Invited commentary

Are vegetarians an 'at risk group' for iodine deficiency?

Iodine deficiency disorders (IDD) are recognized as a major global health problem, in particular in developing countries but also in Europe (Delange & Bürgi, 1989; Delange, 1996). The daily intake of iodine varies widely depending on geographical location and dietary habits. In coastal areas, seafood and iodine-containing mist from the ocean can be important sources of iodine while plant and animal products produced further inland will contain variable iodine contents depending on the geochemical environment. Animal feeds are often supplemented with iodine in industralized countries and, thus, products such as meat, eggs and dairy products are important contributors to the dietary iodine intake in the omnivorous diet.

A plant-based diet, in particular when based on foods grown on soil with low iodine content, can be expected to provide very limited amounts of iodine. Thus, concern has been raised over iodine intake and status of vegetarians living in areas with low soil iodine. A recent study made in Germany, a classical iodine-deficient European country, highlights this important issue (Remer *et al*. 1999).

The study by Remer *et al*. (1999) reports on iodine content and urinary iodine excretion monitored in a group of healthy adults consuming experimental diets (a lacto-vegetarian diet compared with non-vegetarian diets) in a repeated measure design. The results from this study clearly demonstrate that dietary intake of iodine and urinary iodine excretion were significantly lower with the lactovegetarian diet compared with mixed diets. Iodine intake, based on analysis of the diets, was very low from the lactovegetarian diet (about 16 μg/d). However, the analytical data also demonstrate that iodine intake from the non-vegetarian diets was low (35–45 μg/d). For comparison, the current dietary recommendation for adults is 200 μg iodine/d in Germany (Deutsche Gesellschaft für Ernährung, 1991). Consequently, urinary excretion of iodine was low during the entire study: mean values were 37 μg/d and 50–61 μg/d during consumption of the lactovegetarian and mixed diets respectively. The low iodine content of the experimental non-vegetarian diets can partly be explained by the fact that fish and seafood were excluded. Furthermore, the contribution of iodine from beverages in all diets was very limited since iodine-free water was consumed during the study and milk produced in Germany during summer months contains very little iodine.

An important contributor to the total iodine intake in many countries is iodized table salt. In some countries, iodized salt is also used during manufacture of processed foods, e.g. bread in the Netherlands, a major source of dietary iodine in the Dutch diet (Brussard *et al*. 1997). However, no iodized salt or processed foods with added iodine were included in the experimental diets used by Remer *et al*. (1999). Thus, the dietary intake of iodine during this study was representative of the iodine content of 'natural' foodstuffs in the diets. Strict vegetarian diets (vegan diets) which do not include iodine-rich products such as seaweed, iodized salt or dietary iodine supplements have been reported to provide very low quantities of iodine (reviewed by Lightowler & Davies, 1998; Remer *et al*. 1999). However, the study by Remer *et al*. (1999) demonstrates that lactovegetarian diets, based largely on fruits and vegetables grown on low-iodine soil and containing dairy products with low iodine content, will also provide very little iodine.

Furthermore, the results from this study indicate that non-vegetarian diets provide only limited amounts of iodine when naturally rich sources of iodine such as fish and seafood as well as iodized salt are excluded from the diet. Iodized salt was first introduced in Europe in 1922 and is available nationwide in most countries today (Delange, 1996). However, the nutritional impact of iodized table salt has received renewed attention recently. New data based on urinary excretion which indicate a decline in iodine intake have been reported from school-children in Switzerland (Zimmermann *et al*. 1998) and blood donors in New Zealand (Thomson *et al*. 1997). Results from these studies suggest that iodine status may no longer be adequate in the population groups studied. Possible reasons for the decreased iodine intake include changed dietary habits and reduced table salt intake as a positive response to health guidelines.

Thus, low dietary intake of iodine is of concern in vegetarians and, clearly, different possibilities for increasing the iodine intake in vegetarian diets need to be considered. However, low intake of iodine can also be a potential problem in larger segments of the population. The recent studies in Switzerland and New Zealand demonstrate the importance of monitoring iodine intake in industrialized countries and indicate a need for re-evaluation of fortification levels of iodized table salt.

Although the consequences of manifest IDD are well known (goitre, impaired reproductive outcome, as well as mental and physical retardation), the subclinical effects of low iodine intake and the physiological significance of low iodine excretion need to be studied further.

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