Iodine Deficiency in Europe

La condizione di carenza iodica in Europa

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Iodine Deficiency Disorders at the Gates of "Feeding the Planet – Expo 2015"
John Lazarus has nothing to disclose
Iodine deficiency disorders health - consequences, by age

All ages
• Goitre
• Increased susceptibility of the thyroid gland to nuclear radiation
• In severe iodine deficiency, hypothyroidism

Fetus
  Abortion
  Stillbirth
  Congenital anomalies
  Perinatal mortality

Neonate
  Infant mortality
  Endemic cretinism

Child and adolescent
  Impaired mental function
  Delayed physical development

Adults
  Impaired mental function
  Reduced work productivity
  Toxic nodular goitre; hyperthyroidism
Epidemiological criteria for assessing iodine nutrition (WHO, 2007)

<table>
<thead>
<tr>
<th>Median urinary iodine</th>
<th>Iodine intake (μg/L)</th>
<th>Iodine nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
<td>Insufficient</td>
<td>Severe iodine deficiency</td>
</tr>
<tr>
<td>20-49</td>
<td>Insufficient</td>
<td>Moderate iodine deficiency</td>
</tr>
<tr>
<td>50-99</td>
<td>Insufficient</td>
<td>Mild iodine deficiency</td>
</tr>
<tr>
<td>100-199</td>
<td>Adequate</td>
<td>Optimal</td>
</tr>
<tr>
<td>200-299</td>
<td>More than adequate</td>
<td>Risk of iodine-induced hyperthyroidism within 5-10 years following introduction of iodized salt in susceptible</td>
</tr>
<tr>
<td>&gt; 300</td>
<td>Excessive</td>
<td>Risk of adverse health consequences (iodine-induced hyperthyroidism, autoimmune thyroid diseases)</td>
</tr>
</tbody>
</table>
RECOMMENDED DAILY IODINE INTAKE
[Results of WHO Technical Consultation 2005]

Pregnant and lactating requirement 250µg/day [de Benoist & Delange 2007 Pub Hlth Nutr]

Iodine deficiency results in neurodevelopmental delay [Vermiglio et al 1999, de Escobar et al 2007]

Iodine supplementation improves child neurocognitive outcome [Velasco et al 2009 JCEM, Berbel et al 2009 Thyroid]

Sustained I intake of 500µg - 1000µg/day should be avoided because of concerns about fetal hyperthyroidism

Table 1. The daily recommended nutrient intake (RNI) for iodine proposed for pregnant and lactating women, and children less than 2-years-old, and the daily intake that is considered should not to be exceeded.

<table>
<thead>
<tr>
<th>Population group</th>
<th>Recommended iodine intake (µg day⁻¹)</th>
<th>Level of iodine intake beyond which no added health benefit can be expected (µg day⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnant women</td>
<td>250</td>
<td>&gt;500</td>
</tr>
<tr>
<td>Lactating women</td>
<td>250</td>
<td>&gt;500</td>
</tr>
<tr>
<td>Children less than 2-years-old</td>
<td>90</td>
<td>&gt;180</td>
</tr>
</tbody>
</table>

× corresponds to urinary iodine 177µg/litre (approx)

Andersson et al Public Health Nutrition 10(12A) 1606-11, 2007
Population
App 590m
Urinary Iodine in Europe

<table>
<thead>
<tr>
<th>Urinary Iodine (µg/Litre)</th>
<th>No of Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 100 [63-100]</td>
<td>6</td>
</tr>
<tr>
<td>100-150 [101-148]</td>
<td>13</td>
</tr>
<tr>
<td>≥ 150 [173-252]</td>
<td>7</td>
</tr>
</tbody>
</table>

PREGNANT WOMEN IODINE STATUS (DATA from 21 COUNTRIES)

