

IS THERE A HEALTH RISK CONCERNING THE CHILDREN'S CONSUMPTION OF CEREAL BASED PRODUCTS?

A CUMULATIVE MYCOTOXIN RISK ASSESSMENT APPROACH.

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Background & Aims

- 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**
- Cereals are among the **first solid foods eaten by child**
- Mycotoxins (fungal secondary metabolites)
 - are known to potentially cause toxicity and carcinogenic outcomes
 - are commonly found in a variety of foods including cereal-based foods intended for consumption by **infants and young children**¹
 - many species of mycotoxin-producing fungi are known to be capable of producing **more than one mycotoxin**.

AIMS:

- Perform the cumulative risk assessment of mycotoxins present in a set of cereal-based foods including **breakfast cereals (BC)**, **processed cereal-based foods (PCBF, flours)** and **biscuits (BT)**, consumed by children (1 to 3 years old, n=75) from Lisbon region, Portugal:
 - Food consumption data
 - Contamination data
 - Exposure assessment

Risk Characterization



Methodologies

- Food consumption data**
Food consumption data of children (1-3 years old) from Lisbon region (n=75) were collected using a 3 days food diary.
- Contamination data**
Aflatoxins, ochratoxin A, fumonisins and trichothecenes were quantified in PCBF (n=20), BC (n=26) and BT (n=6) samples marketed in 2014 and 2015 in Lisbon. Analysis were performed by HPLC-FLD, GC-M and LC-MS/MS².
- 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 (H1 to H4)³.
- Risk characterization**
Risk was characterized using the Margin of Exposure (MoE, single) and Combined Margin of Exposure (MoET, multiple) for aflatoxins, and the Hazard Quotient (HQ, single) and Hazard Index (HI, multiple) for the remaining mycotoxins⁴.

