Mycotoxin Mitigation in Baby Foods is Key to Food Safety and Nutrition

Rubaiya Jesmin, Geoffrey I. Scott, Paramita Chakraborty, Anindya Chanda

Department of Environmental Health Sciences, Norman J Arnold School of Public Health, USC, Columbia, SC

UNIVERSITY OF SOUTH CAROLINA School of Medicine

Abstract

Mycotoxin contamination of baby foodstuffs is considered one of the most important chemical contaminants, as it causes many chronic health risks. Our studies explored the presence of mycotoxins produced by Aspergillus (Aflatoxin B1, B2, G1, G2 &M1), Fusarium (Deoxynivalenol) and Penicillium (Antibiotics) in baby food products manufactured and produced in lower and middle-income countries such as India, Nepal. These studies also reveal that mycotoxin mitigation is key to improving child nutrition and growth, and that action is urgently required. A total of seventeen commercially available food samples manufactured by different manufacturers were obtained randomly from different retail stores in India and analyzed for this study. All of the analyzed baby food samples were contaminated with aflatoxin M1 at a level exceeding the recommended European Union level of 25ng kg-1. Several (75%) of them contained detectable concentrations of deoxynivalenol and 51.7% samples with DON levels that can lead to dietary intake higher than 1 µg kg−1 recommended by the joint FAO/WHO expert committee on food additives.

Which foods are SAFE for your baby?

Major mycotoxin in baby foods

Mycotoxin	Fungal Species	Food Commodity	US FDA (µg/kg)	EU (EC 2006) (µg/kg)
Aflatoxins B1, B2, G1, G2	*Aspergillus flavus* *Aspergillus parasiticus*	Maize, wheat, rice, peanut, sorghum, pistachio, almond, ground nuts, tree nuts, figs, cottonseed, spices	20 for total	2–12 for B1 4–15 for total
Aflatoxin M1	Metabolite of aflatoxin B1	Milk, milk Products	0.5	0.05 in milk 0.025 in infant formulae and infant milk
Ochratoxin A	*Aspergillus ochraceus* *Penicillium verrucosum* *Aspergillus carbonarius*	Cereals, dried vine fruit, wine, grapes, coffee, cocoa, cheese	Not set	2–10
Fumonisins B1, B2, B3	*Fusarium verticillioides* *Fusarium proliferatum*	Maize, maize, products, sorghum, asparagus	2000–4000	200–1000
Zearalenone	*Fusarium graminearum* *Fusarium culmorum*	Cereals, cereal products, maize, wheat, barley	Not set	20–100
Deoxynivalenol	*Fusarium graminearum* *Fusarium culmorum*	Cereals, cereal products	1000	200–50
Patulin	*Penicillium expansum*	Apples, apple juice, and concentrate	50	10–50

Significance to public health

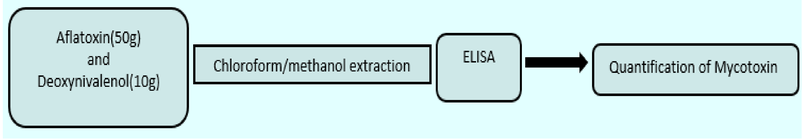
- Almost 4.5 billion people in underdeveloped countries are at risk of mycotoxin contamination(1).
- In the United States, at least one or more mycotoxins were found in infants and toddler foods (2).
- Aflatoxin M1 exposure in children have been associated with stunted growth & slower development(3).

Materials

Primary ingredient information of the food samples analyzed in this study.

