Sea water desalination: A possible cause of iodine deficiency in Israel

It has been only 50 years since Basil Hetzel first demonstrated in Papua New Guinea that endemic goiter and cretinism were attributable to an iodine-deficient diet. Today, studies indicate iodine sufficiency in 123 countries. While the worldwide iodine situation seems to be reaching sufficiency for school-aged children, it is not for pregnant women. The worldwide data for pregnant women is deficient, and the current data indicate widespread maternal iodine insufficiency.

Israel has not had an IDD prevention program, neither a universal salt iodization (USI) nor a urinary iodine monitoring program. Historically, Israel has not been known to have a significant iodine problem. Ovadia et al. (1) noted that the second (2010) Israeli National Health Interview Survey (INHIS-2) showed a medication use prevalence of 4.7%, an apparent 60% increase from a previous survey. They conducted a study in Ashkelon, where a large sea water desalination plant was built, demonstrating a high (76%) prevalence of elevated thyroglobulin (Tg>10 µIU/mL). They demonstrated that this iodine deficiency was due to a low iodine dietary intake and raised the concern of low iodine water intake. They pointed out that during this period three of the world’s largest seawater reverse osmosis (SWRO) plants were built in Israel and supplied drinking water to an increasing proportion of the Israeli population. The SWRO process removes all iodine from the drinking water, and they suggested that deiodized water might be a significant contributor to iodine deficiency in Israel.

The same authors conducted in 2016 the first Israeli National Iodine Survey among both school-aged children and pregnant women (2). The more than 1,000 spot urine specimens from each group represented a national sample of the population. The median (IQR) UIC was 83 (52–127) µg/L for school-aged children, compared to a WHO adequacy of 100 µg/L, and 61 (36–97) for pregnant women, compared to a WHO adequacy of 150–249 µg/L.

Israel clearly has a serious iodine deficiency problem—an iodine supply problem. Ovadia et al. (1) demonstrated a low dietary iodine intake (median 85 µg/day), compared to the recommended daily allowance (RDA) of 150 µg/day. According to the Israeli Water Authority, 80% of the drinking water in Israel presently comes from iodine-depleted (non-detectable or ≤ 1 µg/L) desalinated sea water (3). Israel is presently the country with the largest proportion of desalinated water in the world. Israel lacks a USI program (only 3% of locally produced salt is iodized), and only 6% of pregnant women in Israel took iodine-containing prenatal supplements (2).

A three-pronged attack to this problem is called for—(a) USI, (b) program to markedly increase the use of iodine containing prenatal supplements, and (c) a national surveillance system for both levels of iodine in the salt and levels of iodine in the population, including specifically pregnant women.

That the desalination process for sea water removes many bio-essential micronutrients, including iodine, requires additional research in countries where desalinated sea water is a major source of drinking water. It is very likely that many more countries will adopt such new technologies in order to produce desalinated water to overcome the increasing shortage of fresh water for drinking and agriculture. In Israel, it appears that the mixing of desalinated sea water (0–1 µg/L) with groundwater (levels as high as 174 µg/L) has generally kept the drinking water iodine levels above 20 µg/L. That may not be true of other areas with less mixing or with mixing waters that contain lower levels of iodine. Water desalination is now a new potential contributory source for deficiencies in iodine and other micronutrients that should be followed up closely in order to determine its impact.

References