Most Moroccan children now have enough iodine

Iodine and sodium intakes in Belgium
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Iodine Global Scorecard 2021
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Iodized salt coverage in Syria
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Background

Morocco, a country in North Africa with a population of ca. 36 million, has legislated salt iodization as the national strategy against IDD [1]. In 1995, mandatory iodization of table salt at 80±10 mg of iodine/kg salt was introduced and subsequently adjusted in 2009 to 15–40 mg/kg [2].

Several previous studies in Morocco have assessed the iodine nutrition of children. In 1993, a national survey among school-aged children reported a median urinary iodine concentration (mUIC) of 86 µg/L and a mean goiter prevalence of 22%, but prevalence was highly variable, ranging from 0% to 77.4% in different regions [1]. Subsequently, smaller regional studies in Morocco have assessed the iodine nutrition of children. In 1993, a national survey among school-aged children reported a median urinary iodine concentration (mUIC) of 86 µg/L and a mean goiter prevalence of 22%, but prevalence was highly variable, ranging from 0% to 77.4% in different regions [1]. Subsequently, smaller regional studies in the mountains of Morocco reported that the prevalence of goiter among school-aged children was as high as 67% [3] and mUIC was <20 µg/L, indicating severe IDD [4]. A study of school-aged children in another rural mountainous area reported that the mUIC was 60 µg/L, suggesting mild ID [5].

It has been nearly 3 decades since the last national survey of iodine nutrition in Moroccan school-aged children [1], and, considering previous reports of severe IDD [3,4], updated data are urgently needed. Therefore, the aim of this study was to assess the current iodine nutrition in a nationally representative sample of 6–12-year-old school-aged children in Morocco by measuring the UIC in spot urine samples to inform the national salt iodization strategy.

Methods

This household-based survey was taken from March to June 2019. It was conducted at the national level in four geographic zones (North and East zone 1: coastal, mountainous; West zone 2: coastal, non-mountainous; Central zone 3: high altitude, non-coastal; South zone 4: coastal, mountainous, desert), covering the 12 regions of Morocco. A total of 180 clusters were selected using the probability proportionate to size sampling approach, as recommended by the WHO. Within each cluster, households were randomly selected.

In total, 3118 households were surveyed (60.4% in urban areas and 39.6% in rural areas). Within each selected household, a child aged 6–12 years was recruited for the survey if he/she was present in the household. A mid-stream spot urine sample was collected from the child. Urinary iodine was determined spectrophotometrically using the Sandell–Kolthoff method.

Rural mountainous areas in Morocco are not adequately covered by iodized salt

Results

1043 eligible children were recruited from the sampled households. In total, 56.3% were from urban areas and 43.7% were from rural areas; 50.5% were boys and 49.5% were girls. In total, 40.1% of children were from households belonging to the lowest socio-economic tercile and 27.8% were from the highest tercile.

The mUIC (95% CI) at the national level was 117 µg/L (110; 123). However, the percentage of surveyed samples with UIC < 50 µg/L was 21.6% (19.2%; 24.2%), which exceeds the WHO suggestion of no more than 20% of samples below 50 µg/L, despite an adequate mUIC in the total sample.

There were no statistically significant differences in mUIC by gender: the mUIC (95% CI) in boys and girls was 116 µg/L (107; 126) and 119 µg/L (102; 129), respectively. There were no statistically significant differences in mUIC by urban vs. rural areas: the mUIC (95% CI) in urban and rural clusters was 119 µg/L (110; 129) and 115 µg/L (102; 123), respectively. There were no significant differences in mUIC according to socio-economic status.

However, the mUIC was significantly lower in zone 3 (the high attitude non-coastal zone) compared to the other zones (p < 0.004). In the central (high attitude non-coastal) zone, children appeared to be mildly iodine deficient, with a mUIC (95% CI) of 89 (81; 103). These findings suggest that, despite iodine sufficiency at the national level, a small but significant proportion of children in Morocco may remain at risk for IDD.
Discussion
A national level mUIC value may conceal discrepancies in iodine intake among different sub-groups, including geographic region and/or socio-economic status (6). In Morocco, it appears iodine intake is comparable across rural and urban areas and across households with varying socio-economic status but not parental education. This equitable distribution of iodine intake suggests that the rural poor in Morocco are not at higher risk of ID, an important finding. However, the geographic zone analyses suggest that children residing in the central (high altitude non-coastal) zone are at higher risk of ID than those residing at lower non-coastal altitudes. This finding is in agreement with previous studies in other countries reporting an increase in the prevalence of ID with increasing altitude [7,8].

These data suggest that reaching children in high altitude non-coastal areas in Morocco with adequate iodine remains a challenge, such as communities in the Atlas Mountains in the south and/or the Rif mountains in the north. Based on our data, a future focus of the Moroccan iodized salt program should improve coverage of adequately iodized salt, particularly in these high-altitude non-coastal areas that do not have access to intrinsic sources of iodine, such as salt-water fish, seafood, and milk and dairy products from animals who consume iodine-rich feeds and fodder. Given the growing proportion of salt coming from processed foods in Morocco and the national policy to reduce salt consumption by 10% by 2025 (9), it may be important to extend mandatory salt iodization to include all salt used in the food industry. Strengthening the regulatory monitoring of iodization at the production sites to ensure adequate iodization of all table salt may also be valuable to ensure adequate iodine for all Moroccan children.

