

ADVANCED APPROACHES FOR DETECTION OF MYCOTOXINS IN FOODS

Marija Taskova Kukutanov¹, Sasa Mitrev¹, Emilija Arsov¹, Biljana Kovacevik¹

¹Faculty of Agriculture, Goce Delcev University, Stip, Goce Delcev Str. No. 89, PO box 201, Stip 2000, Republic of North Macedonia
Contact author: marija.taskova@ugd.edu.mk



UNIVERSITY
GOCE DELCEV

INTRODUCTION

Mycotoxins are contaminants in food and feed produced as secondary metabolites by various fungi. In the literature, more than 500 mycotoxins are identified and described as toxic but the most frequently occurring are aflatoxins, ochratoxins, fumotoxins, zearalenone and deoxynivalenol. Unknown consumption may cause mycotoxicosis resulting in hepatotoxicity, neurotoxicity, carcinogenicity etc. Consequently, it is crucial to develop detection methods for mycotoxins that are sensitive, reliable, available and cost effective. Conventional approaches for detection of mycotoxins in food include chromatography techniques such as high-performance liquid chromatography (HPLC) or liquid chromatography–tandem mass spectrometry (LC-MS/MS) and antibody-based immunoassays such as enzyme-linked immunosorbent assay (ELISA). Recently, with the use of nanotechnology, biosensors are proposed and explored as advanced analytical tools for detection of mycotoxins.

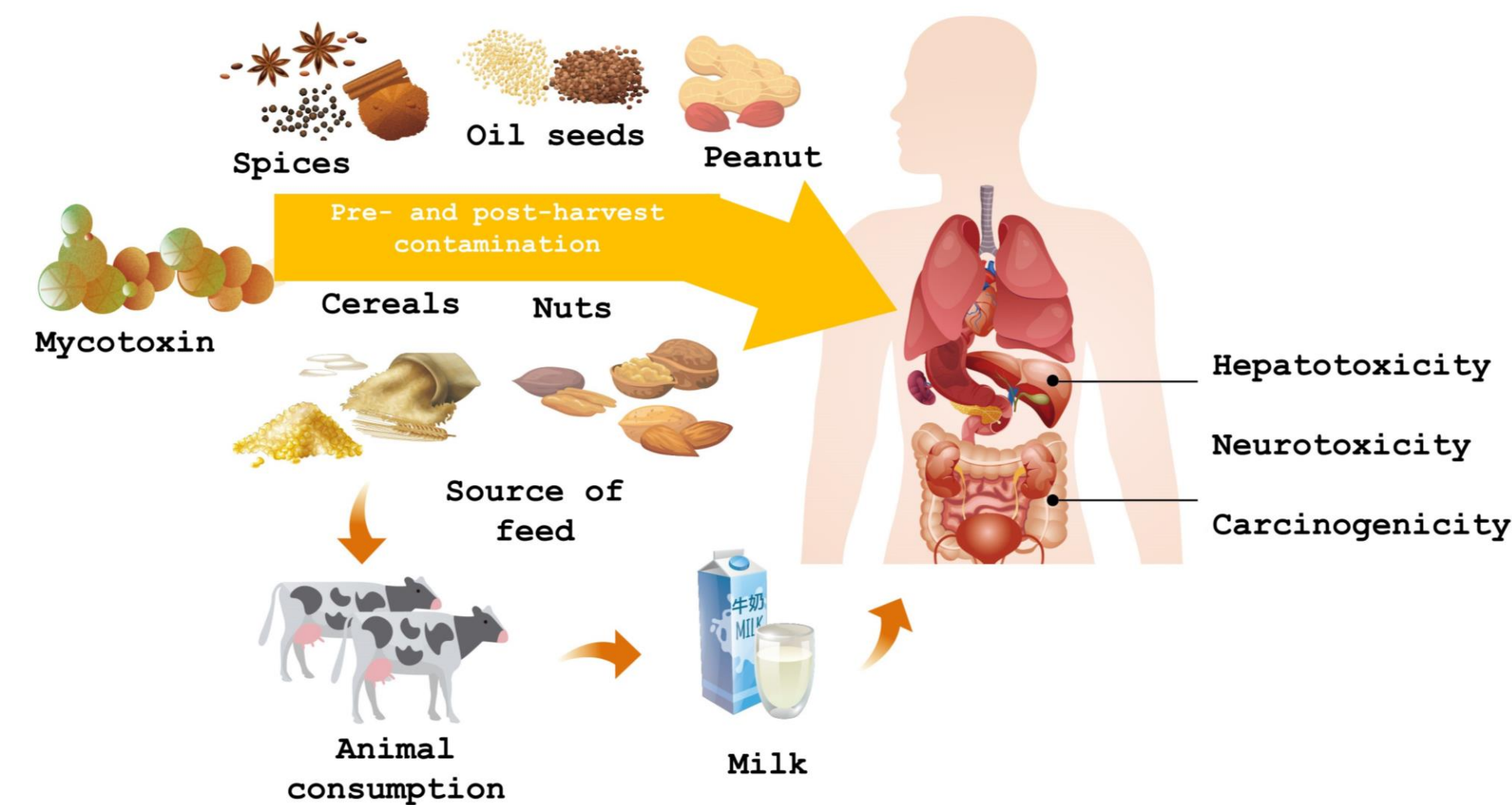


Figure 1. The chain of mycotoxin contamination and effects. Food contaminated with mycotoxins and ingested by animals and humans cause negative health effects.