UI > 150µg/Litre  8
UI < 150µg/Litre   13
## Mandatory Salt Iodisation

<table>
<thead>
<tr>
<th>Mandatory Salt Iodisation</th>
<th>No of Countries</th>
<th>Population (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>13</td>
<td>184.4 [30.8%]</td>
</tr>
<tr>
<td>NO</td>
<td>22</td>
<td>410.0 [69.2%]</td>
</tr>
</tbody>
</table>
Maternal urinary iodine levels in early pregnancy

Range: 9.3 – 1743.5 μg/L
Median: 222.5 μg/L
< 150 μg/L: 30.8%
> 500 μg/L: 11.5%
DENMARK

UIE in 238 pregnant women 2012

<table>
<thead>
<tr>
<th>Iodine Suppl</th>
<th>Yes 84.1%</th>
<th>No 15.9%</th>
</tr>
</thead>
<tbody>
<tr>
<td>UIE (µg/L)</td>
<td>109</td>
<td>68</td>
</tr>
</tbody>
</table>

Andersen et al
Dan Med J 2013

Urinary iodine concentrations in range from 460-1000 µg/liter (n=8) not illustrated.
Values were stratified into 40 bands in the range from 7-440 µg/liter; each band corresponding to 10.8 µg/liter.
UIC indicate suboptimal iodine status in pregnancy – especially in women without supplementation

U0UIC > 150 μg/L defined by WHO as adequate iodine nutrition

NORWAY

N=84

N=35
Pregnant women who do not consume or have low intake of dairy and/or seafood and who do not obtain iodine from supplements are at great risk of having inadequate iodine intake.

There is an urgent need for public health strategies to monitor and secure the iodine status in Norway.

The detailed assessment of diet and supplement use in MoBa represents a unique opportunity to study potential associations between inadequate maternal iodine intake and cognitive development in their children.
Partial Success: MDs, obstetricians and medical staff are aware of the iodine deficiency guideline

New legislation is in preparation ‘Healthy food for public schools’ – iodized salt mandatory

Failure: USI has not been achieved yet.

Endre V. Nagy 2013
Median urinary iodine concentration (mcg/l) – pregnant women

Population studies revealed that median UIC in pregnant women has not reached the expected level.
VALORI MEDIANI DI IODURIA IN BAMBINI IN ETÀ SCOLARE (2006-2012)

9 Regioni con dati di ioduria in età scolare

- 48-98 µg/L
- 100-160 µg/L

In molti casi indagini condotte in aree limitate

Dati degli Osservatori Regionali per la Prevenzione del Gozzo
**VALORI MEDIANI DI IODURIA IN GRAVIDANZA (2006-2011)**

<table>
<thead>
<tr>
<th>Valore</th>
<th>Descrizione</th>
</tr>
</thead>
<tbody>
<tr>
<td>62-95 μg/L</td>
<td>(no assunzione di integratori contenenti iodio)</td>
</tr>
<tr>
<td>126 -134 μg/L</td>
<td>(SI assunzione di integratori contenenti iodio)</td>
</tr>
</tbody>
</table>

**Fabbisogno di iodio in gravidanza**

250 μg/die

**Ioduria mediana attesa in donne in gravidanza con adeguato apporto iodico**

150-249 μg/L

**QUANTE SONO IN ITALIA LE DONNE IN GRAVIDANZA CHE ASSUMONO INTEGRATORI CONTENENTI IODIO?**

Dati su 3300 donne
URINARY IODINE EXCRETION in UK 2009

Proportion of Schoolgirls %

N=737 Median UI = 80.1µg/l (95% CI 76.7- 83.6) [ IQR 1-3: 56.9-109.0]

| Median UI (µg/L) | Continent  
N=3261 | Madeira  
N=196 | Azores  
N=370 |
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>84.9µg/L</td>
<td>69.5µg/L</td>
<td>46.2µg/L</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UI µg/L</th>
<th>Nº</th>
<th>%</th>
<th>Nº</th>
<th>%</th>
<th>Nº</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50</td>
<td>774</td>
<td>23.7</td>
<td>66</td>
<td>33.7</td>
<td>206</td>
<td>26.3</td>
</tr>
<tr>
<td>&lt;150</td>
<td>2712</td>
<td>83.0</td>
<td>180</td>
<td>91.8</td>
<td>365</td>
<td>98.6</td>
</tr>
<tr>
<td>≥150</td>
<td>549</td>
<td>17.0</td>
<td>16</td>
<td>8.2</td>
<td>5</td>
<td>1.4</td>
</tr>
</tbody>
</table>