References
Combined monitoring of iodine and sodium intakes in Belgium


Background
In the years 1985–1998, it was first noted that mild iodine deficiency (MID) was a public health problem among school-aged children in Belgium [1]. In order to optimize the iodine status in Belgium, a voluntary agreement was concluded in 2009 between the bakery sector and the Federal Minister of Public Health to promote the use of iodized salt in bread (10–15 ppm). No reliable data are available on the use of iodized salt by the bakers in Belgium. Furthermore in Belgium iodized salt is allowed to be used in processed food and feed stuff. The 2010 study among Belgian children showed that 37% of Belgian households used iodized salt [2]. A similar figure (38%) was found in the most recent Belgian national food consumption survey [3].

A representative national survey among school-aged children in 2010–2011 showed that they were iodine sufficient (median urinary iodine concentration (UIC) = 113.1 µg/l) and that iodine status had significantly improved compared to 10 years earlier (median UIC = 80 µg/l) [1,2]. However, women of child-bearing age were found to be still suffering from MID with a median UIC of 84 µg/l [2]. The median UIC during pregnancy (118.3 µg/l in the first and 131.0 µg/l in the third trimester) indicated MID among pregnant women in Belgium and some groups of women (younger women, women not taking iodine-containing supplements, women with low consumption of milk and dairy drinks) were found at a significantly higher risk of iodine deficiency [4].

Generally, iodine deficiency in European countries is mild. The main consequences of mild iodine deficiency in adults are a higher prevalence of thyroid nodules and in children, impaired cognition and reduced IQ.

The WHO recommends limiting sodium intake to 2 g per day (equivalent to 5 g of salt per day). The Belgian Superior Health Council (HGR) follows this recommendation. In 2009, it was found that salt intake among Belgian adults aged 45–65 years was twice as high (on average 10.5 g per day) as the WHO and HGR recommendations.

The aims of the present study were to measure sodium and iodine concentrations in urine spot samples among a representative sample of Belgian adults as part of the first Belgian Health Examination Survey (BELHES) and to verify whether the Belgian adult population reached WHO recommendations for salt and iodine intakes.

Young women in Belgium have borderline low iodine intakes
The Belgian Ministry of Health promotes the use of iodized salt in breadmaking

The Belgian Health examination survey (BELHES)
In 2018 the sixth Belgian Health Interview Survey (HIS) was organized. Information on the health status, lifestyle, health care use, and socio-demographic characteristics was collected among a representative sample of 11,611 people residing in Belgium (total population = 11,482,178 in 2018). All Belgian provinces were included. Eligible HIS participants who were at least 18 years of age were invited to participate also in a Health Examination Survey (HES) until a predefined number (n = 1100) was reached. As the fieldwork continued for a short period after recruitment was stopped, finally 1184 people participated.

A spot urine sample of minimum 50 ml was collected in a polypropylene container. In about 98% of the cases the samples were taken before noon. Out of 1184 BELHES participants, 1166 provided a urine sample. For 1132 participants, sodium and creatinine could be analyzed. Thereafter, for 1106 participants there was still sufficient urine volume to analyze iodine. Out of the 1132 participants for whom sodium and creatinine were analyzed in their urine sample, participants without information on measured weight and/or height (N = 5) and pregnant women (N = 7) were excluded. In total, 1120 (95.0%) BELHES participants were included in the final sample. Various equations exist to estimate 24-h sodium excretion from spot urine samples [21–24].

Iodine excretion
Out of the 1106 participants for whom iodine and creatinine were analyzed in their urine sample, pregnant women (N = 7) and participants with extremely high iodine concentrations (N = 7), indicating acute or chronic iodine overexposure, were excluded. In total, 1092 (92%) BELHES participants were included in the final sample.

The study sample included about 50% of women, 31% of 18–39 year olds, and 23% of participants older than 65 years. Median creatinine levels were 141.3 (IQR = 98.2–199.8) mg/dl; 165.2 (IQR = 115.7–214.5) mg/dl for men and 121.6 (IQR = 84.6–175.7) mg/dl for women (data not shown).

Overall, median UIC among Belgian adults was 93.6 µg/L. About 12.1% of Belgian adults had a UIC below 50 µg/L, while 2.2% of adults had a UIC above 300 µg/L (Table 1). When expressing the iodine concentrations in µg/g creatinine, the median UIC was 60.8 ± 1.9 µg/g creatinine for men and 73.1 ± 2.4 µg/g creatinine for women.

### Table 1: Distribution of urinary iodine concentration (UIC) (µg/L) among Belgian adults (n = 1092)—Belgian Health Examination Survey (BELHES) 2019.

<table>
<thead>
<tr>
<th>Population</th>
<th>N</th>
<th>Median (SE)</th>
<th>% (SE) &lt;100 µg/L</th>
<th>% (SE) &lt;50 µg/L</th>
<th>% (SE) &gt;300 µg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>1092</td>
<td>93.6 (2.3)</td>
<td>56.0 (2.0)</td>
<td>12.1 (1.1)</td>
<td>2.2 (0.5)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>528</td>
<td>94.2 (3.3)</td>
<td>54.8 (2.9)</td>
<td>10.1 (1.5)</td>
<td>1.8 (0.6)</td>
</tr>
<tr>
<td>Female</td>
<td>564</td>
<td>91.7 (2.9)</td>
<td>57.3 (2.6)</td>
<td>14.2 (1.6)</td>
<td>2.5 (0.7)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18–39 years</td>
<td>287</td>
<td>98.0 (5.6)</td>
<td>52.4 (4.2)</td>
<td>8.8 (1.8)</td>
<td>1.3 (0.6)</td>
</tr>
<tr>
<td>40–64 years</td>
<td>572</td>
<td>91.0 (2.5)</td>
<td>57.8 (2.6)</td>
<td>13.6 (1.7)</td>
<td>2.3 (0.7)</td>
</tr>
<tr>
<td>&gt;65 years</td>
<td>233</td>
<td>93.4 (4.3)</td>
<td>57.3 (4.0)</td>
<td>13.8 (2.3)</td>
<td>3.1 (1.2)</td>
</tr>
</tbody>
</table>
There were no significant differences in median UIC between sexes, age groups, and regions in Belgium, but males had higher median UIC than females, and the youngest age group (18–39 years) had higher median UIC than the other age groups (Table 1). The median UIC among participants who reported thyroid problems during the last 12 months (median UIC = 104.1 µg/L) was significantly higher (p < 0.001) than the median UIC among those who did not report thyroid problems (median UIC = 92.2 µg/L).

