

Does iodised salt sold in New Zealand contain enough iodine?

Nan Xin Wang, Sheila A Skeaff, Claire Cameron, Rachael M McLean

Iodine is an essential component of thyroid hormones, which are required for regulation of metabolism, temperature control, normal growth and brain development in humans.^{1,2} The World Health Organization (WHO) recommends the use of iodised salt as a key strategy to prevent iodine deficiency in populations living in areas at risk of low iodine intakes.³ The soil in New Zealand is low in iodine, and salt iodisation has been the primary strategy to prevent iodine deficiency since the 1920s.⁴ After the re-emergence of mild iodine deficiency in New Zealand in the 1990s,⁴ a series of reviews by Food Standards Australia New Zealand (FSANZ) resulted in a legislative change in the *Food Standards Code*, and the fortification of bread with iodised salt became mandatory in 2009.^{5,6} Since the fortification of bread, the iodine status of children and adult men have improved.

However, in the 2014/2015 *New Zealand Health Survey*, median urinary iodine concentration (UIC) showed women aged 25 years and older were still classified as mildly iodine deficient.⁷ For example, in women between 25 to 34 years old and 35 to 44 years old, their median UIC was 96ug/L (a population with a median UIC of 100ug/L is considered iodine sufficient) and their prevalence of UIC less than 100ug/L is 51.5% and 50.7% respectively. It is important for women of reproductive age, in particular, to consume an adequate amount of iodine, as during pregnancy the foetus is dependent on the mother to provide thyroid hormones for the development of their central nervous system.⁸ Currently, New Zealand's legislation allows voluntary iodisation of salt at 25–65mg iodine/kg salt.⁶ Compliance with the standard was previously assessed in 2009 by the Institute of Environmental

Table 1: Description of selected retail.

Product	Type	Form	Packaging	Iodised	Sales volume ^a (%)	Price/100g (NZD)
1	Table salt	Fine	High-density polyethylene	Yes	20.1	0.55
2	Table salt	Fine	High-density polyethylene	Yes	34.3	0.42
3	Table salt	Fine	Cardboard	Yes	3.7	0.27
4	Sea salt	Coarse	Home compostable film	Yes	4.2	0.49
5	Low-sodium salt	Fine	Aluminium can	Yes	0.1	1.77
6	Himalayan pink salt	Coarse	Home compostable film	No	14.3	0.72
7	Sea salt	Coarse	Home compostable film	No	4.2	0.49
8	Sea salt	Coarse	Soft plastic	No	3.3	0.42
9	Table salt	Fine	Soft plastic	No	7.1	0.22
10	Table salt	Fine	Soft plastic	No	6.0	0.12

^aThe sales volume is based on all salt sales in New Zealand.

Science and Research,⁹ which found that the median iodine content of iodised salt was 47mg/kg. Similarly, the New Zealand Food Composition Database lists iodised salt at 49mg iodine/kg of salt;¹⁰ however, the data on which this estimate is based are more than 20 years old (in an email from Subathira Sivakumara, Plant & Food Research, 26 May 2022). This study aimed to assess the current concentration of iodine in retail salt in New Zealand.

Methods

The Nielsen Homescan consumer panel (in an email from NielsenIQ, 26 May 2022) provided salt sales data by brand in New Zealand between April 2021–2022 (NielsenIQ, personal communication, 26 May 2022). Salts that exceeded 3% of total salt sales volume were included in the analysis (Table 1). An additional reduced-sodium iodised salt that did not meet the sales volume criterion was also analysed because the introduction of reduced-sodium salt substitutes is a relatively new strategy in New Zealand to reduce sodium intake. In total, 10 salt samples were selected for analysis of iodine content.

The Food and Agriculture Organization of the United Nations (FAO) recommends having at least 10 food samples collected from multiple regions in a country to obtain representative nutrient values for a food.¹¹ Salt was purchased from supermarket outlets in five cities (Auckland, Rotorua, Wellington, Christchurch and Dunedin) in New Zealand. Two packets of each salt sample were bought from each city. However, Product 3 (iodised table salt) could not be obtained in Dunedin. In total, 98 packets of the salt samples were purchased and analysed for iodine content.

All the salt samples were bought in June 2022 and analysed in July 2022. Each salt was made into a salt solution individually. The entire content of each package of salt was emptied into a volumetric flask and weighed on a Sartorius CPA12001S scale (Sartorius AG, Göttingen, Germany) to measure all the iodine in the salt package. Then, the salt was dissolved in distilled deionised water. Once the salt had dissolved and water added up to volume of the flask (i.e., 2 or 5 litres), the full flask was weighed again. A 50mL sample of each salt solution was analysed for iodine content using inductively coupled plasma mass spectrometry

Table 2: Iodine content of retail salt in New Zealand.

Product	n	Iodised	Iodine in salt (mg/kg)		
			Median	25 th , 75 th percentile	Range ^a
1	10	Yes	37	31, 42	23–43
2	10	Yes	36	27, 44	26–54
3	8	Yes	29	24, 31	23–33
4	10	Yes	37	33, 38	29–43
5	10	Yes	35	29, 38	27–40
Total (iodised)	48		35	29, 38	23–54
6	10	No	<3	<2, <3	<2–<3
7	10	No	<2	<2, <2	<2
8	10	No	<2	<2, <2	<2
9	10	No	<1	<1, 1	<1–3.5
10	10	No	<1	<1, <1	<1
Total (non-iodised)	50		<2	<1, <2	<1–3.5

^aThe concentration of iodine in non-iodised salt is too low and the ICP-MS is only able to determine up to a value of less than 1–3.