Sample ID	Primary ingredient information as described on the product package (Country of origin of all these products is India)
1	Formula milk consisting of milk fat, milk Protein, carbohydrates, vitamins and minerals.
2	Sugar, Corn Maltodextrin, Milk Protein Concentrate, Safflower Oil, Canola Oil, Soy Protein Isolate
3[a]	White Rice Flour, Dried Skimmed Milk, Sucrose, Palm Olein, Rapeseed Oil, Coconut Oil, Sunflower Oil, Maltodextrin, Flavor, Minerals & Vitamins.
4[a]	Rice flour, maize maltodextrin, vitamins, minerals and traces of milk
5[a]	Wheat flour, Rice, milk solids, sucrose, soybean oil, corn, legumes, vegetables (tomatoes, carrot, spinach), malt extract, vitamins and minerals
6	Wheat Samples (Flour,bran, fibre), Maize Starch, Milk Solids, Corn flakes, flavoring agents and emulsifiers
7	Skimmed cow's milk, maltodextrin, vegetable oils, sucrose, flavouring agents, coloring agents, salts, vitamins and minerals.
8	Wheat Flour, malted barley, dried whey (milk), dried skimmed milk, sugar, salts, oild, vitamins and minerals
9	Skimmed milk, maltodextrin, lactose, vegetable oil, sugar, glucose, fat reduced cocoa powder, dextrose, flavourings, magnesium sulphate, thickener, vitamins and minerals
10	Brown rice syrup, milk protein concentrate, canola oil, cane sugar, flavoring agent, vitamins and minerals
11	Malt extract, milk solids, sugar, liquid glucose, cocoa solids, caramel, emulsifiers, minerals, vitamins, liquid vanilla flavor and salt.
12	Corn grits, malt extract, sugar beetroot extract, strawberry puree, vitamins and minerals
13	Cashew and oils
14	Powdered gram
15	Oat bran
16	Milk powder (with traces of sugar and soy)
17	Oat Bran

Methodology



Results

Aflatoxin M1

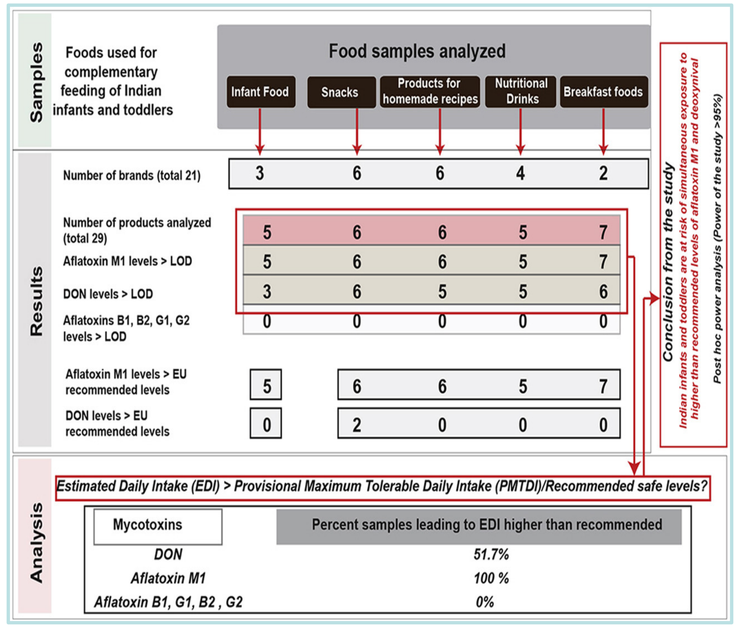
Food Type	Number of samples	Mean concentration range (µg Kg-1) from triplicate readings (± mean SE in the readings)	Percent samples exceeding EU recommended levels (0.025 µg Kg-1)
Infants foods	5	1.0–3.2 (± 0.01)	100
Snacks	6	0.8-2.6 (± 0.01)	100
Food ingredients	6	1.0-3.3 (± 0.02)	100
Nutritional drinks	5	1.7-2.5 (± 0.02)	100
Breakfast foods	7	1.1-2.4 (± 0.01)	100

DON levels

Food Type	Number of samples	Mean concentration range (µg Kg-1) from triplicate readings (± mean SE in the readings)	Percent samples exceeding EU recommended levels (0.025 µg Kg-1)
Infants foods	5	0–14 (± 0.01)	0
Snacks	6	1-228 (± 0.03)	33
Food ingredients	6	0-77 (± 0.02)	0
Nutritional drinks	5	3-76 (± 0.02)	0
Breakfast foods	7	0-49 (± 0.01)	0

Aflatoxin M1 and DON levels in analyzed samples of baby foods available in Kolkata, India for ages 0 -2 years

Research Summary



Conclusions

- 100% contamination of food sample by Aflatoxin M1
- About 51.7% contamination of food sample by DON
- Aflatoxin M1 present in non-milk sample and DON present in milk-based sample

Future Studies

- Tracking the sources of mycotoxins contamination along the food chain
- Mitigating the aflatoxin contamination by using our novel bacteria *V. gazogenes*

References

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