**Salt intake**

The average population salt intake was 8.3 ± 0.1 g per day using the Tanaka equation and 9.4 ± 0.1 g per day using the INTER-SALT equation. For both equations, <5% of the population met the recommended salt intake level of <5 g per day. Salt intakes were significantly higher for males than females.

**Discussion**

This study, based on a representative sample of Belgian adults, showed that the median UIC (94 µg/L) was below the WHO threshold for population iodine sufficiency (100 µg/L), likely indicating MID, while population salt intake was substantially higher than the WHO recommendation of 5 g/day. Iodine status among nonpregnant adult women significantly improved in Belgium over the last decade. A previous national survey conducted among school-aged children and their mothers in 2010–2011 indicated iodine sufficiency among children (median UIC=113 µg/L), but MID among their mothers (median UIC=84.4 µg/L or 66.0 µg/g creatinine) [2]. Population salt intake was substantially higher than the WHO recommendations. Further policy efforts are needed to optimize iodine and reduce salt intake in Belgium.

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**Joint monitoring of iodine and sodium intakes from urine samples is recommended by WHO as an efficient use of resources**

**References**

The 2021 Global Scorecard of Iodine Nutrition

The Iodine Global Network (IGN) compiles data from UIC studies conducted throughout the world and continually monitors global iodine status (1). The IGN Scorecard presents the most recent UIC data for 194 WHO Member States, plus Liechtenstein and Palestine.

In population monitoring of iodine status using UIC, school-age children (SAC) serve as a proxy for the general population (2), therefore, in the IGN Scorecard, preference is given to studies carried out in SAC. The UIC data have been selected for each country in the following order of priority: data from the most recent known nationally representative survey carried out between 2005 and 2020 in (i) SAC, (ii) SAC and adolescents, (iii) adolescents, (iv) women of reproductive age, and (v) other adults (excluding pregnant or lactating women). In the absence of recent national surveys, sub-national data were used in the same order of priority. In the Scorecard, adequate iodine intake in SAC, women of reproductive age and adults is defined based on a mUIC in the range 100-299 µg/L (3). Although WHO defines adequate iodine intake in adults as a mUIC value ≥100 µg/L (2), the scientific basis for this threshold is weak (4). Thus, national classification of iodine status using this thresholds in adults should be interpreted with caution.

Estimated iodine nutrition in 194 WHO Member States in 2020 based on national median UIC in school-age children obtained from studies conducted between 2005–2020.

<table>
<thead>
<tr>
<th>Iodine intake</th>
<th>Insufficienta</th>
<th>Adequateb</th>
<th>Excessivec</th>
</tr>
</thead>
<tbody>
<tr>
<td>National data⁴</td>
<td>18</td>
<td>105</td>
<td>9</td>
</tr>
<tr>
<td>Sub-national data⁴</td>
<td>3</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>No data⁴</td>
<td>42</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reproduced with permission from (7). UIC, Urinary iodine concentration.

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### Table 1: Countries with deficient iodine intake in 2021, ranked by increasing median UIC (µg/L)

<table>
<thead>
<tr>
<th>Country or territory</th>
<th>Median UIC (µg/L)</th>
<th>Date of survey</th>
<th>Data type</th>
<th>Study population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Madagascar</td>
<td>46</td>
<td>2015</td>
<td>National</td>
<td>WRA</td>
</tr>
<tr>
<td>Cambodia</td>
<td>63</td>
<td>2014</td>
<td>National</td>
<td>WRA</td>
</tr>
<tr>
<td>Lebanon</td>
<td>66</td>
<td>2013</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Mali</td>
<td>69</td>
<td>2005</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Norway</td>
<td>75</td>
<td>2017-18</td>
<td>Sub-national</td>
<td>WRA</td>
</tr>
<tr>
<td>Tajikistan</td>
<td>75</td>
<td>2016</td>
<td>National</td>
<td>WRA</td>
</tr>
<tr>
<td>Haiti</td>
<td>77</td>
<td>2018</td>
<td>National</td>
<td>WRA</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>77</td>
<td>2017</td>
<td>National</td>
<td>WRA</td>
</tr>
<tr>
<td>Burundi</td>
<td>80</td>
<td>2018</td>
<td>National</td>
<td>WRA</td>
</tr>
<tr>
<td>Israel</td>
<td>83</td>
<td>2016</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Iraq</td>
<td>84</td>
<td>2011-12</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>84</td>
<td>2013-14</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Samoa</td>
<td>88</td>
<td>2013</td>
<td>National</td>
<td>WRA</td>
</tr>
<tr>
<td>Germany</td>
<td>89</td>
<td>2014-17</td>
<td>National</td>
<td>SAC, Adolescents</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>90</td>
<td>2018</td>
<td>National</td>
<td>WRA</td>
</tr>
<tr>
<td>South Sudan</td>
<td>94</td>
<td>2006</td>
<td>Sub-national</td>
<td>SAC</td>
</tr>
<tr>
<td>Finland</td>
<td>96</td>
<td>2017</td>
<td>National</td>
<td>Adults</td>
</tr>
<tr>
<td>Korea, DPR</td>
<td>97</td>
<td>2009-10</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Mozambique</td>
<td>97</td>
<td>2011-12</td>
<td>National</td>
<td>WRA</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>99</td>
<td>2014</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>&lt;100</td>
<td>2008-20</td>
<td>Sub-national</td>
<td>SAC</td>
</tr>
</tbody>
</table>

