ARE BREAKFAST CEREALS SAFE TO CONSUMPTION BY CHILDREN? A PRELIMINARY EXPOSURE ASSESSMENT APPROACH

Ricardo Assunção[1,2,3], **Elsa Vasco**[1*], Baltazar Nunes[1], Carla Martins[1], Paula Alvito[1,3]

[1]Food and Nutrition Department, National Institute of Health Dr. Ricardo Jorge, Portugal; [2]Universidade de Évora, Portugal; [3]Centre for Environmental and Marine Studies, Faculty of Sciences, University of Lisbon, Portugal.

***elsa.vasco@insa.min-saude.pt**

Background & Aims

In human health risk assessment, ingestion of food is considered a major route of exposure to many contaminants, namely mycotoxins, a wide group of fungal secondary metabolites that cause toxic and carcinogenic outcomes in humans exposed to them[1].

Infants have a more restricted diet and they generally consume more food on a body weight basis than adults thus they are a particularly vulnerable population group to food contaminants[2].

This study aims to **characterize the risk** associated with the **consumption of breakfast cereals (BC)** concerning the exposure of Portuguese children to mycotoxins, namely aflatoxin B_1 (**AFB_1**) and ochratoxin A (**OTA**).

Methods

- **Breakfast cereal samples**
  14 breakfast cereals were purchased from supermarkets in Lisbon Region.

- **AFB_1 and OTA occurrence - HPLC-FLD analysis**
  Column: ODS3, 150x4,6 mm, 5 µm, Phenomenex®
  Flow rate: 1 mL/min
  Mobile phase: KBr/ACN/MeOH/$C_2H_4O_2$
  Injection volume: 800 µL
  Run time: 59 min
  Derivatization: post-column with Kobra cell with KBr
  Equipment: Waters® 2695 with detector 2475

- **Breakfast cereals consumption data**
  Three days food diary from children (n=103) with less than 3 years old from a Primary Health Care Unit near Lisbon.

- **Mycotoxin daily exposure**
  Deterministic and probabilistic (@Risk, Palisade) approaches.
  Different exposure scenarios (H1 to H4) for the mycotoxin dietary exposure assessment in relation to the data treatment of the non-detects (<LOD, limit of detection)[3].
  For the risk characterization, the outputs of exposure, namely the daily intake values, were compared with the reference dose values.

Analytical performance

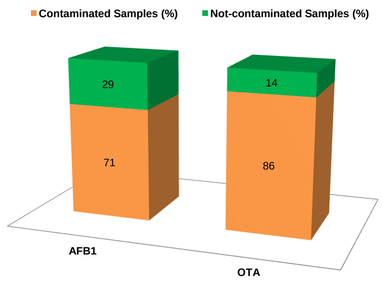
Method Performance

	AFB_1	OTA
LOD (µg Kg^{-1})	0.003	0.006
LOQ (µg Kg^{-1})	0.009	0.019
Recovery (%)	73	71
Accuracy (FAPAS proficiency trials, Z-scores)	-0.6	-0.6

Results

• AFB_1 & OTA occurrence

AFB_1 and OTA occurrence of breakfast cereals samples

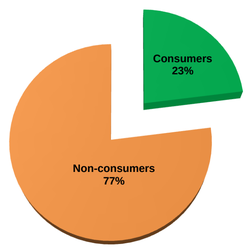


- Approximately 71% and 86% of BC samples were contaminated with AFB_1 and OTA, respectively.

- There are no maximum admissible levels in EU legislation for AFB_1 and OTA in breakfast cereals.