(ICP-MS) in the Department of Chemistry, University of Otago. Five pooled samples were used to conduct precision checks of instrument. The mean iodine concentration of the pooled samples was 35.1ng/ml and a standard deviation of ± 0.19 .

The iodine content of the salts (mg/kg) are reported as a median, 25th, 75th percentile and range.

Results

The median iodine content of iodised salt was 35mg iodine/kg salt (Table 2), with a range between 23–54mg iodine/kg salt. In contrast, the five non-iodised salts that were analysed had a median of less than 2mg iodine/kg salt, with a range of less than 1–3.5mg iodine/kg salt.

Discussion

This study provides up-to-date information on the iodine concentration of retail salt in New Zealand. Our study shows that the current median salt iodisation level is 35mg/kg, which is substantially lower than the iodine content assessed in 2009 (47mg/kg)⁹ and that listed in the New Zealand Food Composition Database (49mg/kg). Additionally, there were two products (Products 1 and 3) with samples that fell below the minimum regulated iodine level of 25mg/kg salt.⁶ The iodine content in salt is not regularly monitored in New Zealand. The WHO recommends that the monitoring of iodised salt occur regularly on-site, at least once in every batch of iodised salt and periodic external monitoring by factory inspections and government audits.¹²

Product 3 had the lowest iodine content and was packed in cardboard. The low iodine content could be due to the more permeable material of the cardboard, which might make the iodine compounds added to salt become less stable, compared to other packaging such as the high-density polyethylene.¹³ The International Council for Control of Iodine Deficiency Disorders recommends an airtight packaging made out of high-density polyethylene or low-density polyethylene to prevent losses of iodine in salt.¹⁴

Our analysis shows that non-iodised salt contains very little iodine (less than 1–3.5mg iodine/kg salt). The consumption of non-iodised salt will not add to iodine intake and will not help women in New Zealand to achieve iodine sufficient status. Of particular concern is the increased popularity of specialty salts such as the pink Himalayan salt, which made up 14% of the total salt sales volume in the last year and are usually not iodised.

Iodine fortification of salt is an effective tool to prevent iodine deficiency. However, a previous study simulating the iodine concentration of salt in New Zealand to meet recommended iodine intake for women of reproductive age found that the median salt iodisation level (35mg/kg) observed in our study will result in 29% of women consuming less than the estimated average requirement of 100 μ g of iodine a day.¹⁵ Inadequate iodine intake prior to pregnancy can lead to irreversible detrimental effects on cognitive development for the foetus in the early stages of pregnancy.¹⁶

Given the finding of iodine concentration at the lower level allowed in New Zealand, the mild iodine deficiency in all women above the age of 25 and the effects of iodine deficiency on the population, it is imperative that New Zealand explores other ways to increase iodine intake in the population. Expanding the number of foods where it is mandatory to add iodised salt would be an option. Currently, FSANZ only requires iodised salt to be added to bread. An electronic survey sent out to food processors (n=800) in 16 countries, including Australia, assessed the challenges that they faced in using iodised salt in processed foods.¹⁷ The Australian food manufacturers reported not using iodised salt in processed foods due to several challenges. These included the higher costs of iodised salt, the effect of iodised salt on product quality, consumers not being concerned about the addition of iodised salt and iodine nutrition not being a priority for the company. These were similar challenges expressed by bread manufacturers in Australia and New Zealand when iodised salt was proposed to be added to bread.¹⁸ Nevertheless, the legislation to add iodised salt to bread was successfully implemented in both countries. Indeed, the Iodine Global Network encourages governments to mandate the use of iodised salt in industrially processed foods.¹⁹ In addition, a systematic review examining the sensory effects of adding iodised salt to processed foods found that there is little change to the physical or chemical properties of a range of products, including cheese, processed meats, french fries, cereals, baked goods and pickled vegetables.²⁰ This shows that there is scope in New Zealand to extend the use of iodised salt to all, or other, processed foods in a mandatory approach.

The strengths of our study were the salt sample collection across the North and South Island of New Zealand and the use of the gold standard analytical method (ICP-MS). Our study was limited to a 1-month window when purchasing the salts and there could be differences in iodine content due to storage time and conditions.¹³

COMPETING INTERESTS

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AUTHOR INFORMATION

Nan Xin Wang: Department of Human Nutrition, University of Otago, Dunedin.

Sheila A Skeaff: Department of Human Nutrition, University of Otago, Dunedin.

Claire Cameron: Biostatistics Centre, Division of Health Sciences, University of Otago, Dunedin.

Rachael M McLean: Department of Preventive and Social Medicine, Dunedin School of Medicine, University of Otago, Dunedin.

CORRESPONDING AUTHOR

Rachael M McLean: Department of Preventive and Social Medicine, Dunedin School of Medicine, University of Otago, PO Box 56, Dunedin.

E: rachael.mclean@otago.ac.nz

URL

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