**SAC, School aged children; UIC, urinary iodine concentration.**

### Table 2: Countries with excessive iodine intake in 2021, ranked by increasing median UIC (µg/L)

<table>
<thead>
<tr>
<th>Country or territory</th>
<th>Median UIC (µg/L)</th>
<th>Date of survey</th>
<th>Data type</th>
<th>Population surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cameroon</td>
<td>&gt;300</td>
<td>2014-2018</td>
<td>Sub-national</td>
<td>SAC</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>311</td>
<td>2018</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>314</td>
<td>2008-09</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Nepal</td>
<td>314</td>
<td>2016</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Benin</td>
<td>318</td>
<td>2011</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>328</td>
<td>2007-10</td>
<td>Sub-national</td>
<td>SAC</td>
</tr>
<tr>
<td>Djibouti</td>
<td>335</td>
<td>2015</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Qatar</td>
<td>341</td>
<td>2014</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Honduras</td>
<td>356</td>
<td>2005</td>
<td>Sub-national</td>
<td>SAC</td>
</tr>
<tr>
<td>Colombia</td>
<td>407</td>
<td>2015-16</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>449</td>
<td>2013-15</td>
<td>National</td>
<td>SAC, Adolescents</td>
</tr>
<tr>
<td>Uganda</td>
<td>464</td>
<td>2005</td>
<td>National</td>
<td>SAC</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>564</td>
<td>2007</td>
<td>Sub-national</td>
<td>SAC</td>
</tr>
</tbody>
</table>

### References
Iodine supplements benefit pregnant women in Iran

Iran has an effective and sustained iodized salt program and has been considered as iodine replete since 2000. However, the first national survey of iodine intake among Iranian pregnant women in 2014 reported a mUIC of 87 µg/L, suggesting this vulnerable group was iodine deficient [1]. Given the significance of supplementation for pregnant women, tablets containing 150 µg of iodine (potassium iodide) and 500 µg of folic acid, were produced for the Iranian market. Also, capsules containing multivitamins plus 150 µg of iodide were produced.

The national distribution of Idofolic tablets was initiated in 2016. In all provinces, women were instructed to begin daily consumption of Iodofolic 3 months before conception and continue the drug during pregnancy. Women who had started Iodofolic 3 months prior to conception or if pregnant, at least for 1 month before interview, entered the current study. The participants were followed-up until the end of pregnancy. Blood and urine samples were collected from pregnant women between October 2018 and March 2019.

A questionnaire was administered to all pregnant women to collect information on the use of supplements, demographic data (e.g., age, parity, and gestational age), and medical history (e.g., thyroid medications, use of vitamin supplements, and history of thyroid disorders).

To reduce day-to-day variations of UIC, each woman provided three spot urine samples during one week in each trimester; the three samples mean was reported for each participant. Venous blood samples were also collected from pregnant women in each trimester to measure thyroid function tests.

Results
The authors enrolled 1128 women (381, 383, and 364 women in the first, second, and third trimesters, respectively).

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To reduce day-to-day variations of UIC, each woman provided three spot urine samples during one week in each trimester; the three samples mean was reported for each participant. Venous blood samples were also collected from pregnant women in each trimester to measure thyroid function tests.

Results
The authors enrolled 1128 women (381, 383, and 364 women in the first, second, and third trimesters, respectively).

The mean age of the participants was 28 ± 6.2 years, and their mean gestational age was 22.7 ± 13.0 weeks.

The overall mUIC (IQR) was 188 µg/L (47–139) in the total cohort. Also, the mUICs were 174 µg/L (110–254), 175 µg/L (116–251), and 165 µg/L (114–235) in the first, second, and third trimesters, respectively (Table 1). In 11 provinces, the mUIC was adequate, except for Fars Province, where it was more than adequate (308 µg/L).

The median iodine content of household salt was 29.6 µg/g. In 85% of household salt, the iodine concentration was ≥ 30 µg/g. Also, more than 95% of households were under iodized salt coverage.

The mUIC of pregnant women in all 12 provinces differed between the two national surveys and was significantly higher after iodine supplementation in all provinces (Figure 1). Also, thyroid function tests were improved after iodine supplementation. Compared to the study done before iodine supplementation, the prevalence of clinical hypothyroidism, clinical/subclinical thyrotoxicosis, TPO-Ab positivity, and isolated hypothyroxinemia decreased significantly, while there was a small increase in subclinical hypothyroidism.

