Mild iodine deficiency among elderly in residential care

In response to the re-emergence of iodine deficiency in New Zealand, in 2009 the government mandated that all commercially made breads be fortified with iodized salt. This study evaluates the impact of the program on iodine intake and status of elderly New Zealanders in residential care homes.

Although the detrimental health effects of iodine deficiency are most pronounced in the fetus and during infancy, adverse effects are observed at all life stages. Thyroid dysfunction in adults is associated with many important adverse health outcomes, including hypertension, dyslipidemia, cognitive impairment, osteoporosis, muscle wasting, and frailty. Older adults are more susceptible to iodine deficiency or excess due to age-related changes in thyroid function. For example, thyroid autonomous nodules are increased in older adults who reside in areas of mild to moderate iodine deficiency, and are associated with subclinical hyperthyroidism when iodine intake is low, or after increases in intake following implementation of iodine fortification programs (1). The elderly are a rapidly growing segment of the population, and it is a high public health priority to ensure they have sufficient iodine intake to maintain optimal thyroid function and reduce the burden on health care resources.

Older adults in long-term residential care are at particularly high risk of nutrient deficiencies because they have small appetites and are often unable to consume enough food to meet their nutrient requirements. Furthermore, they often have both acute and chronic diseases, and use medications or oral nutritional supplements that may increase the risk of suboptimal or excessive nutrient status due to varying nutrient intake, absorption, metabolism and/or excretion.

**Study setting and design**

The New Zealand Nutrition and Ageing Project was a cross-sectional survey conducted in 2014, which recruited 309 long-term residents aged 60 years and older from 16 residential-care homes (rest homes) throughout New Zealand (Auckland, Hamilton, Hawkes Bay, Wellington, Christchurch, Dunedin and Invercargill) to investigate their nutritional status and health. As part of a full nutritional assessment, dietary iodine intake (pre- and post-fortification) and iodine status were measured. Malnutrition risk was determined using the Malnutrition Universal Screening Tool (MUST) (2) with information collected from medical records. This tool uses current BMI, weight loss over the previous 3–6 months and acute illness with no nutritional intake over the previous five days to calculate a risk score. Frailty scores were determined using the Survey of Health, Ageing and Retirement in Europe Frailty Instrument (SHARE-FI) (3).

**About study participants**

The median age was 85 years (range: 65–107 y), with 68% women. Almost all participants (98%) were of New Zealand European ethnicity. The average duration of residence was 31 months (range: 2 months to 13 years). 60 participants were diagnosed with a thyroid disorder (9 with hyperthyroidism, 46 with hypothyroidism, and 5 had undergone a partial thyroidectomy). Fifty participants (16%) were prescribed levothyroxine and four prescribed anti-thyroid medications. 112 participants were prescribed loop diuretics (mostly furosemide), and two were prescribed amiodarone (antiarrhythmic agent), providing 75 mg of iodine per day. Oral nutritional supplements were prescribed for 22 (7%) participants, contributing an average 14 µg of iodine per day, and 29 (9%) were taking supplements containing iodine. Participants at high risk of malnutrition were more likely to be prescribed oral nutritional supplements (24% for high risk, 4% for moderate risk, and 1% for low risk). The majority of participants (83%) were identified as being either pre-frail or frail.

**Low urinary iodine and high Tg levels point to improved but still insufficient iodine intakes**

The median urinary iodine concentration (MUIC) was 72 µg/L, indicating mild iodine deficiency among the elderly adults. Urinary iodine levels were lower in summer/autumn, in the oldest age group, and in participants with stage 3 and 4 chronic kidney disease. Participants treated with levothyroxine had significantly higher MUIC, and a higher proportion with UIC >300 µg/L, compared with participants not...
on this medication. After excluding participants with elevated TgAb (n = 35, 13%), the median thyroglobulin concentration was 18 ng/mL and 26% had an elevated thyroglobulin concentration (>40 ng/mL). Both of these values were above the assay-specific recommendations to indicate population iodine sufficiency (median serum thyroglobulin <13 ng/mL, and/or no more than 4% with thyroglobulin concentration >40 ng/mL), further indicating that the iodine status was insufficient. The prevalence of elevated thyroglobulin concentrations was highest in women and pre-frail participants. In participants treated with levothyroxine, the median serum thyroglobulin concentration of 7 ng/mL was within recent guidelines, but the proportion with elevated thyroglobulin (16%) was higher than recommended.

