Assessment of Iodine Intake in the Israel Coastal Area

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Abstract

Background: Iodine intake is necessary to maintain normal thyroid function and prevent iodine deficiency disorders. In 1990, a resolution calling for universal salt iodination to eliminate iodine deficiency worldwide was taken by the World Health Organization and endorsed by some 130 countries. As of today, very little is known about iodine intake and the prevalence of iodine deficiency disorders in Israel, and the authorities do not require iodine enrichment of regular salt.

Objective: To assess the current level of iodine intake in an unselected group of residents from the Israeli costal area.

Methods: Spot urine samples were collected from three groups: Group A comprising 51 pregnant women attending the Womens Health Clinic at our institution, with a mean age of 32 years and at gestational week 28; group B consisting of 35 healthy subjects, mean age 38; and group C consisting of 16 euthyroid subjects harboring nodular goiters. Tap water and mineral water were also analyzed for iodine content. Iodine concentration was measured using the catalytic reduction of ceric ammonium sulfate method.

Results: When considering all groups together the median urinary iodine concentration was 143 μg/L, with 27% of the study population having concentrations under 100 μg/L and 7.8% under 50 μg/L. Values were distributed similarly between sites of residency, and no significant differences were seen between groups. The mean iodine concentration for tap drinking water was 22.8 μg/L (range 0.5–53.5 μg/L) and for mineral water 7 μg/L (range 0–15 μg/L).

Conclusions: Overall, iodine intake appeared to be satisfactory in our study population, however mild deficiency may exist in up to 26% of this group. A nationwide survey is needed to better determine the status of iodine intake in Israel, allowing for recommendations on salt-iodine enrichment in the future.

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For Editorial see page 97

Iodine deficiency has long been recognized as a leading cause of goiter and impaired thyroid function, with developmental abnormalities being its more severe manifestation. For normal thyroid function to be sustained, an appropriate iodine intake is required [1]. The urinary iodine excretion obtained from a morning spot urine sample is the recommended and most commonly used method to determine the degree of iodine intake within any specific population [2]. Although normalizing urinary iodine by gram of urinary creatinine was suggested to compensate for dilution variance among different spot urine samples, such an approach has been abandoned because the diurnal and seasonal cycles of iodine and creatinine urinary excretion are significantly different [3,4]. Given the individual variability over time of urinary iodine concentration obtained from spot urine samples, a 24 hour collection may be more accurate but is impractical for use in epidemiologic studies.

The Recommended Dietary Allowances of iodine, endorsed by the International Council for Control of Iodine Deficiency Disorders and the World Health Organization, for the ideal intake should be 90 μg/day for children, 150 μg/day for normal adults and 200 μg/day for pregnant and lactating women [2]. Despite early efforts taken independently by some countries to control iodine deficiency through salt iodination [5], it was estimated that in the late 1980s close to a third of the world population was still at risk for iodine deficiency disorders. In 1985 the International Council for the Control of Iodine Deficiency Disorders was founded as a non-governmental organization [6]. Five years later a resolution calling for universal salt iodination to eliminate iodine deficiency worldwide was taken by the WHO and endorsed by some 130 countries. By 1999 almost 80% of these countries had imposed regulatory legislation on salt iodination. Some countries from the Middle East were among those that implemented legislation, e.g., Jordan in 1993, Lebanon in 1964 and Syria. As of today, very little is known on iodine intake or the prevalence of iodine deficiency disorders in the Israeli population. Furthermore, the authorities do not require iodine enrichment of regular salt. In two studies conducted in the late 1950s and early 1960s, isolated pockets of endemic goiter in northern Israel were reported [7,8]. A more recent study by Sack et al. [9] reported urinary iodine concentration in pregnant women in the Western Galilee to be borderline sufficient in Arab villages and normal in Jewish villages. The present study aimed to investigate urinary iodine excretion from residents of the Israeli costal area along with iodine concentration in tap water in the same area as well as mineral water from different manufactories.

Subjects and Methods

Iodine concentration was measured in morning spot urine samples collected from residents of the Israeli central coastal area. The unselected study population comprised 102 adults (99 females) with a mean age of 36.6 ± 10.2, divided into three groups: Group A, consisting of 51 pregnant women attending the Womens Health Clinic at our institution, mean age 32 ± 5 and gestational week 27.9 ± 8.4; group B, with 35 healthy volunteers (2 males), mean age 38.2 ± 11.7; and group C with 16 Israeli-born euthyroid subjects (1 male) harboring multinodular goiters, mean age 48.8 ± 8.3.