<table>
<thead>
<tr>
<th>Urine iodine (µg/L)</th>
<th>First trimester (n = 381)</th>
<th>Second trimester (n = 383)</th>
<th>Third trimester (n = 364)</th>
<th>Total (n = 1128)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (IQR)</td>
<td>174 (110–254)</td>
<td>175 (116–251)</td>
<td>165 (114–235)</td>
<td>188 (124–263)</td>
</tr>
<tr>
<td>Range (min–max)</td>
<td>21–796</td>
<td>20–790</td>
<td>19–786</td>
<td>20–798</td>
</tr>
</tbody>
</table>
Iodized salt and targeted iodine supplementation provide ample iodine for women in Iran

**FIGURE 1** Comparison of percent distribution of median UIC (µg/L) between the first (before iodine supplementation) and the second (after iodine supplementation) national surveys of Iranian pregnant women.

**Conclusions**

The results of this study indicated that iodine supplementation with at least 150 µg of iodine per day appeared to improve the iodine intake of pregnant women in Iran, resulting in a mUIC indicating iodine sufficiency and improved thyroid function. This study highlights the need for the ongoing surveillance of iodine status in pregnant women in Iran and emphasized the importance of raising awareness about increased iodine intake in pregnant women. In Iran, the main source of iodine supply is iodized salt for household use. As universal salt iodization may not be adequate during pregnancy, the authors recommend supplementation of 150 µg of iodine during pregnancy, and if possible, 3 months before attempting pregnancy.

**References**

The thyroid, the organ below the radar


Thyroid disorders rarely get the publicity of more well-known disease groups, but can lead to tragic consequences, especially in mothers and children. Ensuring that they are categorized as a distinct group of non-communicable diseases, could make them easier to combat.

The idiom “so near and yet so far” can be applied, with some modification, to the thyroid gland. It is the most accessible of all endocrine organs and the most affected by disease—even surpassing afflictions of the beta cells of the pancreas, which cause diabetes, another endocrine disorder that is much more familiar to the general public. It is also one of the least well-known contributors to chronic conditions.

Anatomically, the thyroid gland lies in the front part of the neck, covered only by the skin, and lends itself easily to palpitation. Any enlargement is readily seen and physicians need not even touch it to make a diagnosis of a goiter. For that matter, laymen can do likewise with a fair level of certainty.

Thyroid disorders are amongst the most widespread medical conditions globally, their prevalence worldwide varying according to age, sex, the availability of iodine and definition of disease. Iodine deficiency in daily nutrition is the main cause of endemic goiter and hypothyroidism, an issue of extreme concern since one third of the world’s population lives in iodine-depleted areas.

Based on these facts, the World Health Assembly (WHA) passed a resolution in 2012, calling upon the World Health Organization (WHO) to aim to eliminate iodine deficiency as a public health problem. This objective is particularly pressing since, although iodine deficiency is the main cause of endemic goiter and hypothyroidism, additional environmental factors, such as selenium and iron deficiency, pollution, stress, smoking, and obesity, are increasingly involved in the pathogenesis of thyroid disorders. These are further compounded by a multiplicity of genetic factors.

Educating policymakers about this lesser-known cause of poor health, and allowing patients to take a lead role, could help rally efforts to combat thyroid disorders.
A lack of awareness

Iodine Deficiency Disorders (IDD) with or without hypothyroidism comprise the largest bulk of thyroidal disease. If TDs were compared to an army, IDD would be the “legion” while the other thyroidal disorders, like the autoimmune thyroid diseases, thyroid cancer, inflammation and other developmental anomalies, would be mere “platoons.” This component is so large – and yet it seems to be hidden from public and official appreciation. In military surveillance lingo, IDD is operating “below the radar.”

Or, expressed more colloquially, if goiter is seen as the “tip of the iceberg”, IDD is the hidden large dark massive bulk of ice just below the surface. Remember the Titanic!

Goiter and thyroid disorders caused by IDD are often neglected, as they do not command much attention – and excitement – as the other non-communicable diseases (NCD) do. Talk of cancer and it conveys the image of a large necrotic mass of malignant tissues invading the breast, for instance. Talk of hypertension and it brings to mind the sudden cardiac arrest occurring in the office of an executive. But talk of IDD, and most people, and even health professionals, carry a number of misconceptions. How much awareness is there among policy-makers and the general public that the use of adequately-iodized salt provides a simple solution to IDD?

IDD and thyroid disorders have burdens of disease that impact on societies and economies in ways that may not be evident at first glance. Consider a woman with a goiter that she may have carried since her puberty and well into her reproductive years, living in a rural, poverty-stricken, iodine-depleted area. The woman might seek medical care only when a medical-surgical mission arrives in her town. Meanwhile, she has given birth to a number of children who have become educationally-challenged in their formative years in school, with consequent suboptimal productivity in adult life.

And that, precisely, is the tragedy of thyroid disorders. They do not boost our adrenaline levels. Thyroid disorders are so low-key, they do not bring us to tears — except perhaps in the case of families with a child born with mental disabilities or physical deformities as a consequence of the mother’s iodine deficiency.

Insufficient attention from policy makers

It is noteworthy that many thyroid disorders share key risk factors with NCDs — e.g., unhealthy lifestyle, a diet that is qualitatively poor as regards essential micro-nutrients (specifically iodine), including metabolic risk factors — but get even less attention. In the same vein, WHO Europe recognizes a comprehensive approach in tackling noncommunicable diseases (NCDs) that simultaneously: 1) promotes population-level health promotion and disease prevention programs; 2) actively targets groups and individuals at high risk, and maximizes population coverage of effective treatment and care; and 3) systematically integrates policy and action to reduce inequalities in health.

