Inadequate iodine intake in large groups of the Norwegian population

Henjum S, Abel MH, Meltzer HM, Dahl L, Alexander J, Torheim LE, Brantsæter AL

A recently published review suggests that, in Norway, inadequate iodine intakes are widespread among women of childbearing age, pregnant and breastfeeding women, infants who are exclusively breastfed, the elderly, vegans and some immigrant groups. There are few sources of iodine in the diet, and individuals who avoid milk and white fish, or have increased iodine needs, are particularly at risk.

Prior to 1950, endemic goiter was widespread in inland regions of Norway. From 1950 onwards, iodine fortification of cow fodder became mandatory to improve livestock fertility, a measure that resulted in a dramatic increase in iodine concentrations in milk and dairy products. Since then, Norway has been considered iodine-replete. However, recent studies have documented suboptimal iodine status in pregnant and lactating women, elderly, vegans, and non-pregnant women of childbearing age (1) (*Figure 1 and 3*). On the other hand, iodine intake was sufficient among infants and toddlers who received either iodine-enriched infant formula or cow's milk (2), and among children, adolescents, adult men and vegetarians who included milk in their diet (1). Figure 1 shows an overview of iodine concentrations in urine or breastmilk of women of childbearing age, pregnant or lactating women, and Figure 2 shows the calculated iodine intake from food in adult women and men in the national dietary survey (*Figure 1 and 2*).

There are few dietary iodine sources in Norway; milk contributes up to 60% of the iodine intake and seafood up to 15%. Other foods such as eggs and whey cheese contribute small amounts, while table salt contributes negligible amounts. During the last decade, consumption of milk and dairy products has declined while plant-based milk alternatives are becoming increasingly popular (3). Individuals who limit or avoid cow's milk will not get sufficient iodine unless they use iodine-containing supplements. Universal salt iodization is the first-line strategy for the elimination of severe iodine deficiency; however, in Norway, no public strategy to ensure adequate iodine status currently exists. The food industry is not allowed to use iodine-fortified salt. Voluntary addition of 5 µg iodine/g household salt was introduced in 1937, but this is too low to have any significance and is considerably lower than WHO's recommended minimum enrichment level of 15 µg iodine/g salt.

It is well documented that severe iodine deficiency in pregnancy results in lasting damage to children's development. The consequences of milder forms of deficiency are, however, more uncertain. Results from the Norwegian Mother and Child Study (MoBa) have shown that low iodine intake in pregnancy is associated with delayed language development and reduced fine motor skills at age 3 yrs, increased behavioral problems at 3 and 8 yrs, and poorer school performance at 8 yrs (4–6). Low maternal iodine intake was also associated with symptoms of attention-deficit hyperactivity disorder in offspring in MoBa (6). None of the MoBa studies showed any protective effects of iodine supplement use initiated during pregnancy. On the contrary, a negative effect on child neurodevelopment at age 3 was found in a group of pregnant women with a low intake of iodine (i.e. <160 µg/d) who were using iodine-containing supplements. This suggests that an abrupt increase in the supply of iodine during pregnancy might be problematic, and indicates that iodine intake prior to pregnancy and adequate iodine stores is more important than the iodine supply during pregnancy. In MoBa, a habitual iodine intake from food in quantities corresponding to the recommended daily intake before pregnancy (150 µg/d) was protective against adverse child neurodevelopmental outcomes. The Little in Norway study found that an insufficient iodine intake in pregnancy, reflected in a UIC below 100 µg/L, was associated with lower infant language skills up to 18 months. The use of iodine-containing supplements was not associated with beneficial effects. However, there are only few studies, and it cannot be ruled out that these results are due to other systematic differences between the groups than their intake of iodine.

FIGURE 1 **Median iodine concentration in urine and breast milk in Norwegian women of childbearing age (1). Dotted line represents the lowest population median recommended by WHO.**

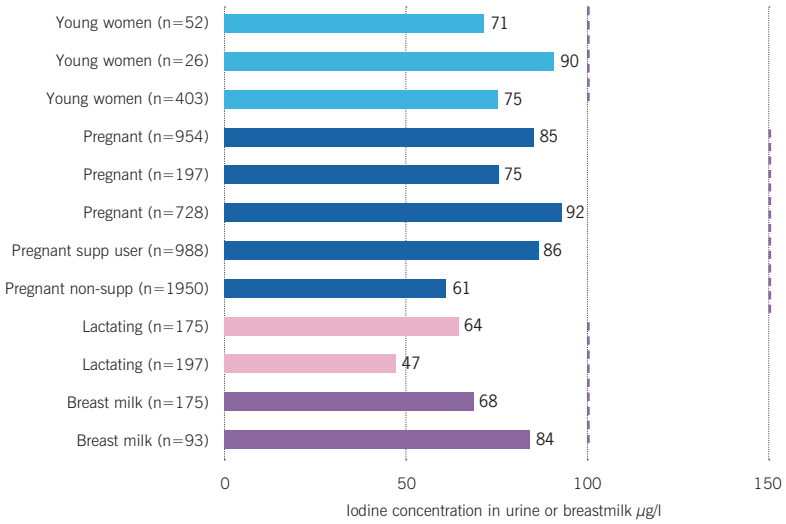


FIGURE 2 **Median dietary iodine intake in Norwegian adults in different age groups in the National Dietary Survey «Norkost 3» conducted in 2010-2011 (3).**