• BC Consumption data

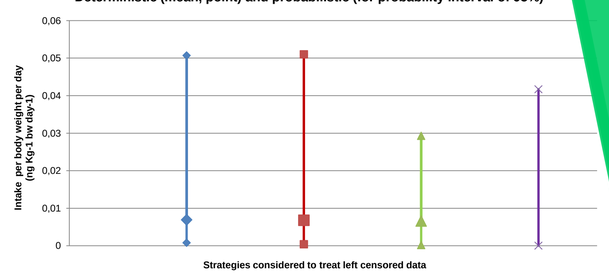
Breakfast cereals consumption data % of children consumers



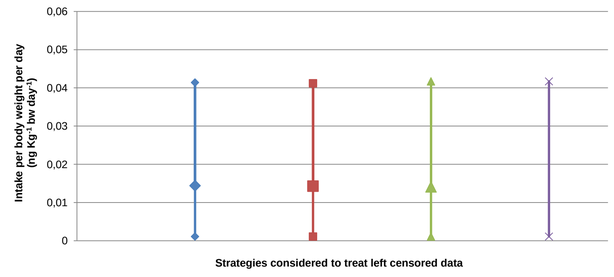
- Approximately 23 % of the studied children consumed BC at least one time in these 3 days.

• AFB_1 & OTA daily intake

AFB_1
Intake per body weight per day (ng Kg^{-1} bw day^{-1})
Deterministic (mean, point) and probabilistic (for probability interval of 95%)



OTA
Intake per body weight per day (ng Kg^{-1} bw day^{-1})
Deterministic (mean, point) and probabilistic (for probability interval of 95%)

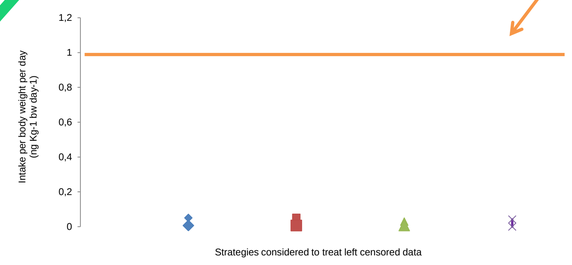


Results of deterministic and probabilistic approaches to estimate children exposure to aflatoxin B_1 and ochratoxin A, through ingestion of breakfast cereals (ng.Kg^{-1} bw.day^{-1}).
Four different scenarios were considered:
•H1: <LOD = LOD
•H2: <LOD = 1/2 LOD
•H3: <LOD = 0
•H4: <LOD = uniform distribution with min=0 and max=LOD

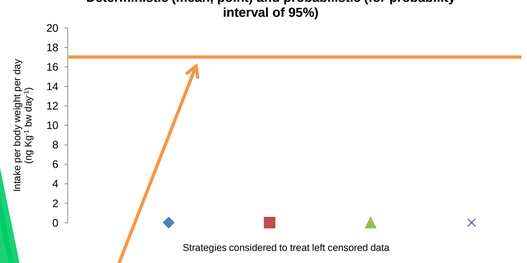
Risk characterization

Intake that does not contribute to the risk of liver cancer (1ng Kg^{-1} bw day^{-1})[4]

AFB_1
Intake per body weight per day (ng Kg^{-1} bw day^{-1})
Deterministic (mean, point) and probabilistic (for probability interval of 95%)



OTA
Intake per body weight per day (ng Kg^{-1} bw day^{-1})
Deterministic (mean, point) and probabilistic (for probability interval of 95%)



Provisional Tolerable Weekly Intake =112 ng Kg^{-1} bw

≈ 17 ng Kg^{-1} bw day^{-1}

Highlights

- This study concerns the **first risk assessment** of **Portuguese children** to single mycotoxins in **Breakfast cereals**.
- **AFB_1** and **OTA** occurred in a significant number of breakfast cereal samples.
- **No EU legislation** for AFB_1 and OTA in breakfast cereals is available.
- Deterministic and probabilistic approaches showed that children **exposure** to single mycotoxins present in breakfast cereals were **well below the dose reference values.**

Risk associated with the exposure to AFB_1 and OTA by breakfast cereals consumption was considered to be out of concern for the population considered.

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References:

[1]Versantvoort et al. (2005). *Food and Chemical Toxicology,* 43: 31–40.

[2]Alvito et al. (2010). *Food Analytical Methods*, 3: 22–30.

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[4]Cano-Sancho et al. (2010). *Rev Iberoam Micol,* 27(3):130–135.

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