Review

The biotransformation of chosen mycotoxins

M. Gajęcka, E. Jakimiuk, Ł. Zielonka, K. Obremski, M. Gajęcki

Department of Veterinary Prevention and Feed Hygiene, Faculty of Veterinary Medicine, University of Warmia and Mazury in Olsztyn, Oczapowskiego 13, 10-718 Olsztyn, Poland

Abstract

Despite the unfavourable influence of mycotoxins on human and animal health and few toxicological aspects that have been documented, about these biologically active substances has not been explored. Aiming at more knowledge and a better understanding of the effects and mechanism of mycotoxin action in mammals would provide the basics for developing strategies to restrain different mycotoxicoses. One of the processes not fully understood is biotransformation, to which mycotoxins are subjected the animal organism. Biotransformation is the conversion of mycotoxins to non-toxic metabolites and occurs mostly in the intestinal mucosal membrane and liver, although other tissues and systems also take part in this process. Mycotoxin biotransformation reactions can be considered bioinactivation or detoxication, but mycotoxin biotransformation processes could also result in products more toxic than the mycotoxin. It can be concluded from research studies that our knowledge of mycotoxin biotransformation is scarce.

Key words: biotransformation, aflatoxin B1, ochratoxin A, deoxynivalenol, fumonisins, zearalenon

Introduction

All organisms are constantly exposed to mycotoxins, the secondary products of metabolic processes in moulds (Shephard 2008). The rate of mycotoxin removal is often determined by the method of biotransformation for substances chemically soluble in water, which are then enzymatically converted in the liver or other tissues for removal (detoxication). Many biotransformation reactions can be considered as mycotoxin bioinactivation or detoxication. Bioinactivation should be understood as lowering the toxic properties of a molecule; its status presens is of the processed form and the toxic properties are reduced or gone. However, biotransformation processes may result in products more toxic than the original mycotoxin. These reactions are normally called bioactivation reactions (Liska et al. 2006, Sergent et al. 2008).

Biotransformation is the conversion of toxic substances to non-toxic metabolites during different phase I and phase II biochemical processes, which are the transformation into more hydrophilic substances. During the first phase of detoxication, as the result of the presence of a mycotoxin, higher enzymatic activity causes oxidation, reduction, and/or hydrolysis reactions that expose functional hydroxyl, carboxyl, or amine groups (Nebbia 2001). The structure of the mycotoxin decides which reaction takes place. The enzymes are responsible for initiating the mycotoxin biotransformation processes. In most cases the biotransformation process allows substances created during phase I to enter conjugation processes, which are the burden of phase II. In some cases different substances may be eliminated directly after phase I reactions.

The enzymatic system of phase I includes several isoenzymes, of which a few hundred have been identi-