

RISK BENEFIT4EU PROJECT

PARTNERING TO STRENGTHEN THE RISK-BENEFIT ASSESSMENT WITHIN EU USING A HOLISTIC APPROACH



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OUTLINE

A brief story...

- ✓ **Mycotoxins in baby foods**
- ✓ **Risk assessment and risk characterisation of mycotoxins mixtures in infant food (MYCOMIX)**

The present challenge...

- ✓ **Risk-Benefit Assessment in food (RB4EU)**
Case-study involving mycotoxins

A brief story...

rivm

National Institute
for Public Health and
the Environment

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Occurrence of Aflatoxins and Ochratoxin A in Baby Foods in Portugal

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Abstract Infants have a more restricted diet and they generally consume more food on a body weight basis than adults. Therefore, the significance and potential health risk of any contaminant in foods consumed by infants is increased and diligent attention must be paid to this particular area. The present study aims to determine the occurrence of aflatoxin M₁ (AFM₁), aflatoxin B₁ (AFB₁) and ochratoxin A (OTA) in processed cereal-based foods (flours) and infant formulae (milk powder) available in the Portuguese market, both sold as conventional and organic origin. Mycotoxin determination was carried out using a method previously applied to duplicate diet samples. This method employed chloroform extraction, liquid–liquid extraction, immunoaffinity column (IAC) cleanup and HPLC analysis with fluorescence detection after post-column derivatisation. Quantification limits were 0.014, 0.004 and 0.028 µg kg⁻¹ for AFM₁, AFB₁ and OTA, respectively. These toxins could only be quantified in 12

of 27 analysed samples (15 positive results): two samples with AFM₁, two samples with AFM₁ and OTA, one sample with AFB₁ and OTA and seven samples with OTA. Positive results concerned four for AFM₁ (26%), one for AFB₁ (7%) and ten for OTA (67%). For these samples, contents ranged between 0.017–0.041 µg AFM₁ kg⁻¹, 0.034–0.212 µg OTA kg⁻¹, and one sample had a value of 0.009 µg AFB₁ kg⁻¹. Considering the presented results, we could provisionally conclude that the presence of these mycotoxins in baby foods does not constitute a public health problem. These are the first results concerning the occurrence of mycotoxins in marketed baby foods in Portugal and this is the first study using the HPLC method, proposed for duplicate diets, in baby food sample analysis.

Keywords Aflatoxins · Ochratoxin A · Baby Foods · HPLC · Portugal · Human Health



Alvito, P C, Sizoo, E A Almeida, CMM and Van Egmond, Hans P. Food Analytical Methods, 2010, 3: 22-30.