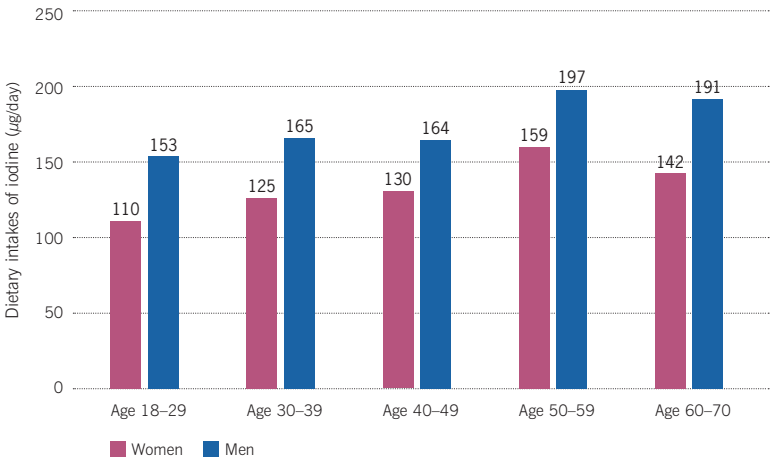
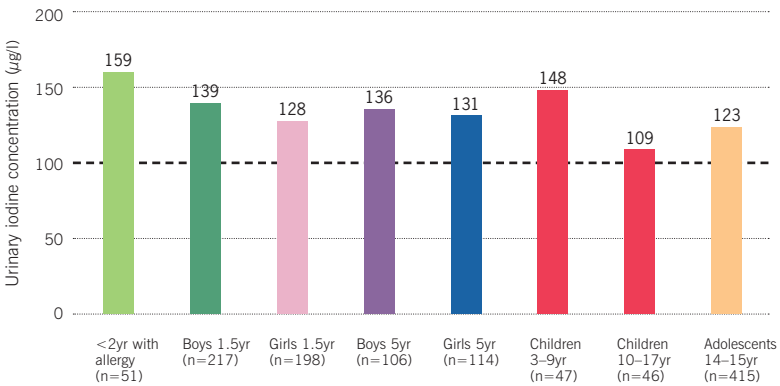


FIGURE 3 **Median urinary iodine concentration in children from five different Norwegian studies (1). Dotted line represents the lowest population median recommended by WHO for children (≥6 y.o.).**



The Norwegian health authorities have recently implemented actions to increase the population iodine intake. They advise to include three daily portions of milk and dairy products, of which at least two portions should be milk or yogurt. Furthermore, iodine supplements of 100 µg/day are recommended for women of childbearing age who have a lower daily intake than 3–5 dL milk/yoghurt (depending on fish intake), and iodine supplementation of 150 µg/day for pregnant and breastfeeding women who have a lower daily intake than 6–8 dL milk/yogurt. In practice, this means that many will need iodine-containing supplements. A benefit-risk assessment of increasing iodine levels in table salt and adding iodine to plant-based alternatives to cow's milk, and using iodized salt in bread products is ongoing.

In conclusion, many groups, in particular women, exclusively breastfed infants and the elderly in Norway have insufficient iodine intakes. Today, only Norway and a few other countries in the world have milk and fish as the main iodine sources in their diet. Because of increasingly diverse food consumption patterns and a reduction in milk and fish intakes, these sources are no longer sufficient to ensure an adequate iodine intake among vulnerable groups of Norwegians, and this is of particular concern in women of childbearing age.

References

1. Henjum S et al. Er inntaket av jod i befolkningen tilstrekkelig? Tidsskr Nor Laegeforen. 2019 Jan 28;139(2) https://tidsskriftet.no/2019/01/oversiktsartikkel/er-inntaket-av-jod-i-befolkningen-tilstrekkelig In Norwegian.
2. Aakre I et al. Sufficient iodine status among Norwegian toddlers 18 months of age - cross-sectional data from the Little in Norway study. Food Nutr Res. 2018 Oct 25;62. https://doi.org/10.29219/fnr.v62.1443
3. Carlsen MH et al. New iodine food composition database and updated calculations of iodine intake among Norwegians. Nutrients 2018; 10: 930 https://doi.org/10.3390/nu10070930
4. Abel MH et al. Suboptimal maternal iodine intake is associated with impaired child neurodevelopment at 3 years of age in the Norwegian Mother and Child Cohort Study. J Nutr 2017; 147: 1314–24. https://doi.org/10.3945/jn.117.250456
5. Abel MH et al. Language delay and poorer school performance in children of mothers with inadequate iodine intake in pregnancy: results from follow-up at 8 years in the Norwegian Mother and Child Cohort Study. Eur J Nutr 2018; 57 https://doi.org/10.1007/s00394-018-1850-7
6. Abel MH et al. Maternal iodine intake and offspring attention deficit/hyperactivity disorder: Results from a large prospective cohort study. Nutrients 2017; 9: 1239 https://doi.org/10.3390/nu9111239