Results

Cereal based foods consumption

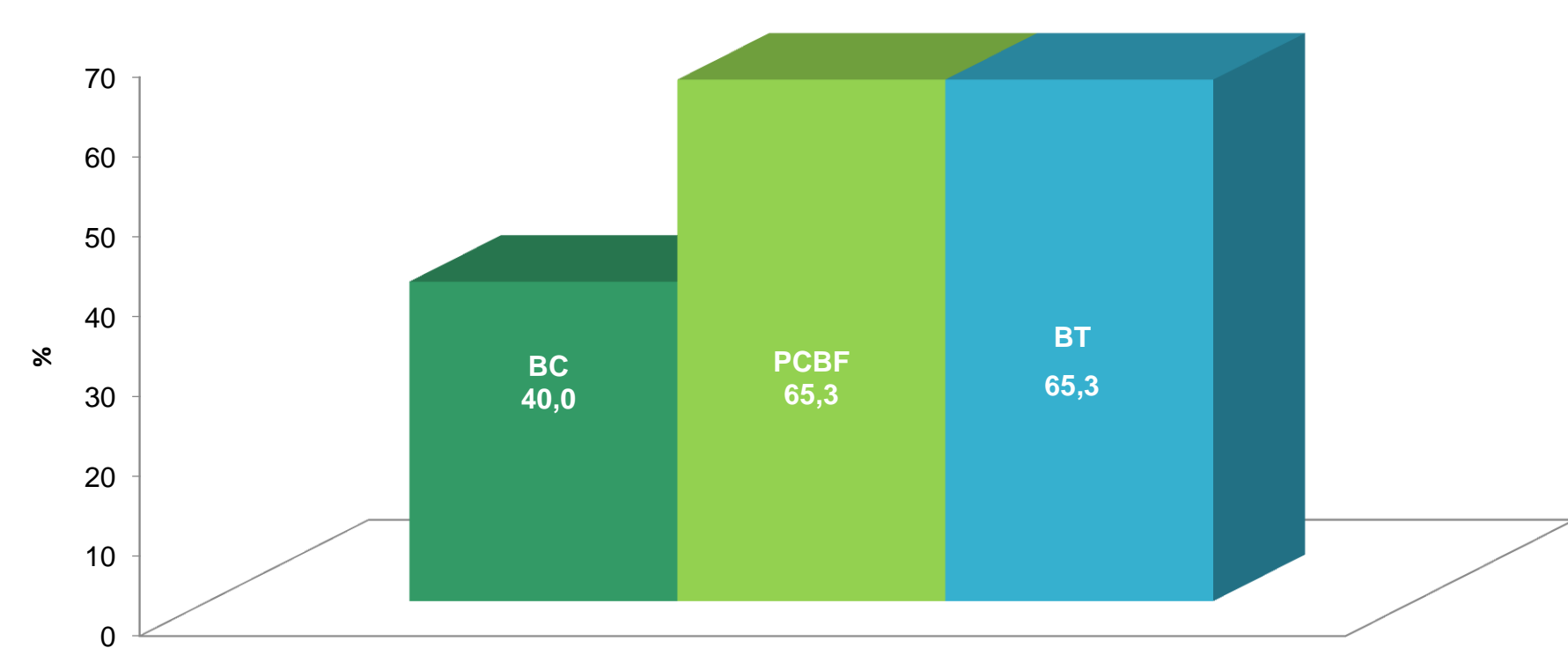


Figure 1: Percentage of consumers of cereal based foods (n=75).

Contamination of cereal based foods

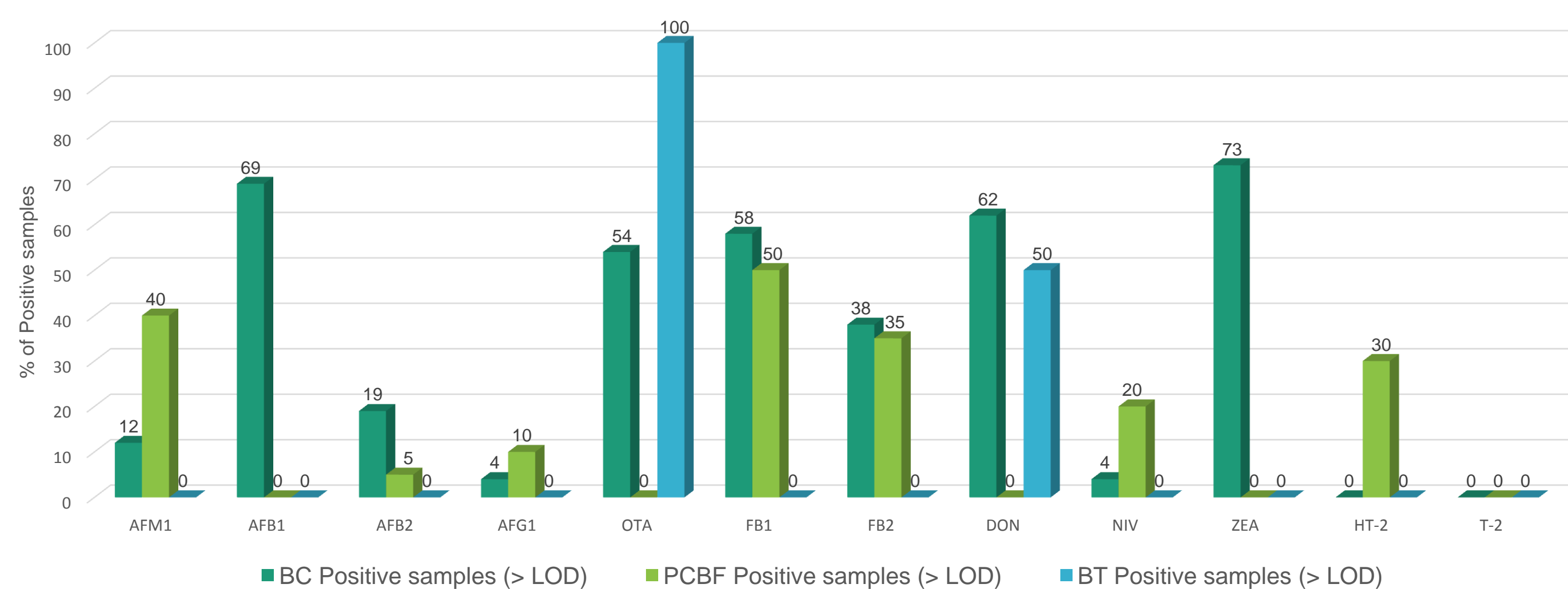


Figure 2: Percentage of contaminated samples, considering each mycotoxin (BC, n=26; PCBF, n=20; BT, n=6).