Table 4 Content of AFM₁, AFB₁ and OTA in baby foods

Commodity	Brand	Production	Composition	Source	AFM ₁ (µg kg ⁻¹)	AFB ₁ (µg kg ⁻¹)	OTA (µg kg ⁻¹)
Cereals							
Flour	A	O	Wheat	Bioshop	<LOD	0.002 ^a	0.013 ^a
Flour	A	O	Rice, wheat	Bioshop	<LOD	0.002 ^a	0.034
Flour	B	O	Oats flour	Bioshop	<LOD	<LOD	0.010 ^a
Flour	B	O	Maize flour	Bioshop	<LOD	<LOD	<LOD
Flour	B	O	Rice flour	Bioshop	<LOD	<LOD	<LOD
Flour	C	C	Milk, cereals 70% (starch maize, rice flour)	Pharmacy	0.018	0.003 ^a	0.142
Flour	C	C	Milk, apple 60%, cereals 35% (starch maize, rice flour)	Pharmacy	0.023	<LOD	0.010 ^a
Flour	D	C	Milk, wheat flour 40.3%, skimmed milk 29.9%	Supermarket	<LOD	<LOD	0.010 ^a
Flour	E	C	Rice flour and maize flour (79%)	Supermarket	0.008 ^a	0.002 ^a	<LOD
Flour	C	C	Milk, cereals 39% (wheat, rice, oats flour, barley, rye, maize)	Pharmacy	0.017	<LOD	0.150
Flour	F	C	Wheat flour (78.7%)	Supermarket	<LOD	<LOD	0.021 ^a
Flour	E	C	Milk, wheat flour 53%	Supermarket	<LOD	<LOD	<LOD
Flour	C	C	Rice flour 68%	Pharmacy	<LOD	<LOD	0.081
Flour	F	C	Flour 78% (wheat, hydrolysed wheat, maize, rye, barley, rice, oats)	Supermarket	<LOD	<LOD	0.077
Flour	C	C	Cereals 62% (wheat, barley, rye, rice, maize, oats flour), fruits	Pharmacy	<LOD	<LOD	<LOD
Flour	G	O	Rice flour 87.9%, quinoa flour 9.7%	Bioshop	<LOD	0.002 ^a	<LOD
Flour	A	O	Rice	Bioshop	<LOD	<LOD	<LOD
Flour	A	O	Rice, oats, barley, apple (5%), almonds, nuts	Bioshop	<LOD	0.009	0.212
Flour	B	O	Wheat flour	Bioshop	<LOD	<LOD	0.032
Biscuit	I	O	Cookies: wheat 60%, grape juice 28%, sunflower oil 2%, ginger 1%	Bioshop	<LOD	<LOD	0.052
Milk							
Powder	H	O	Soy proteins	Bioshop	<LOD	0.003 ^a	0.136
Powder	G	O	Milk, vegetable oils	Bioshop	0.011 ^a	<LOD	0.011 ^a
Powder	G	O	Milk, vegetal oils	Bioshop	0.007 ^a	<LOD	<LOD
Powder	F	C	Milky serum, vegetal fish oils	Supermarket	0.008 ^a	<LOD	<LOD
Powder	F	C	Milk, serum proteins, vegetal fish oils	Supermarket	0.041	<LOD	<LOD
Powder	E	C	Milk, hydrolysed serum proteins concentrate, vegetable oils, starch	Supermarket	0.013 ^a	<LOD	<LOD
Powder	E	C	Milk, hydrolysed serum proteins concentrate, vegetable oils, starch	Supermarket	0.005 ^a	<LOD	0.135

The LOD for AFM₁, AFB₁ and OTA are 0.004, 0.001, and 0.009 µg kg⁻¹, respectively. The LOQ for AFM₁, AFB₁ and OTA are 0.014, 0.004 and 0.028 µg kg⁻¹, respectively.

EU limits for AFM₁, AFB₁ and OTA in baby and infant foods are 0.25, 0.10 and 0.50 µg kg⁻¹, respectively

LOD Limit of detection µg kg⁻¹, LOQ limit of quantification µg kg⁻¹, Production mode: O (organic) and C (conventional)

^a<LOQ

12 of 27 samples revealed presence of mycotoxins in baby foods marketed in Lisbon market: 2 with AFM₁, 2 with AFM₁ and OTA, 1 with AFB₁ and OTA and 7 with OTA.

Considering the presented results, we could provisionally conclude that the presence of these mycotoxins in baby foods does not constitute a public health problem.

A Portuguese Case Study – MYCOMIX Project

MYCOMIX



“Exploring the toxic effects of **MIX**tures of **MYCO**toxins
in infant food and potential health impact”

(PTDC/DTP-FTO/0417/2012)

A Portuguese Case Study – MYCOMIX Project

Are children exposed to mycotoxins through diet?

Are there interactive effects in toxicity of mixtures of mycotoxins?

Children are exposed to mycotoxin mixtures through their diet and this constitutes a health threat

Could this exposure be a health threat to children?





Contents lists available at ScienceDirect

Food and Chemical Toxicology

journal homepage: www.elsevier.com/locate/foodchemtox



Single-compound and cumulative risk assessment of mycotoxins present in breakfast cereals consumed by children from Lisbon region, Portugal



Ricardo Assunção^{a, b, c}, Elsa Vasco^a, Baltazar Nunes^{d, f}, Susana Loureiro^e, Carla Martins^a, Paula Alvito^{a, c, *}

Daily exposure of children to ochratoxin A, fumonisins and trichothecenes showed no health risks to the children population considering individual mycotoxins. The combined exposure to fumonisins and trichothecenes are not expected to be of health concern.