Despite this, WHO has no policy, other than that relating to iodine deficiency, to deal with the specific consequences of thyroid disorders and the upsurge in their incidence. In a world with ever-increasing globalization, with expectations of better health falling far short of desirable and appropriate goals, especially in developing countries, a major effort to counteract the tide of thyroid disorders and other NCDs is crucial.
Iodine sufficiency in children in the Seychelles

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Background
The Republic of Seychelles is a group of 115 islands located east of the African coast in the Indian Ocean. The capital city is Victoria on Mahé, the largest island. The Republic has a population of 94,000, and the total territory is 1,374 km². There is no national legislation for salt iodization and there has been no previous survey of iodine status in the Seychelles.

Methods
Local investigators, in cooperation with The University of Ulster in Northern Ireland, collected 600 spot urine samples from school-aged children on the island of Mahé, where 90% of the population reside. The median (IQR) age of the children was 7.4 (7.1-7.9) years.

The samples were shipped to the ETH Zurich, Switzerland. Measurements of the urinary iodine concentration (UIC) were done using the Pino-modification of the Sandell-Kolthoff method, and measurement of urinary creatinine concentration was done using the Jaffé method.

Results
The median urinary iodine concentration of the children was 147 µg/L and the median urinary creatinine concentration was 0.7 g/L. The median (IQR) I:Cr ratio was 185 (105, 355) µg/g (Table 1). Only 8% of the children had a spot UIC >300 µg/L.

Conclusions
Overall, school-aged children in Victoria, the capital city of the Seychelles are iodine sufficient. The median UIC is 147 µg/L, which is in the recommended range of 100-300 µg/L from the WHO.

Future studies should investigate the iodine status of children living on other islands of the Seychelles, as well as the iodine status of pregnant women, another vulnerable group.

Schoolgirls in Mahé have sufficient dietary iodine

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<tr>
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<th>UIC [µg/L]</th>
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<tr>
<td>Median</td>
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<td>IQR</td>
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Despite conflict, nearly 2/3rds of households in Syria have adequately iodized salt


Background
This report presents the findings of the 2019 SMART Survey conducted in 13 Governorates out of 14 Governorates in Syria between March and April 2019. Idleb Governorate was inaccessible due to insecurity and hence not included in the survey. The last nationwide SMART Survey in Syria was conducted in March 2016 covering only 11 Governorates. Obtaining an up to date representative nutritional status data was one of the major gaps faced by the nutrition actors for designing appropriate nutrition response since the conflict started in Syria. The main objective of the 2019 SMART Survey was to assess the current nutritional status of children 0-59 months old and women of reproductive age (15-49 years old) at governorate and national levels.

In Syria, salt iodization is the public health measure through which iodine is provided. There is legislation for mandatory salt iodization for salt producers. However, because of the conflict, there has been challenges on the importation of potassium iodate used in salt iodation impacting on progress that had been in the past.

Therefore, one of the objectives of the SMART survey was to estimate the coverage of household iodized salt at the national level. A representative sample of 8,140 households across 13 governorates/domains participated in the survey.

Many Syrian households are still using iodized salt despite years of conflict
Results

*Figure 1* shows that 63% of the salt used by households in the study population is sufficiently iodized. Packing was also checked while testing the salt for iodization. Data shows that only 1% of the salt in packages labelled as iodized was not actually iodized.

*Figure 2* shows that 77% of the salt used by households in the study population is locally produced. Importation of potassium iodate has been a challenge to facilitate salt iodation in the country.

*Figure 3* shows salt iodization by governate in Syria. The Damascus governate has highest rate of iodized salt at 87.8%. The lowest rate of iodized salt was noted in Ar-Raqqa with only 22.4%, followed by Al Hassakeh and Deir Zour with 24.2% and 30.4% respectively.

Conclusions

Overall, the data shows an increase the rate of salt iodation from 38.7% in the 2016 SMART survey to a current level of 63%. It is noted that prior to the survey, the national government managed to distribute limited quantities of potassium iodate to local salt producers and this possibly contributed to the increase noted. In addition, there is a possibility that some companies could be importing iodated salt and repacking locally.
Puerto Rican pregnant women are iodine sufficient but their iodine awareness is low

The United States (US) has been considered iodine-sufficient since the 1940s. However, National Health and Nutrition Examination Surveys have demonstrated a reemergence of mild ID in pregnant US women over the last decade (1). There are only very limited data from the Caribbean islands regarding iodine nutritional status. Barbados, Dominica, Jamaica Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Grenada, Cuba, and the Dominican Republic have been found to be iodine-sufficient; Trinidad and Tobago was found to have excessive iodine intake, whereas Haiti remains iodine-deficient (2-4).

Based on the most recent data available to the Iodine Global Network, none of the Greater Antilles islands have data regarding iodine status during pregnancy. There is no information regarding iodine status in the US territories, and iodine status does not appear to be monitored on a continuous basis in the US territories. No legislation exists in Puerto Rico to mandate fortification of foods with iodine or the use of iodized salt, and the iodine status of Puerto Rico has not been studied.

The primary objective of this study was to assess the iodine status in the pregnant women of Puerto Rico. It also aimed to assess their knowledge about iodine during pregnancy, the use of prenatal vitamins, and the use of iodized salt.

Methods
A convenience sample of 125 subjects was enrolled. All the subjects were recruited from a high-risk obstetric clinic of the University of Puerto Rico in the Adult University Hospital, located in the Medical Center of Puerto Rico in San Juan, a referral center for all of Puerto Rico. The inclusion criteria included Puerto Rican women aged 21 years or older who were pregnant at the time of the study.