The General Direction of Health decided to implement iodine supplementation (150-200µg/day) in preconception, pregnancy and lactation. The use of iodized salt is advised but no concrete measure has been undertaken. The impact of the supplementation will be evaluated in 2-3 years.
Belgium

Conclusions

• Fortification of bread with iodized salt corrected iodine deficiency in school-aged children, but not in pregnant women.

• Although nearly 60% of pregnant women in Belgium reported taking iodine supplements the median UIC still indicated MID particularly in the first trimester of pregnancy.

• Even though pregnant women are mildly iodine deficient in Belgium, the frequency of neonatal TSH >5 mU/L was low: 3%.

• To provide these women with an adequate iodine intake:
  – The use of both iodized salt in bread and iodized household salt needs to be increased.
  – Iodine supplements should be started before pregnancy.

Rodrigo Moreno-Reyes
Iodine deficiency in pregnant women in Austria

Pregnant women in the Vienna area: median UIC 87 μg/l.

Only 13.8% were in the recommended range of 150–249 μg/l, [21.5% UIC of 0–49 μg/l, 40.2% UIC 50–99 μg/l and 19.5% UIC 100–149 μg/l].

79 women on iodine supplementation vs no suppl (97.3 vs 80.1 μg/l, P = 0.006). Suppl doses of 100–150 μg per day insufficient to normalize iodine excretion.

Sodium and iodine concentrations in the urine were tightly correlated (R = 0.539, n = 61), suggesting that low intake of iodized salt might contribute to insufficient iodine supply.

Pregnant women in the Vienna area have a potentially clinically significant iodine deficiency. Currently recommended doses of iodine supplementation may not be sufficient.

Lindorfer et al Eur J of Clin Nutr online 10 December 2014; doi:10.1038/ejcn.2014.253
Improving UIC after universal salt iodization 2002-2003

No. of samples

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1991</td>
<td>58</td>
<td>57.5</td>
<td>92.5</td>
<td>117</td>
<td>112.5</td>
<td>135.2</td>
</tr>
<tr>
<td>1999-2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004-2005</td>
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<tr>
<td>2006-2008</td>
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<tr>
<td>2009</td>
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<td></td>
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<tr>
<td>2011</td>
<td></td>
<td></td>
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</tbody>
</table>

No. of samples:
- 2018
- 7045
- 4757
- 2144
- 118
- 104

ROMANIA
## Iodine Status in Most Populous Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Population (app 390millions)</th>
<th>UI (µg/L)</th>
<th>UI (µg/L) Pregnant</th>
<th>Monitoring</th>
<th>Iodisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>65</td>
<td>136</td>
<td>81*</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Germany</td>
<td>80</td>
<td>100</td>
<td>**</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Italy</td>
<td>62</td>
<td>80-100</td>
<td>80-100</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Spain</td>
<td>47</td>
<td>173</td>
<td>88***</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>Turkey</td>
<td>75</td>
<td>100</td>
<td>222</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>UK</td>
<td>60</td>
<td>80</td>
<td>60%&lt;150</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

* Lyon Area 2012
** Berlin 20% I deficiency 2003
*** N Spain Most women I deficient 2013

South Spain Insufficient 2011
Catalonia I Sufficient 2011
# Iodine Deficiency in Europe

## General and Pregnancy
- Hungary
- Ireland
- Italy
- UK
  - \( n = 4 \)

## Pregnancy Only
- Suboptimal iodine status in pregnant women \( n = 10 \)
- Albania, Belgium, Czech Republic, France, Greece, Israel, Norway, Portugal, Romania, Serbia
Our study suggests that the recommended quantities of salt, if iodized at 30 mg/kg, are sufficient to achieve the adequate daily iodine intake both in adults and children.