Exposure to aflatoxin B₁ (AFB₁) suggested a potential health concern for the high percentiles of intake (P90, P95 and P99) considering individual toxins.

The combined margin of exposure (MoET) for the aflatoxins group could constitute a potential health concern and AFB₁ was the main contributor for MoET.



ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Food Chemistry

journal homepage: www.elsevier.com/locate/foodchem



Assessment of multiple mycotoxins in breakfast cereals available in the Portuguese market



Carla Martins^{a,b,c,*}, Ricardo Assunção^{a,c,d}, Sara C. Cunha^e, José O. Fernandes^e, Alessandra Jager^f, Tânia Petta^g, Carlos Augusto Oliveira^g, Paula Alvito^{a,c}

96% of the analysed breakfast cereal samples were contaminated with several mycotoxins. Twenty-two combinations were identified including two to seven different mycotoxins.

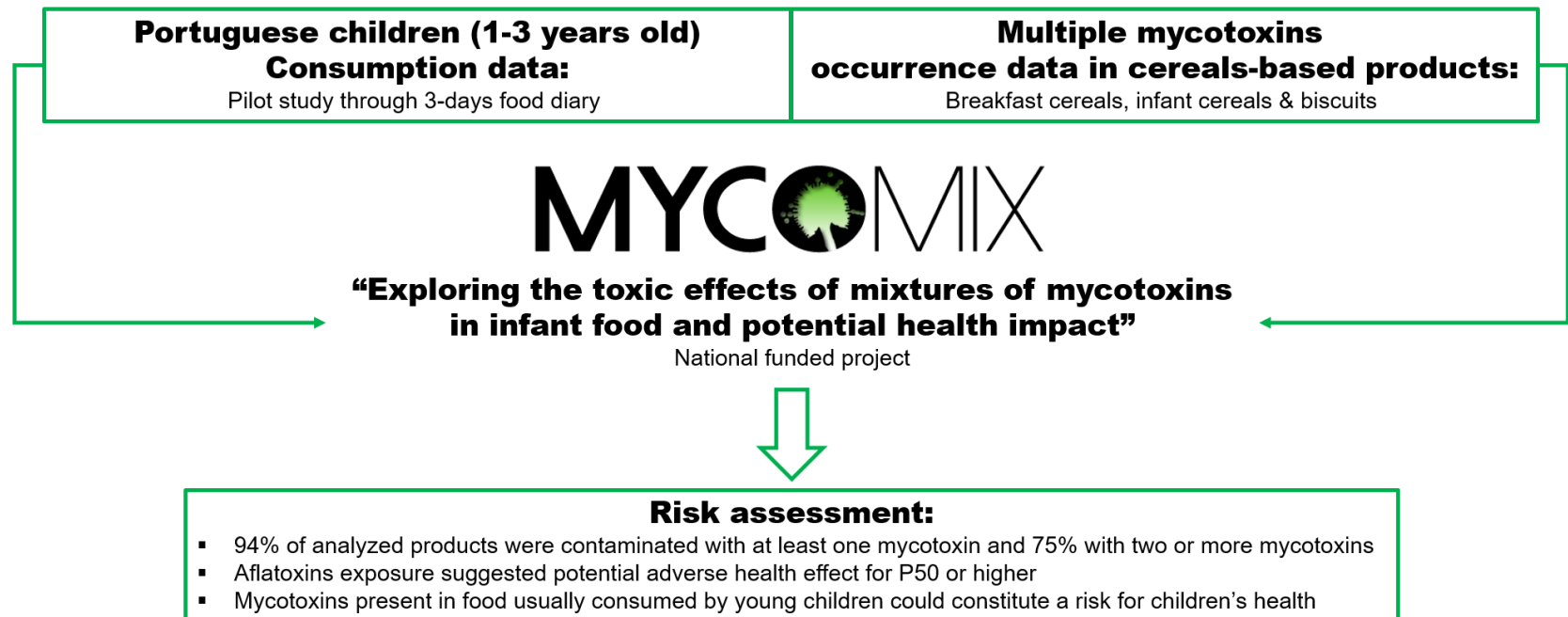
Mycotoxin contents were all below the maximum levels established in the European legislation for breakfast cereals, when available.