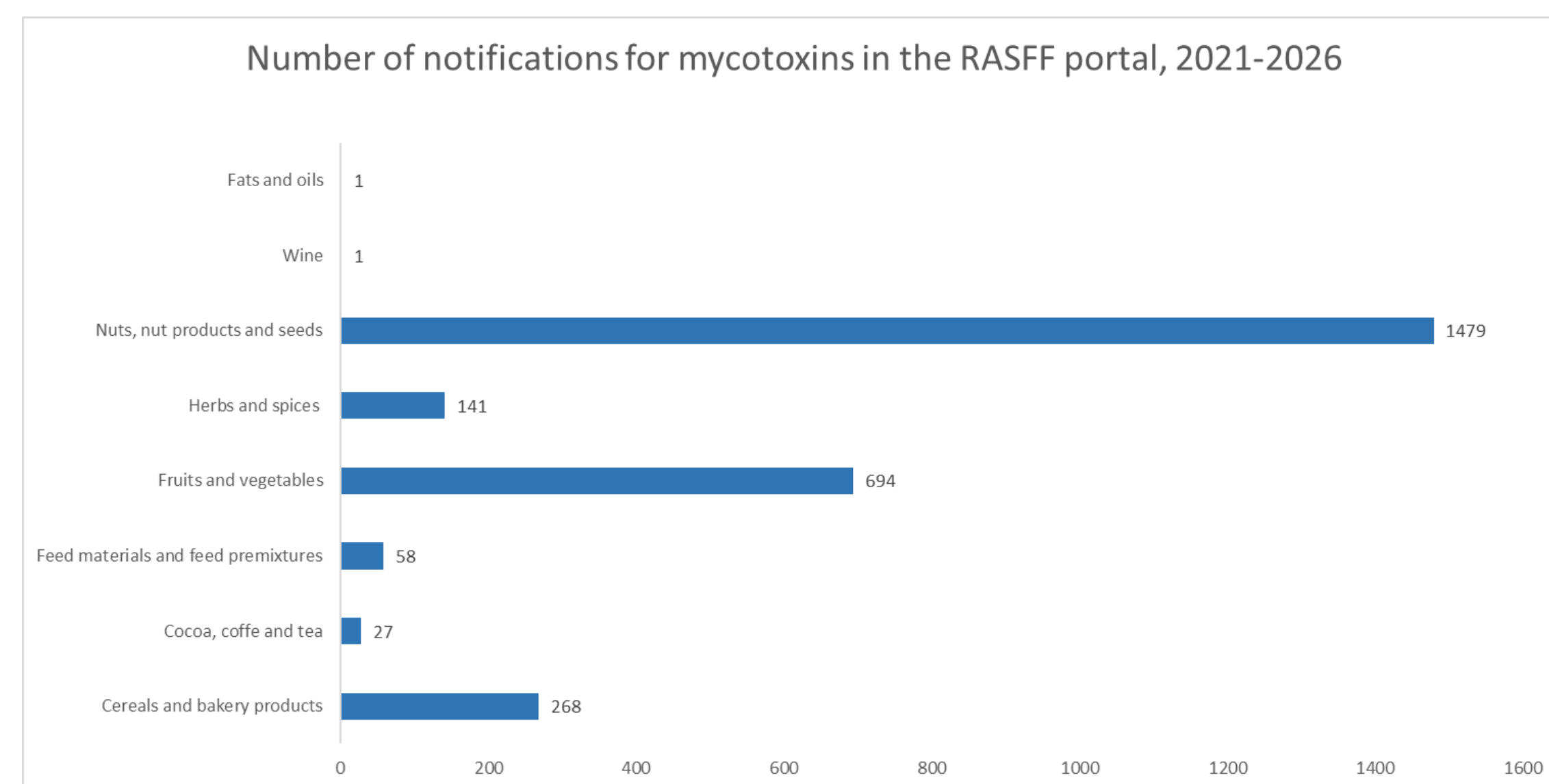


Chart 1. Number of notification in food items for Mycotoxins in the time period from 01.01.2021 to 01.01.2026 by the RASFF portal in Europe. Review of notification by search criteria – mycotoxin in different food items/category.

