MINISTRY OF FOOD AND DRUG SAFETY
National Institute
of Food and Drug Safety Evalution

Risk Assessment of Tin

Tin (Sn) is a metal contained in the crust of the earth and forms various compounds by combining with other chemicals. Sn also easily combines with iron to prevent corrosion. Thus, Sn coating has been used in canned foods from old times.

This risk assessment for Sn was conducted in the following four stages in accordance with the Regulations on Risk Assessment Methods and Procedures as well as the Risk Assessment Guide: Hazard identification, hazard characterization, exposure assessment, and risk characterization. A PTWI of 14 mg/kg bw/week of Sn was applied as the HBGV.

Target foods were selected from the 2008–2010 (three years) Integrated Database, and this study covered 89% of the total food intakes of Koreans. Food commodities were purchased across Korea between 2012 and 2015. A total of 233 canned foods were collected.

The analysis of Sn in food was performed using Inductively Coupled Plasma-Mass Spectrometry (ICP-MS), and the absence of Sn in the analyte indicated that the Sn levels in the analytes were lower than the detection limit of the assay. In risk assessment, half of the detection limit was applied to the undetected results (GEMS/Food- Euro, 1995).

The Sn detection rate in processed foods (canned foods) was 81.1%. The Sn concentration was <1.0 mg/kg, and the average Sn in all processed canned foods was 0.086 ± 0.213 mg/kg.

Table 1. Sn concentration

Categories		Concentration Levels (mg/kg)								
		Cases	No detection cases	Detection rate (%)	Average	Deviation	Min	P50	P95	Max
Processed foods (Canned foods)	Edible oils	3	0	100	0.016	0.005	0.011	0.016	0.021	0.021
	Teas	40	19	52.5	0.001	0.001	<0.000	0.001	0.002	0.004
	Drinks	32	11	65.6	0.001	0.001	<0.000	0.001	0.003	0.007
	Liquors	23	14	39.1	0.001	0.001	<0.000	<0.000	0.002	0.006
	Other foods	30	0	100	0.469	0.315	0.014	0.605	0.977	0.980
	Nonstandard general processed foods	105	0	100	0.056	0.153	<0.000	0.011	0.260	1.274

* If there is a value below the third decimal point, it is indicated as <0.000.

Risk assessment showed that dietary exposure to Sn remained at safe levels within the health-based guidance values (HBGVs). Average daily exposures in Korean population to Sn was 0.010 μg/kg bw/day.

Sn exposure through canned foods was 0.010 μg/kg bw/day, and the risk level against the safety standard for human exposure of Sn (PTWI, 14 mg/kg bw/week) was 0.0005%.

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Table 2. Sn exposure through food intake

Categories		Exposure Levels (μg/kg bw/day)						
		All ages	≤2 years	3–6 years	7–12 years	13–19 years	20–64 years	≥65 years
Processed foods (Canned foods)	Edible oils	<0.000	0.001	0.001	<0.000	<0.000	<0.000	<0.000
	Teas	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000
	Drinks	<0.000	0.001	<0.000	<0.000	<0.000	<0.000	<0.000
	Liquors	0.001	0	0	<0.000	<0.000	0.001	<0.000
	Other foods	0.005	0.002	0.011	0.004	0.008	0.005	0.003
	Nonstandard general processed foods	0.003	0.005	0.004	0.007	0.005	0.003	0.001

It is known that the main sources of Sn exposure include coated canned products. Thus, the health effects of Sn exposure should be regularly evaluated through the ongoing verification of exposure levels, management, and survey by establishing Sn standards for canned products.

This report is based on published research reports. Therefore, the data in this report will be reassessed when new information has been identified or when sufficient monitoring data are available.

Key words: Tin, Analysis, Canned product, Food, Source of exposure, Exposure Level, Risk Assessment, Toxicity, Provisional Tolerable Weekly Intake