Conclusions pointed out an urgent need to review legislative limits in food matrices consumed by children and to perform a more accurate risk assessment of children's exposure to mycotoxins mixtures in food.

Portuguese children dietary exposure to multiple mycotoxins - an overview of risk assessment under MYCOMIX project


Food and Chemical Toxicology (*in press*)

Ricardo A. Assunção, Carla T. Martins, Elsa R. Vasco, Alessandra V. Jager, Carlos A. F. Oliveira, Sara C. Cunha, José O. Fernandes, Baltazar N. B. Nunes, Susana P. M. Loureiro and Paula C. Alvito





Climate change and the health impact of aflatoxins exposure in Portugal – an overview

Ricardo Assunção ^{a,b}, Carla Martins^{a,b,c}, Susana Viegas^{d,e}, Carla Viegas^{d,e}, Lea S Jakobsen^f, Sara Pires^f and Paula Alvito^{a,b}

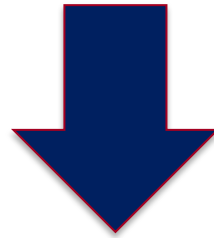
Considering the +2°C scenario of temperature increase in next 100 years in Europe, and the estimated increase of aflatoxin contamination of maize, in the southern European countries, it is expected that in the future the number of DALYs and the associated cases of hepatocellular carcinoma due to aflatoxins exposure will increase due to climate change.

The potential impact on health of the Portuguese population through the dietary exposure to aflatoxins, should represent an alert for the potential consequences of an incompletely explored perspective of climate change.

Mycotoxins and climate change – EFSA video
<https://www.youtube.com/watch?v=yi46ZQLjMYw>

The present challenge...

Food could be a vehicle of health **adverse**
but also **beneficial** effects



ASSESSMENT OF RISKS + BENEFITS

Consumption of foods presenting various types of **chemical** (e.g. acute toxic or endocrine-disrupting substances), **microbial** (e.g. pathogens), and/or **nutritional** (e.g. saturated fatty acids) **hazards**, together with **beneficial nutritional** components (e.g. unsaturated fatty acids).

Risk-benefit assessment performed in Portugal

- Only approached issues related with **fish and seafood consumption**
- Mainly dedicated to the **nutritional** and **chemical** components
- Just few included probabilistic approaches
- Studies including **common health metrics** (as DALYs) are not available

Portugal remains as a country that **needs technical** and **scientific** support to develop and implement **RBA**

RiskBenefit4EU



RiskBenefit4EU – Partnering to strengthen the risk-benefit assessment within EU using a holistic approach

AIM: to strengthen the EU capacity to **assess and integrate food risks and benefits** in the areas of **microbiological**, **nutritional** and **chemical** components through the development of a **harmonized framework** that will be available to EU member states organizations.

RiskBenefit4EU



RiskBenefit4EU will contribute for the development and the establishment of RBA as a tool to provide **scientific evidence to inform risk management decisions** in the area of food safety and nutrition

Can we ever have a quantitative tool that enable food and health authorities to estimate the balance between risks and benefits of foods?

Until now Portugal has not a multidisciplinary team that could execute food risk-benefit assessment in a holistic perspective.

DTU and INRA, as experts in the RBA area, will support and collaborate with Portuguese team in order to organize and develop, **for the first time**, an approach for cereal-based products consumed by children through the application of a case study.

