

Overview

The aim of this project was to evaluate the concentration of selected toxic elements (As, Cd and Pb) in cinnamon and cinnamon-flavored baby foods. The baby foods were acid digested and analyzed using Inductively Coupled Plasma-Mass Spectrometer (ICP-MS) to determine concentration levels. The importance to determine these levels is to contact FDA and/or the vendors to analyze and potentially issue a public health alert or a voluntary recall in cases of high heavy metal contamination .

Introduction

Consumption of fruit and vegetables in preschool aged children is significantly lower than nutritional recommendations (Shanks et al., 2021). One potential strategy for improving fruit and vegetable acceptance and consumption is the use of herbs and spices to improve palatability.

To promote fruit consumption among toddlers and children, parents often prefer spice-flavored fruit puree pouches. Pouches quickly hooked parents by offering a simple, grab-and-go solution for modern, busy lives.

Over the past decade, sales of flavored fruit puree pouches, which are processed complementary foods made from fruit puree and flavored by different herbs and spices such as cinnamon, are becoming more popular in the U.S. The cinnamon used mostly came from outside the U.S. (Rohilla, 2024).

On the other hand, a recent nationwide investigation led to the identification of approximately 500 cases of childhood lead (Pb) exposure believed to be linked to consumption of apple cinnamon puree pouches (Napier et al., 2024). The FDA found that cinnamon used in the apple cinnamon puree pouches contained Pb levels that were way higher than proposed safety limits.

Methods

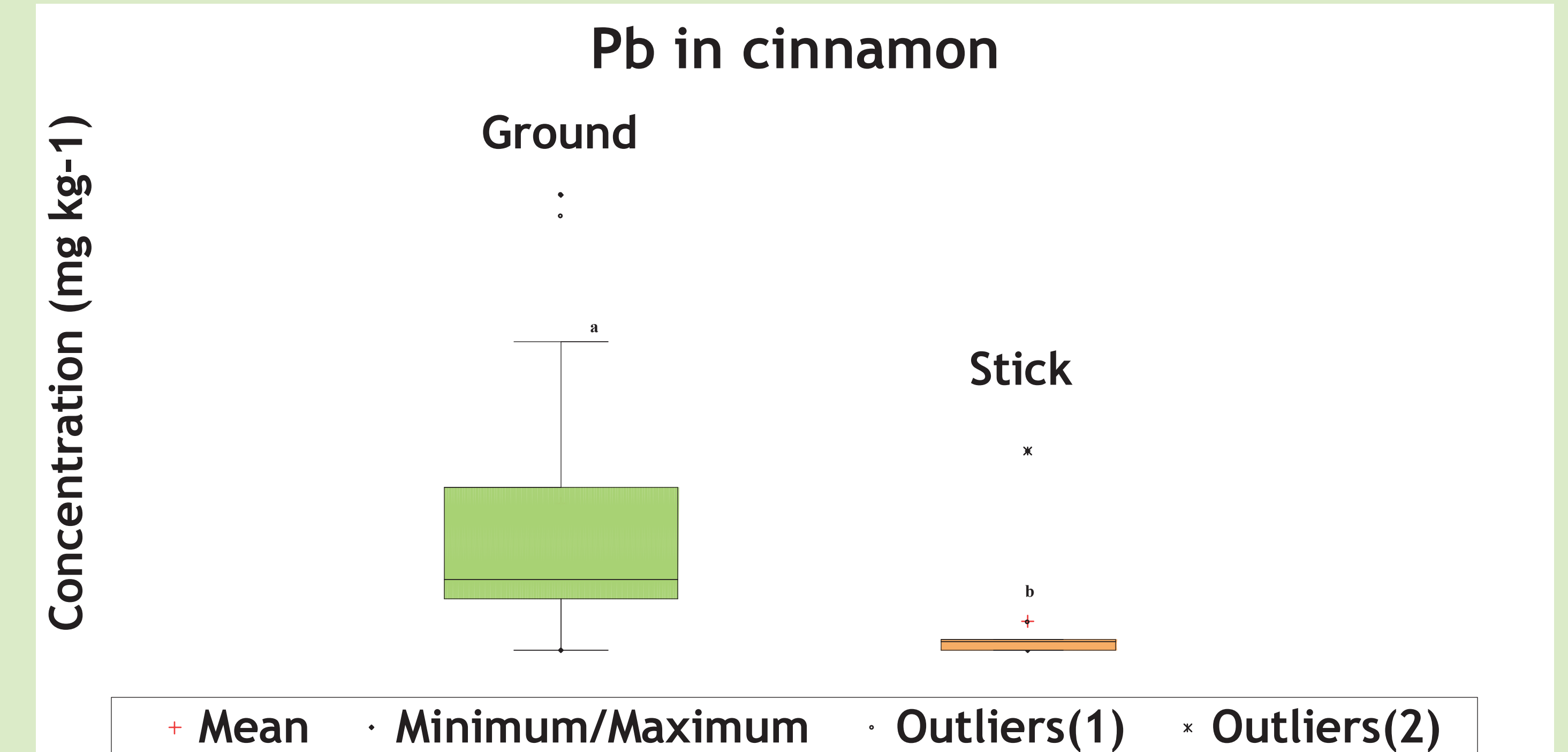
ICP-MS Analysis (EPA Method 3050B)

