APPLICATION OF MATHEMATICAL MODELS TO MYCOTOXINS CHILDREN RISK ASSESSMENT: A CASE STUDY OF PORTUGUESE CHILDREN EXPOSURE TO CO-OCcurring MYCOTOXINS IN PROCESSED CEREAL-BASED FOODS

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Results

- Processed cereal-based foods consumption
  - Approximately 47% of the studied children consumed CBF at least one time in these 3 days.
  - 27% of consumers were aged < 1 year old and 73% aged between 1 and 3 years old.

- Contamination of processed cereal-based foods
  - 75% of analyzed CBF were contaminated with, at least, one mycotoxic
  - OTA presented the highest contamination level.
  - All samples revealed levels of AFB1 and AFG2 below the LOD value.

- AFM1 revealed a margin of exposure (MoE) below 10000, suggesting potential health concern for the higher percentiles of intake (≥ P75). MoE of the remaining aflatoxins were above 10000 for all percentiles³.
  - OTA presented a hazard quotient (HQ) below 1 for all percentiles, suggesting no potential health concern³.
  - Considering the co-occurrence of aflatoxins, and applying the concentration addition concept, combined margin of exposure (MoET) was below 10000 for ≥ P75 and this fact constitutes a potential health concern³.

Methodologies

- Food consumption data
  - Food consumption data of children (0-3 years old) from Lisbon region (n=103) were collected using a 3 days food diary.

- Contamination data
  - Aflatoxins and ochratoxin A were quantified in 20 CBF samples marketed in 2014 and 2015 in Lisbon. Analysis were performed by HPLC-FLD¹.

- Exposure assessment
  - Daily exposure of children to mycotoxins was performed using deterministic and probabilistic approaches. Different strategies were used to treat the left censored data (mycotoxin levels < limit of detection, LOD).

- Risk characterization
  - AFM1 revealed a margin of exposure (MoE) below 10000, suggesting potential health concern for the higher percentiles of intake (≥ P75). MoE of the remaining aflatoxins were above 10000 for all percentiles³.
  - OTA presented a hazard quotient (HQ) below 1 for all percentiles, suggesting no potential health concern³.
  - Considering the co-occurrence of aflatoxins, and applying the concentration addition concept, combined margin of exposure (MoET) was below 10000 for ≥ P75 and this fact constitutes a potential health concern³.

Aims

- Characterize, for the first time, the risk associated with the exposure of Portuguese children to single and multiple mycotoxins present in processed cereal-based foods (CBF):
  - Food consumption data
  - Contamination data
  - Exposure assessment

- Background

  - People, animals and the environment can be exposed to single and multiple chemicals at once from a variety of sources.
  - Risk assessment is usually carried out based on one chemical substance at a time.

  - Mycotoxins
    - Fungal secondary metabolites that are known to potentially cause toxicity and carcinogenic outcomes;
    - Commonly found in a variety of foods including those intended for consumption by infants and young children, namely in processed cereal-based foods available in the Portuguese market¹.

  - The use of mathematical models, including probabilistic approaches using Monte Carlo simulations, constitutes a prominent issue in human health risk assessment.

Children are a particularly vulnerable population group to food contaminants and the present results point out an urgent need to establish legal limits and control strategies regarding the presence of multiple mycotoxins in children foods in order to protect their health. The development of packaging materials with antifungal properties is a possible solution to control the growth of moulds and consequently to reduce mycotoxin production, contributing to guarantee the quality and safety of foods intended for children consumption.

References

- Hawkins, V. et al. (2017). Food and Nutrition Department, National Institute of Health Dr. Ricardo Jorge, Portugal; 2IFAPA, Universidad de Évora, Portugal; 3Centre for Environmental and Marine Studies, University of Aveiro, Portugal; 4Department of Biology & CESAM – Centre for Environmental and Marine Studies, University of Aveiro, Portugal

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