RiskBenefit4EU: partners



Instituto Nacional de Saúde
Doutor Ricardo Jorge



U.PORTO



FACULDADE DE CIÊNCIAS DA NUTRIÇÃO E ALIMENTAÇÃO
UNIVERSIDADE DO PORTO



Portugal



Technical University of Denmark



Denmark France

Funding:



EFSA Partnering Grant

RiskBenefit4EU

Grant Agreement Number GP/EFSA/AFSCO/2017/01 - GA02

RiskBenefit4EU: objectives



- 1) To **capacitate** recipient partners on food RBA
- 2) To develop **RBA tools** that can estimate the overall health effects of foods, food ingredients and diets
- 3) To develop a **harmonized framework for RBA** that can be applied to data from different countries
- 4) To validate the generated framework through the application to a **case study**
- 5) To **disseminate and promote** the harmonized framework to potential **EU users**

RiskBenefit4EU: main activities



Training

(where project partners will transfer and exchange knowledge)



Workshop on Risk-Benefit Assessment of Foods
21st & 23rd May 2018, Lisbon

Research

(framework development and its application to a case study)



RBA
case study

Dissemination and promotion activities

(through web-site dissemination, publications and international conference organization)



Website

<https://riskbenefit4eu.wordpress.com/>

RiskBenefit4EU: tasks



RiskBenefit4EU | Partnering to strengthen the risk-benefit assessment within EU using a holistic approach

Task 1:
Project management and coordination

Task 2:
Capacity building
& Framework
development

Task 3:
Framework
application

Task 4:
Sustainability and
dissemination
activities

Task 5:
Quality assurance and impact evaluation

Task 1: Project management and coordination

- Management and coordination activities associated to the project organization.
- Led by INSA, Portugal
- Includes:
 - *organization of project meetings, and training activities;*
 - *elaboration of reports;*
 - *financial management*



Task 2: Capacity building and framework development

- Capacity building activities and framework development
- Led by INRA, France
- Includes:
 - *knowledge transfer through the capacity building of all partners for the methodologies needed for RBA (nutrition, toxicology and microbiology), using common health metrics;*
 - *development of the harmonized framework for RBA*

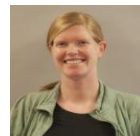


Task 3: Framework application

- Application of the generated framework (task 2) to a case study
- Led by DTU, Denmark
- Includes:
 - *Portuguese case study on cereal-based foods gathering already obtained data.*



Scientific
consultant



Technical University of Denmark



RiskBenefit4EU: case study

- To validate all the developed tools, a Portuguese **case study on cereal-based foods** will be developed

↳ **Needed data?**

MYCOMIX

Chemical contaminants
(Mycotoxins)



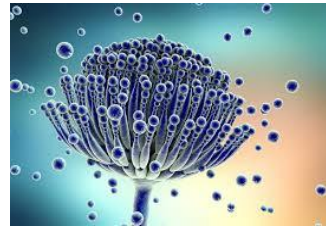
Microbiological contaminants



INQUÉRITO ALIMENTAR NACIONAL
E DE ATIVIDADE FÍSICA

Consumption data: information on
food consumption

The RiskBenefit4EU case study will concern the **health risks** associated with consumption of **cereal-based foods**, an important source of nutrients with **beneficial health effects**.



Task 4: Sustainability and dissemination activities



- Sustainability of the generated capacity building and dissemination activities
- Led by INSA, Portugal
- Includes:
 - *Micro-site under PortFir*
 - *International conference (2019) – ICFC2019*
 - *Open-access publications*
 - *Future training activities*



ICFC 2019. mp4

**SAVE
THE
DATE**

6-7 June 2019

ICFC 
International Conference on Food Contaminants


Lisbon, Portugal

<https://riskbenefit4eu.wordpress.com/>

Task 5: Quality assurance and impact evaluation

- Quality assurance and the impact evaluation of the main activities developed under RiskBenefit4EU
- Led by Uporto, Portugal
- Includes:
 - *Application of questionnaires to measure the impact of training activities*
 - *Quality control*



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UNIVERSIDADE DO PORTO





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Isabel Carvalho Oliveira-INSA

Thank you!