Subjects were excluded if taking iodine-containing drugs or supplements like multivitamin complexes or amiodarone, and with a known history of thyroid dysfunction. Iodine concentration was also measured from tap water obtained from residential sites in the same regional area, at 15 different points, and from mineral water obtained from 5 different manufactories (one imported from Italy, the others locally produced). More than seven major cities were represented (Tel Aviv, Petah Tiqva, Netanya, Rishon Lezion, Ramat Hasharon, Herzliya, Kfar Saba). Urinary iodine concentration was measured using the catalytic reduction of ceric ammonium sulfate method [10]. According to the WHO definition, normal urinary iodine is defined as between 100 and 300 μg/L, and different degrees of iodine deficiency are considered as follows: 50–100 μg/L = mild, 25–50 μg/L = moderate, < 25 μg/L = severe [2].

Results are expressed as the median, with the mean ± standard deviation when specified. Comparison among groups was done using Student's *t*-test and correlation between variables using regression analysis with Pearson's coefficient. *P* values <0.05 were considered significant.

Results

Considering all groups together, the median urinary iodine concentration was 143 μg/L, with a mean value of 130.1 ± 49.5 μg/L. A median urinary iodine concentration less than 100 μg/L was found in 27.4% of the overall study population, with 7.8% subjects having levels under 50 μg/L. The levels of urinary iodine by groups are shown in Table 1 and the different degrees of iodine intake according to WHO stratification in Figure 1. No significant differences were seen between groups. Subjects with multinodular goiters had normal urinary iodine levels that were not statistically significantly different from those of non-goiterous subjects (129 vs. 140 μg/L, *P* = 0.546). No correlations were found between age or gestational week and the urinary iodine levels. Values were distributed similarly between sites of residency.

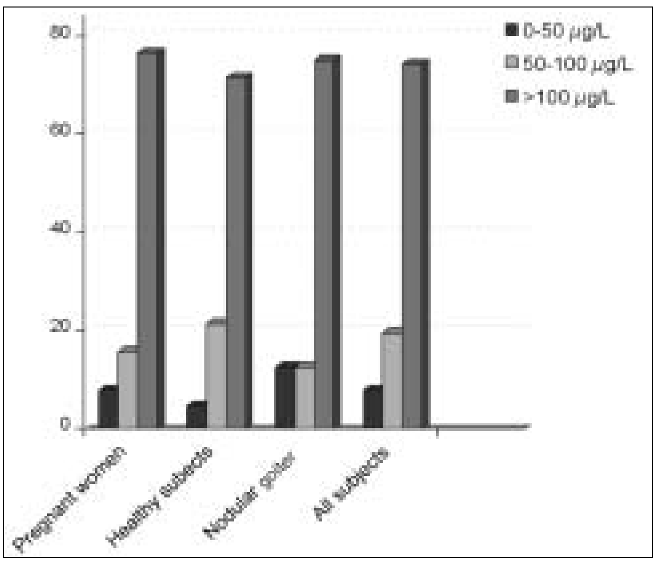

Figure 1. Distribution of subjects by group according to different levels of urinary iodine concentration: 0–50 μg/L (severe-moderate deficiency), 50–100 μg/L (mild deficiency), and >100 μg/L (sufficient).

Table 1. Urinary iodine concentration expressed as the median in a group of people who reside in the Israel coastal area

	No.	Urinary iodine
Pregnant women	51	143 μg/L
Healthy subjects	35	137 μg/L
Nodular goiter	16	129 μg/L
All subjects	102	137 μg/L

The mean iodine concentration obtained from tap drinking water from all 15 sites was 22.8 ± 18.5 μg/L (range 0.5–53.5 μg/L). Levels below 10 μg/L were found at 5 of 15 sites. The higher concentrations were observed in Rishon Lezion (50 μg/L) and Petah Tiqva (34.8 μg/L), the lowest in Ramat Hasharon (9 μg/L), Herzliya (9 μg/L) and south Netanya (3 μg/L). The mean iodine concentration in manufactured mineral water was only 7 ± 5.7 μg/L. Iodine concentration was 0–10 μg/L among Israeli produced brands and 15 μg/L in the one imported from Italy.

Discussion

Iodine intake appears to be borderline satisfactory in this study group of residents living in the Israeli coastal area. Nevertheless, up to 27% did fall in the range of mild to moderate iodine deficiency. This finding may lie in contradiction with the current belief that because of its Mediterranean Sea vicinity, iodine deficiency in Israel should not represent a problem in Israel. Also, it may explain the perception of a high rate of amiodarone-induced thyrotoxicosis rather than hypothyroidism among Israelis (C. Benbassat, personal observation). Epidemiologic studies in neighboring Mediterranean countries have shown iodine intake to be below the desired levels [6]. A national survey among 2,300 Jordanian schoolchildren reported a median urinary iodine level of 157 μg/L in the year 2000, compared with 40 μg/L in a similar survey 7 years earlier – before the addition of 40–60 ppm iodine into the salt was implemented. Still, by the year 2000, up to 11% of Jordanian schoolchildren showed urinary iodine levels that were lower than 50 μg/L. In Lebanon, median urinary iodine rose from 56 to 94 μg/L between 1993 and 1997. Urinary iodine was especially low in Syria where a 1991 survey reported that almost 50% of the population had levels below 50 μg/L [6].