The study subjects completed a written survey that included questions regarding demographics, personal or family history of thyroid disease, use of topical iodine, smoking status, use of prenatal vitamins in the last 24 hours, or use of prenatal vitamins known to contain iodine. The subjects who had added table salt to their food in the last 24 hours had a higher median UIC of 211.2 (46.3-2179.0) µg/L compared to those who had not added salt to their food, who had a median UIC measured at 153.9 (15.3-944.7) µg/L. Surprisingly, women who reported taking prescription prenatal vitamins had a lower median UIC of 148.6 (15.3-1188.6) µg/L compared to those who were not taking prescription prenatal vitamins, measured at 249.7 (47.8-2179.0) µg/L.

Results
The mean age of the 125 pregnant women was 29 ± 5.29 years. 78% reported taking a prenatal multivitamin in the last 24 hours prior to the collection of the urine specimen, 74% of whom did not know the iodine content of their vitamins. Only 6% of the participants recalled being educated by a health care professional about adequate dietary iodine during pregnancy. Only 2% of the participants reported that they believed that pregnant women need more dietary iodine than nonpregnant adults. 93% reported buying table salt to use at home. 55% reported having added salt to their food in the last 24 hours prior to providing their urine sample. When asked about factors taken into consideration when selecting salt bought at stores, 20% reported that iodization was an important factor, 40% considered cost to be important, and 36% reported that the brand was a consideration.

The median (range) UIC in the sample was 189 (15.3-2179.0) µg/L. UIC did not differ by age, education, birthplace, family history of thyroid disorders, use of salt, and use of multivitamins, including prenatal vitamins. Urine spot specimens were collected.

Conclusions
This sample of pregnant women in Puerto Rico were iodine-sufficient based on their median UIC. This is the first study to measure UIC in this population. The population had higher UIC compared to pregnant women in the mainland US (144 [120-190] mg/L) according to the most recent data (1). The results are encouraging in that the study population had adequate UIC despite the lack of a national iodine fortification program on the island. There was a substantial knowledge gap regarding iodine nutritional needs during pregnancy.

References
Tibetan adults are now iodine sufficient


Background
Tibet, a region in central Asia with average altitudes >4000 m, historically had severe iodine deficiency and a high prevalence of thyroid diseases, especially among those living in the territory’s eastern and southern areas. The region remained one of seven provinces in China that did not meet the goal of eliminating IDD by the year 2000 [1,2]. An annual iodine supplementation program was implemented in Tibet from 2000 to 2004, especially targeting pregnant and lactating women. Annual iodine supplementation was provided with a capsule containing iodized oil annually, and the program achieved a coverage of almost 95% of the target population [3]. However, a multicenter study published in 2008 found that Tibet was the only province in China in which <90% of the population were using iodized salt [4]. By 2018, the total population of Tibet had increased to 3.44 million, but previous studies that reported iodine deficiency in Tibet [1,2] were conducted >10 y ago. Thus, there is a lack of recent province-wide data on the iodine status of the Tibetan population.

Methods
From September 2016 to August 2018, participants were recruited from the general Tibetan population in four cities whose locations spanned a wide region of western China and were found at three altitude levels: Group A (Ali, altitude: ~4300 m) had 238 men and 264 women, Group B (Shigatse and Lhasa, altitude: ~3700 m) consisted of 250 men and 311 women, and Group C (Nyingchi, altitude: ~2900 m) included 142 men and 294 women. Participants were required to have lived in Tibet for >1 y. Urine iodine concentrations (UICs) were measured. In all, 1499 healthy adults (all >19 years-old; mean age 40 years) were enrolled in the study.

Results
The median (m) UIC was 137.9 µg/L. About 30% had UICs <100 µg/L, and 9.6% had UICs >300 µg/L. Divided into four age groups: 19 to 29, 30 to 39, 40 to 49, and 50 to 64 years, the mUICs decreased with age (152.1, 152.1, 139, and 121.8 µg/L).

There was a low prevalence of thyroid disorders: the prevalence of clinical hyperthyroidism, clinical hypothyroidism, subclinical hyperthyroidism and subclinical hypothyroidism were 0.5%, 1.3%, 1.7% and 17.9%, respectively. The prevalence of almost all thyroid disorders was higher in women than in men.

Conclusions
This multicenter cross-sectional study found that the iodine status of adults in Tibet is adequate, and most adults have normal thyroid function. The results of the present study suggested that the iodine fortification and supplementation programs have yielded population-wide benefits in the Tibetan region. However, the median UIC (137.9 µg/L) was lower than that of the Chinese population in other lower altitude regions [5]. The authors suggested that one contributing factor in the Tibetan population could be the method of food preparation. Tibetans eat a lot of stewed food and stewing may lead to a loss of iodine in the food and salt.

However, the present study did not include some important subgroups of the population, such as pregnant women and children, who should be included in future studies.

References
Meetings and Announcements

New database on the iodine content of U.S. Foods

The United States Department of Agriculture (USDA), the National Institutes of Health (NIH) Office of Dietary Supplements (ODS) and the U.S. Food and Drug Administration are pleased to inform you of the release of an analytically-based database on the Iodine Content of Commonly Eaten U.S. Foods

ODS and USDA also collaborate to publish data on the analytically determined content of iodine-containing multivitamin/mineral dietary supplements

https://dietarysupplementdatabase.usda.nih.gov/

Additional information on the iodine content of dietary supplements, based on product labels, is available from the NIH Dietary Supplement Label Database

https://dsld.od.nih.gov/dsld/

The food iodine database provides values for approximately 430 foods and is being updated on an ongoing basis with new foods and data; also presented are the data sources. Values were determined using the ICP-MS method and in most cases have multiple samples contributing to the mean value. This initiative responds to a key recommendation of the 2014 ODS Iodine Roundtable series (AJCN 104 Suppl 3, 2016, special issue on iodine). The databases and their methodologies will be useful in clinical practice, public health, and clinical/population science research in the U.S. and in other countries.