- 75% of PCBF, 50% of BT and 96% of BC analyzed samples were contaminated with, at least, one mycotoxin.
- OTA, ZEA, AFB₁, DON and FB₁ were the most frequent mycotoxins in cereal based samples (> 50%).

Exposure assessment & Risk characterization

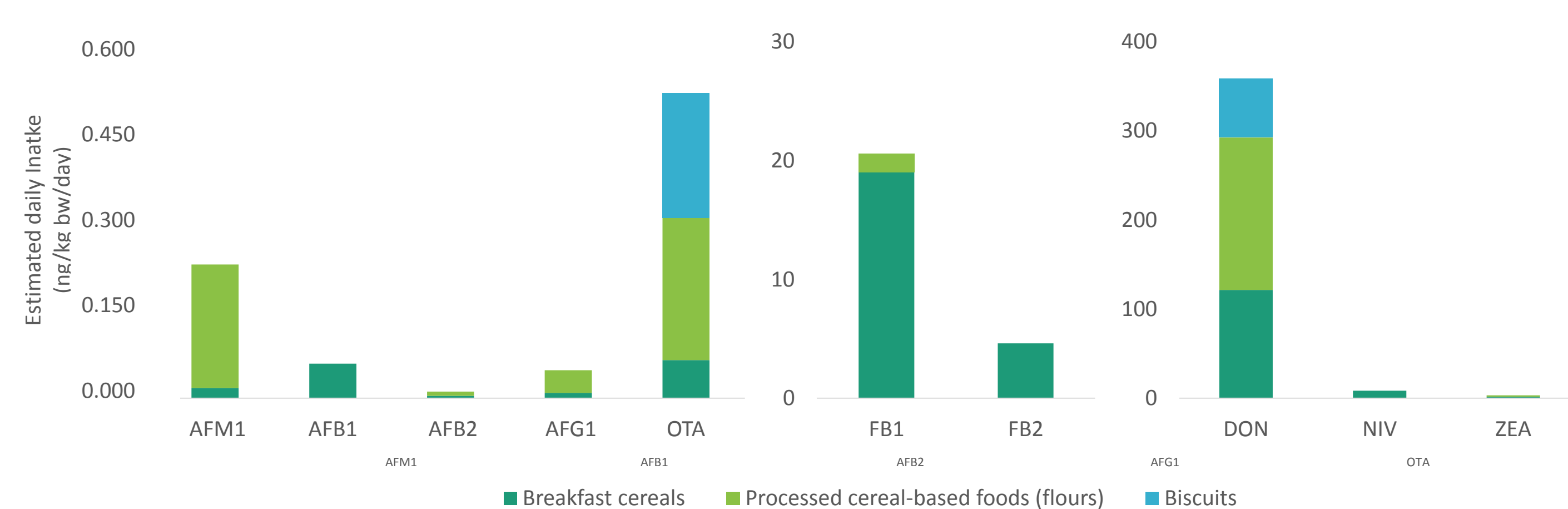


Figure 3: Results of probabilistic approaches (for P95) to estimate children exposure to aflatoxins (AFM₁, AFB₁, AFB₂, AFG₁), ochratoxin A (OTA), fumonisins (FB₁, FB₂), trichothecenes (DON, NIV) and zearalenone (ZEA) through ingestion of breakfast cereals, processed cereal-based foods (flours) and biscuits (ng/kg bw/day). Results show the worst case scenario (H3, occurrence values < LOD = LOD).

- Main results revealed a significant health concern related to **aflatoxins** and especially aflatoxin M₁ exposure according to the combined margin of exposure (MoET) and margin of exposure (MoE) values (below 10000)⁴, respectively.
- The aflatoxin children intake is mainly due to ingestion of **processed cereal-based products (flours)** contamination.
- For higher percentiles of intake (≥ P97.5%), **DON intake** revealed a significant health concern⁴, showing a hazard quotient (HQ) above 1.
- For the remaining mycotoxins, hazard quotients (HQs) were below 1 for all percentiles, suggesting no potential health concern⁴.

These are the **first results** on cumulative risk assessment of **multiple mycotoxins present in cereal-based foods consumed by children**. Considering the present results, more **research studies** are needed to provide the **governmental regulatory bodies** with data to develop an approach that contemplate the human exposure and, particularly, children, to multiple mycotoxins in food. The last issue is particularly important considering the **potential synergistic effects** that could occur between mycotoxins and its potential impact on human and, mainly, children health.