THYROID
Volume 18, Number 6, 2008

DOI: 10.1089/thy.2007.0379

The Average of Dietary Iodine Intake due to the Ingestion of Seaweeds is 1.2 mg/day in Japan

Dear Editor:

Since 1958 more than 100 papers on urinary iodine excretion have been published in Japan. Recent studies on the urinary iodine concentration in school children have shown median values of 288 μg/L in Hokkaido (1) and 282 μg/L in Tokyo (2), but the maximum value was more than 3 mg/L and 16% of the median values were >1 mg/L (2). In most of the earlier studies, daily urinary iodine excretion averaged from 1 to 20 mg. It has been confirmed that urinary iodine excretion varies according to the quantity and frequency of seaweed consumption. Even in the same person, urinary iodine excretion could increase from 100 to 30,000 μg/d within a day and decrease from 30,000 to 100 μg/d within a few days (3). It is still not possible to report the average urinary iodine excretion in Japan, and in the World Health Organization (WHO) maps on urinary iodine excretion, values for Japan are still blank (4). A reliable answer is needed to the question "What is the average of iodine intake in Japan" or simply "What is the iodine intake in Japan". In this study, an attempt was made to calculate the average of dietary iodine intake from the consumption of seaweeds.

Iodine content of seaweeds differ greatly according to species; *Laminaria* (Konbu) contains 0.3% of iodine by dry weight, *Undaria* (Wakame) 0.02–0.03%, and *Porphyra* (Nori) <0.01%. Konbu was selected to calculate the average dietary iodine intake. The Family Income and Expenditure Survey by the Statistics Bureau, Ministry of Internal Affairs and Communications (5) included 8749 target households in 2006 and the survey included items pertaining to specific consumption, such as Konbu. The other method was to calculate iodine intake from the total consumption of Konbu in Japan using data obtained from the Japan Konbu Association (6).

The average annual consumption of Konbu per household (two or more persons per household, average of 3.16 persons per household) in Japan is 450 g by dry weight, that is, 1.17 mg of iodine per day per person. Consumption of Konbu per household has decreased gradually by 30% in the last 20 years; from 641 g in 1986 to 450 g in 2006. Consumption differs greatly according to the age of heads of households; <29 years old, 145 g; 30–39 years old, 208 g; 40–49 years old, 315 g; 50–59 years old, 504 g; 60–69 years old, 561 g; >70 years old, 616 g in 2006. Households with elderly heads (>70 years) eat four times more Konbu than those with young heads (younger than 29 years). It is also shown that consumption of Konbu in single-person households averages 567 g/y and differs according to age of the person, e.g., <34 years old, 54 g (male 18 g and female 112 g); 35–59 years old, 331 g (male 212 g and female 546 g); and >60 years old 991 g (male 772 g and female 1082 g). Eighteen grams of Konbu per year is 150 μg/d of iodine. Regional differences expressed as annual consumption of Konbu per household of two or more persons in cities with Prefectural Government is 517 ± 200 g/y (mean and SD) and the range is from 241 g (0.6 mg/d of iodine) in Miyazaki city to 1104 g (2.9 mg/d of iodine) in Toyama city. According to the Japan Konbu Association, 95% of Konbu is produced in Hokkaido and 5% in the northern part of Honshu Island, and was distributed mainly on the Japan Sea side until the end of the 14th century. The Konbu road reached to Tokyo in the 17th–18th centuries (Fig. 1).

Total consumption of Konbu in Japan is 20,000 tons per year by dry weight (6). Since the population of Japan is 130 million, the iodine intake by the ingestion of Konbu is 1.26 mg/d per person.

The results of methods numerically derived from independent two sources are remarkably similar and it may be concluded that the average of daily iodine intake through Konbu is about 1.2 mg in Japan. Of course, iodine intake from Konbu is not the total iodine intake, but the answer to the question "What is the iodine intake in Japan" may be that excessive iodine intake in Japan is due to the ingestion of seaweeds especially Konbu and iodine intake by the seaweeds averaged 1.2 mg/d in 2006. It should also be mentioned that the average intake of Konbu differs greatly according to age, family structure, and region.

Adverse effects of Konbu ingestion was reported as costal goiter in one area of Hokkaido where the average daily intake of iodine from Konbu was 20 mg/d (7). Ingestion of 10 mg of iodine for 1 week in normal Japanese increased the response of thyrotropin in the thyrotropin releasing hormone test (8). When 30 mg of iodine was given daily to normal Japanese for 4 weeks, serum free thyroxine concentrations decreased and thyrotropin levels increased significantly, although within normal ranges, and the size of thyroids measured by echogram increased significantly. These abnormalities disappeared within 2 weeks after stopping iodide administration (9). Normal human thyroids can adapt to excess intake of iodide by autoregulation and pituitary–thyroid axis (10,11).

It should be noted that the average of iodine excretion in Japan is not officially reported, and the Japan Thyroid Association is planning to measure urinary iodine excretion systematically throughout Japan.

This study was presented in part at the 2007 American Thyroid Association meeting in New York (12).

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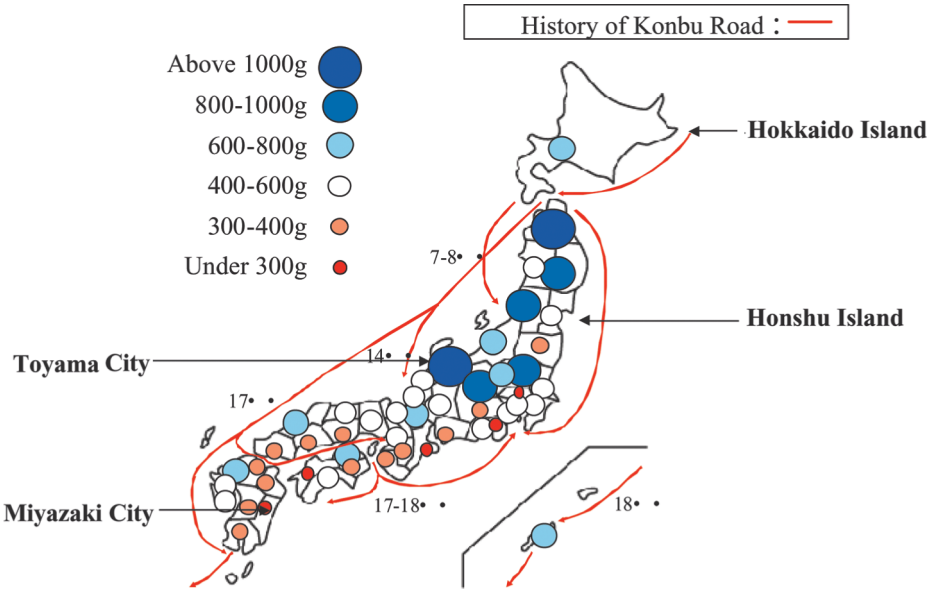

FIG. 1. Annual consumption of Konbu in cities with prefectural government obtained from the Statistics Bureau, Ministry of Internal Affairs and Communications. The average consumption per family in Japan is 450 g by dry weight; a city with maximum consumption is Toyama City (1104 g) and a city with minimum consumption is Miyazaki City (241 g). Regional differences may be due to the history of Konbu Road which started from Hokkaido in the 7th–8th centuries mainly on the Japan Sea side. Konbu Road reached to Tokyo in the 17th–18th centuries.

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