China celebrated National IDD Control Day on May 15

The Chinese National Day for the Prevention and Treatment of IDD was proposed at the "China 2000 Mobilization meeting on the Elimination of IDD 2000" held by the State Council in September 1993. It was originally on May 5, 1994 and was designated as the National IDD Publicity Day. The purpose is to strengthen publicity and raise public awareness of the prevention and treatment of IDD. It has been held on May 15 since 2000, and the theme for the new year is announced by the national health authorities at the beginning of May every year.

http://www.nhc.gov.cn/jkj/s5874/202104/a8a0eb954a4641e08cf718dd23438abe.shtml for details).
Abstracts

The Iodine Status and Prevalence of Thyroid Disorders among Women of Childbearing-age in China: National Cross-sectional Study

Mandatory universal salt iodization in China was implemented 20 years ago; however, the current iodine status and prevalence of thyroid disorders among childbearing-age women are uncertain. A nationally representative cross-sectional study with 26166 enrolled participants aged 18 to 49 years from all 31 provincial regions of mainland China was performed. The participants were given a questionnaire and underwent ultrasonography of the thyroid. The serum concentrations of thyroid hormones and thyroid antibodies and the urine iodine concentration (UIC) were measured. The median UIC was 179 µg/L indicating adequate iodine status.

The weighted prevalence of thyroid disorders were as follows: 1.1% had overt hyperthyroidism, 0.6% had subclinical hyperthyroidism, 0.8% had Graves’ disease, 1.3% had overt hypothyroidism, 14.3% had subclinical hypothyroidism, 13.5% were positive for TPOAb, and 14.6% were positive for TgAb. Excessive iodine and overweight were associated with higher odds of subclinical hypothyroidism. Li Y, et al. Endocrine Practice 2021

Iodine Excretion and Intake in Women of Reproductive Age in South Australia Eating Plant-Based and Omnivore Diets: A Pilot Study

Women consuming a strictly vegan/plant-based diet may be at increased risk of low iodine intake due to avoidance of animal products containing iodine. The aim of this pilot study was to determine the iodine excretion and intake in women consuming vegan/plant-based diets compared with women consuming omnivore diets. Fifty-seven women (n = 31 plant-based, n = 26 omnivores), provided two spot urine samples to assess urinary iodine concentration (UIC). Two days of dietary intake were also recorded by participants. As the data were not normally distributed results are reported as median (IQR). UIC was significantly different between groups, 44 (36–66) µg/L in the vegan/plant-based group versus 63 (40–80) µg/L in omnivores (p < 0.05). UIC did not meet the >100 µg/L level recommended by the WHO. Iodine intake was also significantly different, 78 (62–91) µg/day in the vegan/plant-based group and 125 (86–175) µg/day in the omnivores (p = 0.000). Iodine intake and bread intake were correlated with iodine excretion, representing a diet strategy of decreasing bread intake and avoiding animal-based foods containing iodine. The weighted prevalence of thyroid disorders were 1.3% had hyperthyroidism, 0.6% had hypothyroidism, 14.3% had subclinical hypothyroidism, and 13.5% were positive for TPOAb. Excessive iodine and overweight were associated with higher odds of subclinical hypothyroidism. Jin Y, et al. Br J Nutr. 2021 PMID: 33858523


Monitoring the population iodine status is essential for iodine deficiency eradication. This study assessed the average dietary iodine intake and the iodine status of a random sample of the Italian general adult population. The study population included 2378 adults aged 35–79 years (1229 men and 1149 women) from all 20 Italian regions. Dietary iodine intake was assessed by the measurement of 24 h urinary iodine excretion. The median daily iodine intake of the whole population was lower (96 µg/d, interquartile range 51–165) than the daily adequate iodine intake according to both EFSA and WHO recommendation (150 µg/d), with a significantly lower value among women (85 µg/d) compared with men (114 µg/d). Iodine intake diminished with age and increased with BMI (body mass index) in male but not in female participants, without achieving the adequate intake in any sex, age, or BMI category. In this random sample of Italian general adult population examined in 2008–2012, iodine intake still remained lower than the recommended values despite the implementation of a strategy of salt iodization in 2005. Jacore R et al. Nutrients 2021, 13, 1529.

Pregnant Women Are Iodine Deficient While There Is Adequate Iodine Status Among School-Aged Children in Sarawak, Malaysia

Mandatory universal salt iodization (USI) has been implemented in Sarawak since 2008. The aim of this study was to assess the current iodine status among school-aged children (SAC) and pregnant women (PW) after 10 years of USI implementation in Sarawak. This cross-sectional survey among school-aged children and pregnant women was conducted between July and October 2018 in Sarawak. The multistage proportionate to population size sampling technique was used to select 30 schools and 30 maternal and child health care clinics. A total of 988 children and 677 PW participated in the study. The overall median UIC level among the children was 126.0 µg/L (interquartile range [IQR], 71.0–200.9 µg/L) and classified as adequate iodine status. The median UIC among PW was 123.9 µg/L (IQR, 56.5–192.1 µg/L) indicating mild iodine deficiency. Comprehensive monitoring of the iodine deficiency disorder problem among PW is warranted. Kuang Kuay L et al. Food Nutr Bull. 2021 May 24 doi: 10.1177/037957211211002079.