

Memorandum

Date: November 3, 2022

Subject: Cadmium (Cd) in Bugak Seaweed Chips

Re: CMS Case # 645358, Task # 677691, Private laboratory sample # 3800693

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As requested by OFS, DRDA evaluated the safety of exposure to Cd in Bugak Seaweed Chips (seaweed chips). A sample of the seaweed chips was analyzed by a private laboratory, Certified Laboratories, and found to contain 0.406 mg/kg ($\mu\text{g/g}$) Cd. DRDA was notified by an email from OFS that the Office of Regulatory Science (ORS) supports the findings, but a written memorandum from ORS has not been reviewed by DRDA at the time of this assessment.

DRDA Conclusion

DRDA concludes that exposures to Cd from consumption of the seaweed chips are likely to be a health concern for children (MF 0-6 y) but not for the general population (MF 2+ y).

Consumption and Exposure Estimates

DRDA generally uses data from What We Eat in America (WWEIA), the food consumption portion of the National Health and Nutrition Examination Survey (NHANES), to estimate intakes of foods for exposure assessments. However, NHANES/WWEIA does not track consumption of bugak seaweed chips. DRDA therefore estimated consumption of this product using all vegetable-based snack chips as a proxy.

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DRDA used data from What We Eat in America (WWEIA), the food consumption portion of the National Health and Nutrition Examination Survey (NHANES), to estimate intakes of seaweed chips. To characterize upper-level chronic dietary exposures to Cd from seaweed chips, 90th percentile daily consumption of all vegetable-based snack chips was estimated based on average daily amounts consumed by NHANES/WWEIA 2017-2018 respondents who reported consuming vegetable-based snack chips at least once during the two days of the survey (i.e., 2-day averages for eaters only).

For Cd exposures, the populations of concern are young children (0-6 y) and the general population (2+ y). Estimated upper-level chronic exposures to Cd from consumption of seaweed chips are shown in Table 1.

Table 1. Estimated upper-level chronic exposures to Cd from consumption of seaweed chips by children (MF 0-6 y) and the general population (MF 2+ y)

Contaminant	Population	Concentration in Sample (µg/g)	Estimated Upper-Level (90 th %ile) Chronic Seaweed Chips Consumption ^a (g/kg bw/day)	Estimated Upper-Level (90 th %ile) Cd Exposure from Seaweed Chips ^b (µg/kg bw/day)
Cd	MF 0-6 y	0.406	1.53	0.62
	MF 2+ y		0.67	0.27

^a Estimated based on two-day average consumption (eaters only) of vegetable-based snack chips, NHANES/WWEIA 2017-2018.

^b Concentration in sample (µg/g) * upper-level consumption (g/kg bw/day) = estimated total exposure (µg/kg bw/day).

Safety Assessment

Cadmium (Cd)

Cd is an accumulative toxic element with a long biological half-life between 10 to 33 years in humans. Therefore, the toxicity of Cd generally results from chronic exposure. For the general population who are non-smokers, diet is the major source of Cd exposure. Chronic exposure to Cd in food may lead to its accumulation in the kidney (generally regarded as the most sensitive target for Cd toxicity), and this can cause renal tubular dysfunction and damage over time (WHO, 2011). EFSA has established a tolerable weekly intake (TWI) of 2.5 µg/kg bw/weekly for Cd, corresponding to **0.36 µg/kg bw/day** (EFSA, 2009). The TWI is based on a meta-analysis of human epidemiological studies assessing the relationship between urinary Cd and beta-2-microglobulin levels and a toxicological model to convert urinary Cd to dietary Cd exposure.

As shown in Table 1, regular consumption of the seaweed chips would result in Cd exposure for children (MF 0-6 y) above 0.36 µg/kg bw/day, which is the EFSA TWI adjusted for daily exposure.

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Therefore, Cd exposure from consumption of the seaweed chips is likely to be a health concern for children. Regular consumption of the seaweed chips would result in Cd exposure for the general population (MF 2+ y) that is below 0.36 µg/kg bw/day, which is the EFSA TWI adjusted for daily exposure. Therefore, Cd exposure from consumption of the seaweed chips is not likely to be a health concern for the general population.

References

European Food Safety Authority (EFSA) (2009). Cadmium in Food. Scientific Opinion of the Panel on Contaminants in the Food Chain. *EFSA Journal* 980, 1-139.

World Health Organization (WHO) (2011). Cadmium. Safety evaluation of certain food additives and contaminants. WHO Food Additives Series, No. 64/FAO JECFA Monographs 8. World Health Organization, Geneva. Available at

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