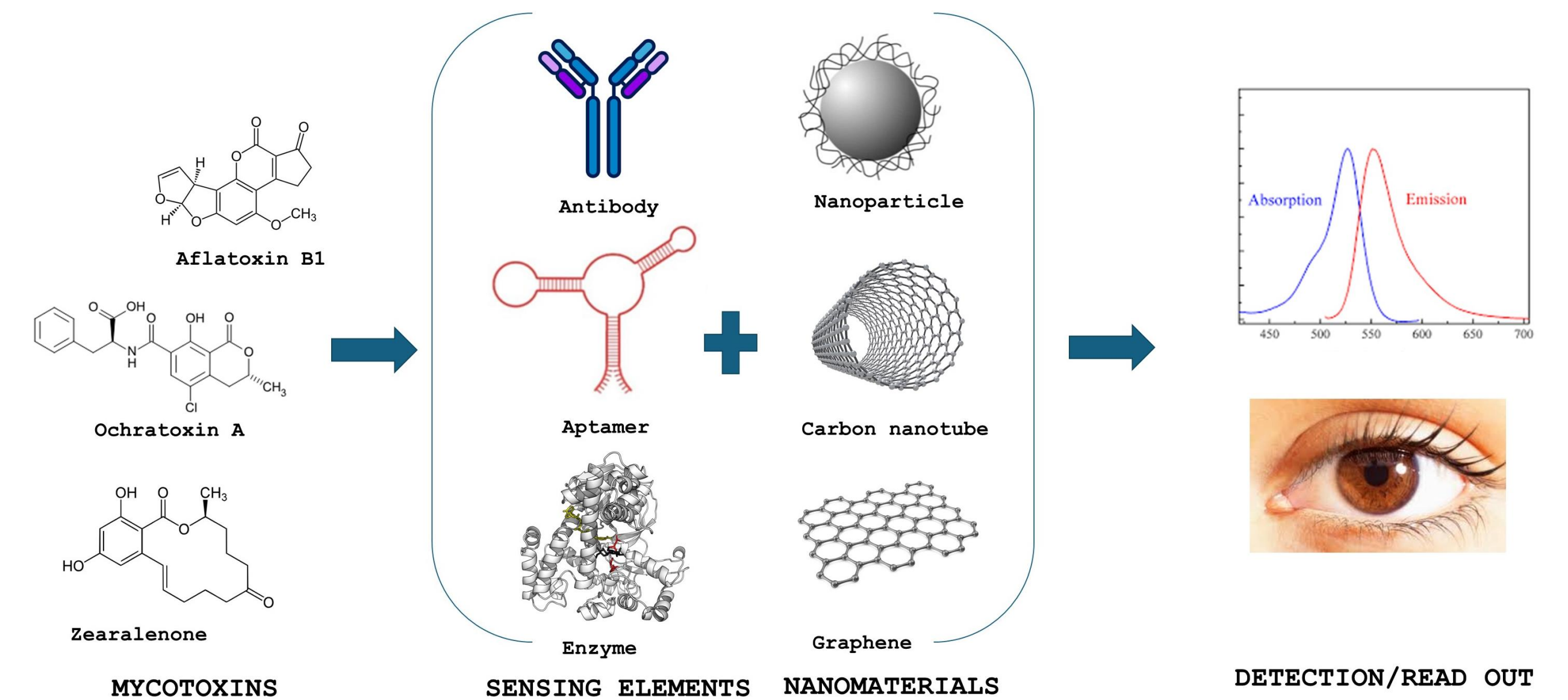


Figure 2. Schematic illustration of an advanced biosensors (sensing element and nanomaterial) for fast and reliable detection of mycotoxins in foods and feeds-

DISCUSSION

Current available techniques for detection of mycotoxins have certain limitation connected to the high cost, time consumption, technical complexity and the need for skilled personnel. There is immense need for development of a new, fast and cost-effective tools for detection of mycotoxins. In that regards biosensors are proposed with a high potential into enhancing sensitivity and selectivity identifying trace amounts of mycotoxins in compound matrices. Biosensors consist of sensing element (receptor) attached on a nanomaterial with transducer to the readout system. They may employ, optical, electrochemical and electrochemiluminescence (ECL) principles. In the literature, aptamer-based biosensors are highlighted as new tool for food mycotoxin assessment. They are non-toxic, offer high efficiency because of the high surface density, have high stability compared with antibodies and hold possibility for customization. The future efforts in the field will be on improving biosensor robustness, size, integration with digital technologies and machine learning methods for predicting the presence of mycotoxins.

CONCLUSION

The development of an advanced biosensor system and their integration into food safety systems have high potential to increase the safety and the quality of the food supply chain. The progress in technology and the interdisciplinary research will further boost the biosensor application for maintaining food safety.

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