Consumer Reports Methodology for Testing for Heavy Metals in Fruit Juices
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The objectives of this study were: 1) to determine the levels of total arsenic, inorganic arsenic, cadmium, lead, and mercury in various ready-to-drink shelf-stable fruit juices, and 2) to assess any associated health risk. We tested 135 samples (three unique samples each of 45 products) of apple, grape, pear, and blends of juices. The products tested were selected based on marketing data and data from a shopper survey of stores in New York and New Jersey. We purchased the samples between December 2017 and March 2018 in the New York and New Jersey areas, from other regions in the U.S., and online. We made efforts to include nationally available products and tried to get unique samples or lots of each product from different geographical regions of the U.S.

To be clear, Consumer Reports conducts its testing to provide consumers with advice to inform their decision-making. We do not perform compliance or regulatory testing, and our results are not meant to be viewed as such.

Sample Preparation
The samples were transferred into brown polyethylene jars, blind coded to preserve their identities, and shipped overnight to an independent, accredited laboratory. At the lab, sample preparation or homogenization was performed in fume hoods known to be free from trace metals contamination. Water, sample containers, and other materials used for the analyses were monitored for contamination to account for any biases in sample results.

Testing
All samples were prepared and analyzed in accordance with the most up-to-date industry standards and test methodologies. The testing conformed to the quality control criteria and performance requirements set in the cited official methods, as well as to those in ISO 17025.

Risk Assessment
We estimated daily consumption of the juices using the typical label serving recommendations and reported consumption of juices, and determined the associated daily doses of the metals from those estimates, our test results, and the average body weights of adults and children 1 to under 6 years old.

To estimate the potential cancer risk from exposures to inorganic arsenic, we used the following equation: *Excess Cancer Risk = Lifetime Average Daily Dose x Cancer Slope Factor.*

We applied cancer slope or potency factor (CSF) of inorganic arsenic that was derived by the Environmental Protection Agency (EPA IRIS 2010) for combined incidence of bladder and lung cancer, and set our Tolerable Risk Level at no more than one excess case of cancer in 1,000 people.

To assess the potential risks of non-cancer health effects from estimated exposures/doses of inorganic arsenic, cadmium, lead, and methyl mercury, we compared our exposure estimates to the health-based limits listed in Table 1 below.

Table 1. Selected Health-Based Exposure Limits

Heavy Metal	Source	Value (Unit)
Inorganic Arsenic	EPA (1991)	0.1-0.3 ug/kg bw/day
Cadmium	EFSA (2009)	0.36 ug/kg bw/day
Lead	OEHHA (2017)	0.5-2.0 ug/day
Methyl Mercury	EPA (2001)	0.1 ug/kg bw/day

Daily Arsenic Intake Limit to Reduce Risk in Juice

Based on a CSF of 25.7 per mg/kg bw/day; a risk tolerance level of 1 in 1,000, or 0.001; and a derived daily intake limit of **0.038 ug inorganic arsenic/kg bw/day,** CR believes that a 3 ppb limit of inorganic arsenic in juices would better protect frequent juice drinkers from the cancer and non-cancer effects of inorganic arsenic, especially children who may consume apple or grape juice regularly and are exposed to a larger dose than adults due to their body weights.

Juice Consumption Advice

Based in part on CR's proposed limit of 3 ppb of inorganic arsenic in juice and to reduce the combined exposure to inorganic arsenic, cadmium, and lead from juice—including the risks for cancer and non-cancer health effects from those exposures—CR recommends that consumption of fruit juice is limited as follows:

<1 year old	No fruit juice
1 - 3 years old	Not more than 4 oz. daily
4 - 6 years old	Not more than 6 oz. daily
7 - 18 years old	Not more than 8 oz. daily
Adults	Consume in moderation