Despite the information available on suboptimal iodine nutrition in the countries neighboring Israel, which have similar geographic conditions, few data are available for Israel. Endemic goiter in northern Israel was reported 40 years ago. Brand et al. [7] studied 2,189 children from 13 different communities in the Upper Galilee, a highland area bordering Lebanon and Syria. Goiters were found in 12–17% of girls but in only 6–9% of boys. No cretins, deaf or dumb children were found in this area. The I^{131} uptake was high (77.9% at 24 hours) but not different from that in subjects without goiter in the same area. Urinary iodine was measured in only 18 children and the average level was 41 μg/24 hr (range 10–70 μg/24 hr) in both goiterous and non-goiterous children, significantly lower than that of the Jerusalem controls with 100–120 μg/24 hr. The iodine content in drinking water was 0.5–6 μg/L, also below the 58 μg/L found in Jerusalem. Barzilai and co-workers [8] studied 5,500 people (4,675 children) from 7 Arab villages in the Wadi Ara region, a valley crossing the lower part of northern Israel from east to west, and 1,250 people (450 schoolchildren) from 5 Jewish settlements in the Jordan Valley. The prevalence of goiter was 31% (range 17–68%) in Wadi Ara and 24% (range 17–34%) in the Jordan Valley. Iodine intake in these populations was not investigated. More recently, Sack et al. [9] studied urinary iodine excretion as a surrogate of iodine intake in 146 pregnant women from the Western Galilee (47 Jewish, 99 non-Jewish). Among the Jewish women urinary iodine was normal (median 127 μg I/g Cr) with only 3% under 50 μg I/g Cr; among the non-Jews urinary iodine was borderline low (median 96 μg I/g Cr) with 23% under 50 g I/g Cr.

Another finding in our study was that the iodine content of drinking water was on average well above the 10 μg/L cutoff considered acceptable by the WHO. Yet, one-third of the samples were below this level. Furthermore, a mean iodine concentration of 5 μg/L was seen in mineral water from Israeli producers. Drinking water in the Israel coastal area is a mix of water pumped from local underground wells and that provided by the national aquifer system running across the country and originating mainly from the northern area. The proportion of water coming from each source is not equally distributed between cities and was not estimated in this study. Also, the vast majority of subjects included in our study confirmed mineral water to be the primary source of dinking water. Therefore, geologic factors resulting from differences in geography does not necessarily account for the level of iodine intake in our study population.

Interestingly, in our study we did not find any statistically significant difference in urinary iodine excretion between pregnant and non-pregnant women. Decreased thyroid function during pregnancy has been correlated with a poor outcome and long-term neuropsychiatric sequelae in the offspring [11,12]. Whether mild forms of iodine deficiency can have a negative impact in pregnancy has yet to be determined [13]. Several studies assessing iodine intake in pregnancy have been published [14,15]. This population is of special interest because iodine excretion rate is increased, probably in parallel with an increased glomerular filtration rate, and subtle iodine deficiency can be unmasked [14]. Glinoer and colleagues [15], however, failed to demonstrate an increase in urinary excretion in 60 pregnant women followed throughout their pregnancy.

Iodine deficiency has been linked with the development of diffuse goiter [1]. Whether this applies to nodular goiters, too, is controversial [16]. We did not observe any statistically significant difference in urinary iodine between subjects affected with goiter and those without a previous history of thyroid disease. In a French study of 4,300 adults undergoing routine thyroid ultrasound, urinary iodine was not correlated with the presence of goiter [17]. One possible reason for this is that adults and not children comprised the study population. While all subjects with goiters were born in Israel in our study, their current iodine intake is probably affected by a relocation flux inside Israel.

From our study it seems that iodine intake is borderline satisfactory in the Israel coastal area, as it is in the Western Galilee. This study, however, included a very small number of subjects and the results cannot be generalized to the entire population. Furthermore, it was not meant to estimate the incidence of iodine deficiency disorders in relation to iodine intake, a goal that should be investigated by cross-sectional studies using populations of school-aged children. In view of the lack of extensive contemporary data, we call for a nationwide survey to better determine the real status of iodine intake in Israel, allowing for recommendations with regard to salt iodization in the future.

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