

Ubiquitous contamination with multiple mycotoxins and other fungal metabolites in dietary rations of dairy cattle in Punjab, Pakistan

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Abstract

Pakistan is third in worldwide dairy production ranking, behind India and USA. The climatic conditions of South Asia favour the contamination of crops with mycotoxins, such as aflatoxins, which can impair human/animal health. This study targeted the analysis of a broad range of mycotoxins and fungal secondary metabolites (>500) in total mixed rations (TMR) (n=30) using a validated multi-metabolite liquid chromatography/electrospray ionization-tandem mass spectrometric (LC/ESI-MS/MS). The samples were collected in big commercial dairy farms (> 200 lactating cows) in Punjab, Pakistan, detecting 96 mycotoxins/fungal metabolites. Contamination with multiple mycotoxins was ubiquitous. On average, the samples contained 14 mycotoxins/sample (range: 11 - 20). Metabolites derived from “other fungi” and *Fusarium* spp. showed the highest occurrences, concentration, and diversity among the detected fungal compounds. Aflatoxin B1 (AFB1) occurred in 40% of the samples, and 7% exceeded the EU maximum limit for feeding dairy cattle (5 µg/kg). The maximum concentration of this potent carcinogenic was 33.8 µg/kg (more than 7 times over the EU maximum limit). No other mycotoxin than AFB1 exceeded the EU guidance values. Excepting for ergot alkaloids (73%), all the groups of metabolites (i.e., derived from *Alternaria* spp., *Aspergillus* spp., *Fusarium* spp., *Penicillium* spp., and other fungi) occurred in 100% of the TMR samples. Although the contamination levels of single mycotoxins are relatively low, the effects on animal health, reproduction, and productivity under the detected realistic scenario (“cocktails effect”) are still unpredictable. Thus, future toxicological studies should address interactions (additivity, potentiation, synergism, and antagonism) as well as the long-term exposure effects of “mycotoxin mixtures”. Our studies reconfirm that the monitoring and surveillance of aflatoxin M1 in dairy products in the South Asian region are essential and highly required.

Keywords: Dairy, Feed safety, Mixtures toxicology, Mycotoxin co-occurrence