include using multi-mycotoxin adsorbents to limit gastrointestinal absorption and systemic distribution.

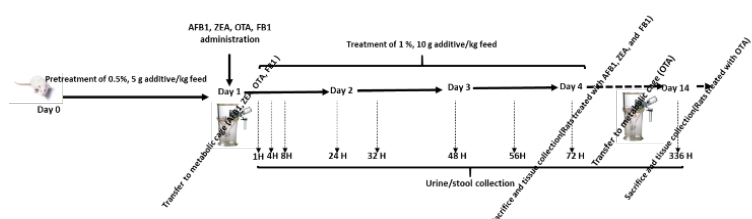
This study was aimed to develop novel multi-mycotoxin detoxifying agents (MMDAs) to decontaminate feed and mitigate mycotoxin exposure, following EFSA guidelines. We screened the *in vitro* efficacy of materials derived from yeast cell walls (YCW) and performed *in vivo* tests on rats.

In vitro tests demonstrated YCW's effectiveness in adsorbing aflatoxin B1 (AFB1), zearalenone (ZEA), ochratoxin A (OTA), and fumonisin B1, though they were ineffective against trichothecenes.

In vivo experiments were carried-out by administering target mycotoxins (single exposure) to rats ($N=9$ for each group) with and without YCW co-treatment. The results showed that YCW significantly ($p<0.05$) reduced gastrointestinal absorption and urinary excretion of ZEA, OTA, and FB1 approximately by 25%, 30%, 45%, respectively. Toxicokinetic assessments demonstrated decrease in the area under the curve (AUC_{0-t}) for ZEA, OTA, and FB1, as well as reduction in peak urinary concentrations (C_{max}) of ZEA and FB1, underscoring the product's protective potential. Histopathological examination indicated that YCW alleviated mycotoxin-induced damage to the intestines and liver. Furthermore, biochemical analysis showed that YCW treatment restored serum enzyme levels to normal ranges.

In conclusion, the YCW-based product effectively reduced urinary mycotoxin excretion and alleviated mycotoxin-induced damage. These findings highlight the potential of YCW-based detoxifiers to enhance animal health, limit mycotoxin transfer along the food chain, and ultimately contribute to improved human health by reducing mycotoxin exposure through animal-derived products.

Please insert Image/Figure



Recent Publications (maximum 5)

- Amminikutty N., Spalenza V., Jariyawattanachaikul W., Badino P., Capucchio M.T., Colombino E., Schiavone A., Greco D., D'Ascanio V., **Avantaggiato G.**, Dabbou S., Nebbia C., Girolami F. Turmeric powder counteracts oxidative stress and reduces AFB1 content in the liver of broilers exposed to the EU maximum levels of the mycotoxin. *Toxins* 2023, <https://doi.org/10.3390/toxins15120687>
- D'Ascanio V., Greco D., Abbasciano M., **Avantaggiato G.** Optimization and in-house validation of the analytical procedure for official control of bentonites as aflatoxin inactivators. *Food Chemistry* 2023, 137198. <http://dx.doi.org/10.1016/j.foodchem.2023.137198>
- Greco D., D'Ascanio V., **Abbasciano M.**, Santovito E., Garbetta A., Logrieco A., Avantaggiato G. Simultaneous Removal of Mycotoxins by a New Feed Additive Containing a Tri-Octahedral Smectite Mixed with Lignocellulose. *Toxins* 2022, 14 (6), 393 <http://dx.doi.org/10.3390/toxins14060393>
- D'Ascanio V., Greco D., Menicagli E., Scala R., Maquod F., Antonacci M., Tricarico D., **Avantaggiato G.** In vitro and in vivo efficacy assessment of a new bentonite based material acting as a multi-mycotoxin binder. *The FASEB journal* 2021, Special Issue: Experimental Biology 2021 Meeting Abstracts, 35(35): 1-2 <https://doi.org/10.1096/fasebj.2021.35.S1.05324>

Biography (150-word limit)



Dr. Giuseppina Avantaggiato, a senior researcher at CNR-ISPA, is a biochemist, Food/Feed Safety Expert, and Ethics Manager. She is a recognized expert in mycotoxin management, with expertise spanning analytical chemistry, biotechnology, and toxicology. She specializes in developing/validating methods to analyze microbial metabolites and contaminants in food/feed and biological samples, using biomarker-based approaches for exposure assessment. She is Leader of the CNR-ISPA working group on the development and in vitro/in vivo efficacy assessment of additives to reduce exposure of farm animals and humans to mycotoxins, bacterial pathogens and toxins. The group shows a strong dynamism in attracting resources in competitive calls, including European, EFSA and Ministerial Projects, and >30 Collaborative Research Agreements with small/medium/large enterprises. The group has registered 2 patents and maintains a high scientific production that is summarized in more than 50 publications and several doctoral theses in Food Safety and Analytical Chemistry. Her H-index is 21 on Scopus