

This is a provisional English translation of an excerpt from the original full report.

## **Risk Assessment Report Barium (beverages)**

Food Safety Commission of Japan (FSCJ)  
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### **Executive summary**

The Food Safety Commission of Japan (FSCJ) conducted a risk assessment on barium, a chemical substance, relating to the revision of the standards and criteria for beverages.

The data used for the assessment include those from: acute toxicity tests (in rats), subacute toxicity tests in mice and rats, chronic toxicity and carcinogenicity tests in mice and rats, reproductive and developmental toxicity tests in mice and rats, genotoxicity tests, epidemiological and clinical studies, among others.

Barium is known to be nephrotoxic in test animals, and is reported to affect blood pressure in rats at the concentration lower than that affects the kidney by approximately double orders. The effect of barium on the human kidney has not been reported so far, while that on the cardiovascular system is currently under epidemiological and clinical investigations. Regarding carcinogenicity of barium, any suggestive evidence has not been found either in humans or test animals. In addition, barium has been considered non-genotoxic.

Hence, the FSCJ concluded that it is appropriate to establish a tolerable daily intake (TDI) of barium in terms of non-carcinogenicity.

By an epidemiological study, conducted in residents drinking water with high barium levels in an area of Illinois, the no observed adverse effect level (NOAEL) of barium was calculated to be 0.21 mg/kg body weight per day, based on the residents' average systolic and diastolic blood pressure and medical histories of diseases including high blood pressure, heart disease, heart attacks, and kidney disease. Additionally, a clinical study targeted at 11 healthy males was conducted to examine the effect of barium on blood pressure demonstrated that drinking water equivalent to 0.21 mg of barium/kg b.w. per day did not result in any alteration on electrocardiogram or arrhythmia.

The FSCJ established the NOAEL of barium to be 0.21 mg/kg body weight per day based on these findings, and the TDI of barium to be 20 µg/kg body weight per day by dividing the NOAEL by an uncertainty factor (individual difference of 10).

### **III. Risk Assessment**

Barium is nephrotoxic in test animals, and is reported to affect blood pressure in rats at the concentration lower than that affects the kidney by approximately double orders. The effect of barium on the human kidney has not been reported so far, while that on the cardiovascular system is currently under epidemiological and clinical investigations. Regarding carcinogenicity of barium, any suggestive evidence has not been found either in humans or test animals.

IARC has not evaluated the carcinogenicity of barium, and EPA has evaluated the carcinogenicity in humans to be low. In addition, the results of genotoxicity tests suggested that barium is non-genotoxic.

Hence, the FSCJ concluded that it is appropriate to establish a tolerable daily intake (TDI) of barium in terms of non-carcinogenicity.

Concerning adverse effects of barium on human health, an epidemiological study has been conducted in 1,203 adults in McHenry city and in 1,175 adults in West Dundee village in Illinois. The two areas are nearly identical in demographic and socioeconomic characteristics, but different in the average barium levels in drinking water, i.e. 0.1 mg/L (0.0029 mg/kg body weight per day) and 7.3 mg/L (0.21 mg/kg body weight per day), respectively. Studies on average systolic and diastolic blood pressure, medical histories of diseases including high blood pressure, heart disease, heart attacks, and kidney disease in the residents found no significant difference between the residents in two areas. Another clinical study has been conducted to examine the effect of barium on blood pressure with the subject of 11 healthy males. In this clinical study, the examinees were asked to drink every day 1.5 L of distilled water for 2 weeks, water with 5 ppm barium (0.11 mg/kg body weight per day) for 4 weeks, and water with 10 ppm barium (0.21 mg/kg body weight per day) for 4 weeks, successively. However, any variation of blood pressure was not evoked at any time point, and any alteration on electrocardiogram or arrhythmia was not observed. Based on these findings, though the data were limited, the FSCJ established the NOAEL of barium to be 0.21 mg/kg body weight per day, and the TDI of barium to be 20 µg/kg body weight per day by applying an uncertainty factor (individual difference of 10) to the NOAEL.

TDI: 20 µg/kg body weight per day (of barium)

(Basis for TDI establishment):	Epidemiological study and water drinking test in healthy males
(Species):	Human
(Method of administration):	Administration by drinking water
(Observational basis for NOAEL establishment):	Effects on cardiovascular system
(NOAEL):	0.21 mg/kg body weight per day
(Uncertainty factor):	10 (individual difference of 10)

#### <Reference>

When a person weighing 50 kg drinks 2 L per day of tap-water containing 21 µg/L of barium, which is the maximum amount of barium detected in the actual condition survey regarding non-regulated substances in tap-water in the fiscal year 2009, the intake amount is considered to be 0.84 µg/kg body weight per day. This amount is equivalent to 1/24 of the TDI of 20 µg/kg body weight per day.