Sheneice R. Moore
GeneBIORETS
LSU Health Sciences Center, New Orleans, LA

Mentor's Name: Tewodros Rango Godebo, PhD
LSU Health Sciences Center New Orleans, Department of Environmental Health, Climate, and Sustainability

Lead and Arsenic in United States Spices

Spices are dried plant parts that are used as seasonings. These spices make a mixture of colors and flavors, and many have cultural significance through culinary traditions. Some spices also provide unique health benefits because they are composed of antioxidants and anti-inflammatory compounds. Currently, the US does not have regulations for heavy metal content in spices. However, the New York Department of Health (NYDOH) has recently implemented strict guidelines for spices. Although not enforceable in the US, there is also international guidance from the Food and Agriculture Organization (FAO), who base their standards on risk assessment and risk management studies. Lead (Pb) and Arsenic (As) are two heavy metals that are known to cause health concerns. Lead is a neurotoxin that mimics essential metals like calcium, often causing the body to store and accumulate it in teeth and bones, leading to other health risks. Elevated levels of As impair vital processes including cellular respiration and DNA synthesis, resulting in severe metabolic disorders, neurocognitive delay in children to decrease immune function in adults. The objective of this project is to determine the concentrations of Pb and As in spices purchased from local retail grocery stores and compare them to NYDOH and FAO standards.

The study consisted of 28 spices (cinnamon, garlic, onion, coriander, oregano, paprika, cayenne pepper, cumin, rosemary, black pepper, turmeric, mustard powder, chili powder, and nutmeg) from various brands. The spices were dried, weighed, and then microwave digested using strong acids. The samples were analyzed for metals using Inductively Coupled Plasma Mass Spectrometry (ICPMS), and statistical analysis was done using GraphPad Prism 11.0. The mean (range) for Pb and As were (in µg/kg) 368 (0.01-2,550) and 107.3 (0.3-410), respectively. Cayenne pepper had the highest amount of As at 410 µg/kg, and oregano had the highest amount of Pb at 2550 µg/kg. No samples exceeded FAO standards for As, but two samples (cayenne pepper and oregano) exceeded the standard set by NYDOH. The same oregano sample exceeded the FAO standards for Pb, and 16 samples exceeded the NYDOH standards. Nutmeg had the lowest amount of both Pb and As at 0.3 µg/kg and 0.01 µg/kg, respectively. Spices that were made from leaves had the highest concentrations of both Pb and As. To better protect our communities from the negative effects of Pb and As, a national regulatory framework should be established and implemented using consistent surveillance, routine toxicological screening, and strict enforcement of contaminant limits across both domestic and imported goods.