1. Samples weighed out in Triplicate to 0.25 grams
2. Samples digested with concentrated Nitric Acid using Hot Block digestion
3. Hydrogen Peroxide was added and the sample digested again
4. After digestion is complete, ultrapure water was added to make 50mL solution
5. Sample aliquots were filtered with syringe filter using 0.45µm pore filter
6. 10x samples created using 5mL of original solution and 45mL of 2% Nitric Acid
7. Samples were analyzed using the Inductively Coupled Plasma Mass Spectrometry (ICP-MS)



Results

- Ground cinnamon contained significantly higher levels of As, Cd and Pb than cinnamon sticks.
 - ❖ Ground cinnamon exhibited nearly 10x higher Pb concentration
- The tested cinnamon flavored fruit puree pouches and baby foods comply with the safety limits in terms of As, Cd and Pb.
 - ❖ This was in fact a small and targeted survey in terms of sample size.
- Economic driven adulteration of cinnamon with Pb-based pigments for appealing color and weight might be a reason for higher median concentration of Pb in ground cinnamon compared with cinnamon sticks (Yáñez-Jácome et al., 2024).



Baby foods	Origin	As	Cd	Pb
		µg kg ⁻¹		
Beech-nut baby food: oats, apple, yoghurt and cinnamon	USA	18.7	3	6.33
Beech-nut baby food: apple, granola and cinnamon		22.3	4.33	BD
Happy baby organics: oats, banana puree, plum puree, amaranth and cinnamon		BD	3	BD
Happy Tot organics super food: apple, sweet potato, carrots, chia seeds and cinnamon		BD	BD	BD
Happy Tot organics fiber & protein food: pears, peaches, pumpkin, apple, chia seeds and cinnamon		49	12.4	BD
Gerber grain & grow: oats, pears and cinnamon		11.3	BD	BD
Beech-nut waffles: wheat flour, pumpkin, chickpea and cinnamon		BD	BD	BD
Upper threshold limit (µg kg ⁻¹) for toxic elements in infant formulae and follow-on formulae		100*	5-20	20

Conclusions

- Cinnamon flavored baby foods were safe in terms of As, Cd and Pb.
- The significantly low median As, Cd and Pb contents in cinnamon sticks explains why parents and care givers should turn to grinding cinnamon sticks at home to enhance the flavor of home-made fruit puree pouches.
- Monitoring of baby foods for heavy metal contamination should be conducted periodically.

Acknowledgements

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Selected References

Rohilla , N., 2024. USA Fruit Puree Market Overview. <https://www.kenresearch.com/industry-reports/usa-fruit-puree-market>. Accessed on Feb 11, 2025
Shanks, C.B., Milodragovich , A., Smith, E., Izumi, B., Stephens, L. and Ahmed, S., 2021. Preference for fruits and vegetables is linked to plate waste among preschool children. *SSM -Population Health*, 15, p.100908.
Napier, M.D., 2024. Childhood Lead Exposure Linked to Apple Cinnamon Fruit Puree Pouches —North Carolina, June 2023 —January 2024. *MMWR. Morbidity and Mortality Weekly Report*, 73.
Yáñez-Jácome , G.S., Romero -Estévez, D., Rosero -Jácome , A.P., Cipriani -Avila, I., Navarrete, H. and Vélez -Terreros , P.Y., 2024. Lead content in cinnamon and its health risk assessment for Ecuadorian consumers. *Food and Chemical Toxicology*, 193, p.115010.