In the adjusted analyses, the MUIC was higher during summer/autumn than during winter/spring, participants on loop diuretics had lower MUIC, and median thyroglobulin concentration increased with age and with BMI.

**Iodine intake has improved after mandatory iodization of bread**

The mean intake of bread per day was 66 g/day, or approximately 2 slices of bread (~30 g per slice). Bread intake was significantly higher in men than in women, and it was inversely associated with age, malnutrition risk and frailty, and positively associated with BMI. Mandatory fortification of commercially baked bread with iodized salt increased the mean intake of iodine from bread by 31 μg/day, and comparison of studies conducted pre- and post-fortification in other sectors of the population suggest iodine status has improved. The MUIC in the present study (72 μg/L) was slightly higher than the pre-fortification MUIC of 61 μg/L reported for community-dwelling older participants in the nationally representative 2008/2009 Adult Nutrition Survey (4).

While the finding of iodine insufficiency in this elderly population is strengthened by the use of two objective biochemical indices of iodine status, the results should be interpreted with caution because each index individually has limitations that hinder interpretation in older adults. Further exacerbating the difficulties in assessing iodine status in institutionalized adults is the high prevalence of diseases or use of medications that may alter nutrient metabolism and nutrient requirements, and influence the validity of nutrient biomarkers. Renal insufficiency decreases urinary iodine excretion through reduced renal filtration of iodine from plasma and increased tubular resorption of the filtered iodine, leading to high levels of iodine in plasma. Therefore, in patients with renal insufficiency low urinary iodine concentration does not necessarily indicate poor iodine status. In the present study, while the authors observed lower MUIC in participants with chronic kidney disease, serum thyroglobulin concentrations were not statistically associated with renal function which is a risk factor for hypothyroidism—was associated with lower risk of frailty in older women (5).

When developing the mandatory bread fortification policy in New Zealand, strategies such as mandating universal salt iodization, or replacing all salt with iodized salt in processed foods, or in breakfast cereals, biscuits and crackers in addition to bread, were considered. These options were rejected after public consultation, because of perceived logistical difficulties, and a risk of excessively high intakes for children in the case of universal salt iodization. However, extending mandatory use of iodized salt in other food items would be a good strategy to improve iodine intakes of older adults because it would increase iodine intake without the need for an increase in food intake. Supplementation, however, is problematic because taste fatigue limits adherence, and polypharmacy increases the risk of nutrient-drug interactions. With an increased risk of hyperthyroidism with even a modest increase in iodine intake in the elderly with a history of iodine deficiency, any intervention should include close monitoring of adverse health effects. Worldwide, assessment of nutritional status in this age group is limited. The importance of such is particularly relevant in the context of global population ageing, with numbers of older adults escalating in regions with a history of iodine deficiency, including New Zealand, the UK, and some regions in Europe, Africa and Asia.

**Important implications**

This study provides important information on predictors of low iodine status in institutionalized elderly. That frail participants were at higher risk of elevated thyroglobulin concentration is of particular interest. Frailty is an important geriatric syndrome that substantially increases morbidity, health care costs, and reduces quality of life. The criteria for frailty (weakness, exhaustion, slowness, poor exercise tolerance and/or unintentional weight loss) overlap with the symptoms of thyroid dysfunction (fatigue, reduced muscle strength, and weight change). Recent cross-sectional studies have found positive associations between high-normal thyroxine hormone concentration and frailty, or reduced physical function, in older men. Alternatively, TgAb positivity—

**References**