Forest plots showing effect of iodine supplementation on cognitive function (global cognitive index) in school-age children in mild-to-moderate iodine deficiency: (a) unadjusted SMD of the change from baseline.

(a)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Iodine</th>
<th>Control</th>
<th>SMD</th>
<th>SMD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>s.d.</td>
<td>Total</td>
<td>Mean</td>
</tr>
<tr>
<td>Gordon et al. 2009</td>
<td>0.7</td>
<td>2.5</td>
<td>84</td>
<td>0.1</td>
</tr>
<tr>
<td>Zimmermann et al. 2006</td>
<td>4.8</td>
<td>6.2</td>
<td>159</td>
<td>1.4</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td>243</td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: $\tau^2 = 0.02$; $\chi^2 = 2.30$, df = 1 ($P = 0.13$); $I^2 = 56%$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: $Z = 2.84$ ($P = 0.005$)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

(b)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Iodine</th>
<th>s.e.m.</th>
<th>Total</th>
<th>Control</th>
<th>s.e.m.</th>
<th>Total</th>
<th>Weight %</th>
<th>SMD</th>
<th>SMD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SMD</td>
<td>s.e.m.</td>
<td>Total</td>
<td>Total</td>
<td>s.e.m.</td>
<td>Total</td>
<td>Weight %</td>
<td>IV, random, 95% CI</td>
<td>IV, random, 95% CI</td>
</tr>
<tr>
<td>Gordon et al. 2009</td>
<td>0.148</td>
<td>0.132</td>
<td>84</td>
<td>82</td>
<td>0.134</td>
<td>34.8</td>
<td></td>
<td>0.15 (--0.11, 0.41)</td>
<td></td>
</tr>
<tr>
<td>Zimmermann et al. 2006</td>
<td>0.331</td>
<td>0.085</td>
<td>159</td>
<td>151</td>
<td>0.085</td>
<td>65.2</td>
<td></td>
<td>0.33 (0.16, 0.50)</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td></td>
<td></td>
<td>243</td>
<td>233</td>
<td></td>
<td>100.0</td>
<td></td>
<td>0.27 (0.10, 0.44)</td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 1.36$, df = 1 ($P = 0.24$); $I^2 = 26%$</td>
<td></td>
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</tr>
<tr>
<td>Test for overall effect: $Z = 3.07$ ($P = 0.002$)</td>
<td></td>
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</tbody>
</table>
Studies investigating the effect of maternal iodine supplementation on neurodevelopmental indices in the child.

European Initiatives-IGN

UK: UK Iodine Group

Activities: Advocacy, meetings, publications, research

Active research in several countries eg Belgium, Switzerland, Norway, Turkey etc

EU: Commission research call- Evaluating existing screening and prevention programmes. EUthyroid programme grant application in progress. SUCCESS!!
Horizon 2020 3yr grant EUthyroid

EU: Plan for iodine meeting with EU 2017

ETA: ICCIDD Satellite meeting
EUthyroid Work Packages

WP No
1 Outcome research and registry data
2 Harmonisation of national thyroid and IDD monitoring studies
3 Thyroglobulin
4 Maternal iodine status during pregnancy and neuropsychological development of the offspring
5 Health economy, health technology assessment and health policy
6 Dissemination
7 Management
Summary

• Discrepancies between schoolchildren and pregnant women
• Re-emerging I deficiency in industrialised countries
• Iodised salt and food industry
• Necessity to lower salt consumption

• I status is some countries is satisfactory
• Many countries have inadequate Iodine status in pregnancy
• About 400m population from 20 countries still have no/limited access to iodised salt
Acknowledgements

National Coordinators IGN