Contaminants in Kids' Snacks

GOALS

The goals of this project were to:

- Check for chemical contaminants that have previously been reported in foods targeting children and compare the measured levels of the contaminants with available health-based guidelines or limits.

PRODUCT SELECTION

CR selected 21 food products that are popular among school-aged children. These products represent a popular cross section of the market, including chips, crackers, bars, seaweed snacks, fruit candy snacks, applesauce, yogurt, string cheese, and processed meat.

TEST APPROACH AND METHODS

Three samples consisting of 2 to 3 unique lots for 21 products were sent to an ISO 17025-accredited laboratory for testing. All samples were purchased anonymously at retail as a consumer would. Samples were prepared and analyzed for contaminants in accordance with the following methods:

- Nitrate by Colorimetric-AOAC 935.48
- Nitrite by Colorimetric-AOAC 973.31
- Phthalates by GC-MS/MS-GB 5009.271-2016 mod.
- Acrylamide by LC-MS/MS/J. Agric. Food Chem.54.19 (2006): 7001-7008
- 3-MCPD and GE by GC-MS/MS-AOAC 2018.03
- As, Cd, Hg, Pb by ICP-QQQ-MS-AOAC 2015.01
- Inorganic Arsenic by IC-ICP-QQQ-MS-Internal Lab SOP

All 21 products were tested for heavy metals (arsenic, cadmium, lead, and mercury) and phthalates. Nine chips/crackers, four bars, and one seaweed snack were also tested for 3-MCPD, glycidyl ester (GE), and acrylamide. One processed meat snack was tested for sodium nitrate and sodium nitrite. Four products had high levels of total arsenic and were subsequently tested for inorganic arsenic.

We reviewed all the test results and quality control data provided by the contract lab for accuracy and clarity, and checked for errors.

DATA ANALYSIS

To estimate the average concentration of a heavy metal in a tested product, we applied a method used by many risk assessors,[1] including the Environmental Protection Agency.[2] If a heavy metal was detected (greater than the method detection limit, or MDL) in any of the samples tested of the product, the samples that had test results below the MDL were assumed to have a concentration of half the MDL for that heavy metal. If the heavy metal was not detected in any of the samples tested of the product, we assumed a concentration of zero for all the samples of that product for the heavy metal. This approach to risk assessment appropriately considered important uncertainties about potential levels of undetected risk in samples with test results below the MDL.

EXPOSURE AND RISK ASSESSMENTS

We estimated a child's daily intake, based on the manufacturer recommended daily servings and with a child's average weight of 23.1 kg (about 51 pounds), of the tested inorganic arsenic, cadmium, lead, DEHP, acrylamide, and GE, and where appropriate and applicable, compared the intake estimates with the exposure limits in the table below.

Noncancer exposure risks were calculated by the Hazard Quotient Method[3] and the following equation for arsenic and DEHP:

HQ = Exposure Dose/Reference Dose

An HQ >1 (for inorganic arsenic and DEHP), %MADL >100 (for cadmium and lead), or %NSRL >100 (acrylamide and GE) would indicate that consumption of one serving per day would be of health concern.

Health-Based Exposure Limits Selected for Risk Assessments

Contaminant	EPA RfD mcg/kg bw/day	OEHHA MADL mcg/day	OEHHA NSRL mcg/day	Lowest Intake Associated w/ Endpoints of Concern mcg/kg bw/day
Inorganic Arsenic	0.06[4]	NA	NA	NA
Cadmium	NA	4.1[5]	NA	NA
Lead	NA	0.5[6]	NA	NA
DEHP	20[7]	410[8]	310[8]	0.03[9]
Acrylamide	2[10]	140[11]	0.2[11]	NA
GE	NA	NA	0.54[12]	NA

OEHHA=California Office of Environmental Health Hazard Assessment. MADL=Maximum Allowable Dose Level. NSRL=No Significant Risk Level. RfD=Oral Reference Dose. NA=Not Applicable.

[1] Xue, J.; Zartarian, V.; Wang, S.; et al., "Probabilistic Modeling of Dietary Arsenic Exposure and Dose and Evaluation with 2003-2004 NHANES Data," *Environmental Health Perspectives* 118, no. 3 (2010): 345-50. [2] "Regional Guidance on Handling Chemical Concentration Data Near the Detection Limit in Risk Assessments," *Environmental Protection Agency,* www.epa.gov/risk/regional-guidance-handling-chemical-concentration-data-near-detection-limit-risk-assessments. [3] "Risk Assessment for Other Effects," *Environmental Protection Agency,* www.epa.gov/fera/risk-assessment-other-effects. [4] U.S. Environmental Protection Agency Integrated Risk Information System (IRIS) Chemical Assessment Summary, Arsenic, inorganic, cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0278_summary.pdf. [5] State of California, OEHHA, Cadmium, oehha.ca.gov/chemicals/cadmium. [6] State of California, OEHHA, Lead, oehha.ca.gov/proposition-65/chemicals/lead. [7] U.S. Environmental Protection Agency Integrated Risk Information System (IRIS) Chemical Assessment Summary, DEHP, iris.epa.gov/ChemicalLanding/&substance_nmbr%3D14. [8] State of California, OEHHA, DEHP, oehha.ca.gov/proposition-65/chemicals/di2-ethylhexylphthalate-dehp. [9] "Role of epidemiology in risk assessment: a case study of five ortho-phthalates," *National Library of Medicine,* pmc.ncbi.nlm.nih.gov/articles/PMC8591894. [10] U.S. Environmental Protection Agency Integrated Risk Information System (IRIS) Chemical Assessment Summary, Acrylamide, iris.epa.gov/ChemicalLanding/&substance_nmbr%3D286. [11] State of California, OEHHA, Acrylamide, oehha.ca.gov/proposition-65/chemicals/acrylamide. [12] State of California, OEHHA, Glycidol, oehha.ca.gov/proposition-65/chemicals/glycidol.