Iodine Deficiency in Pregnancy

R. Negro
U.O. Endocrinologia
P.O. «V. Fazzi Lecce
Iodine and Thyroid Hormones
Iodine and Thyroid Hormones feed-back
## Iodine Deficiency Characteristics

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From the World Health Organization (WHO)/United Nations Children's Fund (UNICEF)/International Council for Control of Iodine Deficiency Disorders (ICCIDD)
Increased Thyroglobulin
Increased $T_3/T_4$ ratio
Thus during pregnancy, the physiologic changes that take place in maternal thyroid economy lead to an increase in thyroid hormone production of ~50% above preconception baseline hormone production. In order to achieve the necessary increment in hormone production, the iodine intake needs to be increased during early pregnancy.
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<td>Neonatal TSH (&gt;5 IU/mL)</td>
<td>&lt;3%</td>
<td>3-20%</td>
<td>20-40%</td>
<td>&gt;40%</td>
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<tr>
<td>Cretinism</td>
<td>No</td>
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From the World Health Organization (WHO)/United Nations Children's Fund (UNICEF)/International Council for Control of Iodine Deficiency Disorders (ICCIDD)
Iodine
Thyroxine
Placenta
maternal serum: 150 nmol/L
Extraembryonic coelom with coelomic fluid: 1 nmol/L
Amniotic cavity with developing embryo: 0.05 - 0.2 nmol/L
Placental Deiodinase Activity
Morreale de Escobar G. et al. J Clin Endocrinol Metab 2000; 85: 3975-87
Thyroid Hormones and Fetal Central Nervous System

• Thyroid hormones are involved in:
  1) Neurogenesis
  2) Cell migration
  3) Myelination
Is neuropsychological development related to maternal hypothyroidism or to maternal hypothyroxinemia?
• In humans T₄ is already present in the coelomic fluid bathing the yolk sack, as early as the 6th gestational week (Contemprè B, 1993)

• In the fetal brain, T₄ and T₃ are present in significant amounts by the 10th week after conception (Bernal J 1984)

• At term, about 30-50% of T₄ present in neonates represents the maternal contribution (Vulsma T 1989)
Hypothyroidism

Due to severe dietary iodine deficiency

Severe hypothyroidism in BOTH Mom and fetus

Impaired cognitive development

Poor growth

Iodine deficiency is considered the most common cause of preventable brain damage in the world today
Iodine deficiency

• In 2011, 393 million Europeans (44.2%), including pregnant women and those of child-bearing age, were estimated to be iodine deficient.

Iodine status in pregnancy: dietary habits and geographical origin

322 pregnant women 3rd trimester

UIC < 50 mcg/L

Iodine Prophylaxis and Risk of Maternal Thyroid Failure in Conditions of Mild Iodine Deficiency

100 consecutive thyroperoxidase antibody-negative pregnant women from a mildly iodine-deficient area.

62 women who had regularly used iodized salt for at least 2 yr prior to becoming pregnant (Long Term)
38 commenced iodized salt consumption upon becoming pregnant (Short Term)
Iodine Prophylaxis and Risk of Maternal Thyroid Failure in Conditions of Mild Iodine Deficiency

Moleti M et al. J Clin Endocrinol Metab 2008
Iodine Prophylaxis and Risk of Maternal Thyroid Failure in Conditions of Mild Iodine Deficiency

Moleti M et al. J Clin Endocrinol Metab 2008
Early Iodine Supplementation: The Offspring

KI 200mcg from 4-6 w; FT4 >20th

KI 200mcg from 12-14 w; FT4 <10th

KI 200mcg from 37-40 w; FT4 <10th

Developmental Quotient

Berbel P et al. Thyroid 2009;19: 511-19
Effect of inadequate iodine status in UK pregnant women on cognitive outcomes in their children

Methods: We analysed mother–child pairs from the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort by measuring urinary iodine concentration from 1040 first-trimester (median 10 weeks) pregnant women, and a measure of intelligence quotient (IQ) in the offspring at age 8 years.

Women’s results for iodine-to-creatinine ratio were dichotomised to less than 150 μg/g or 150 μg/g or more on the basis of WHO criteria for iodine deficiency or sufficiency in pregnancy.
Maternal iodine-to-creatinine ratio (mcg/g) in the first trimester
Mild iodine deficiency during pregnancy is associated with reduced educational outcomes in the offspring

- 228 mothers-offspring (antenatal clinics at the Royal Hobart Hospital, Tasmania, Australia)
- 1-3 urine samples collected (UIC): $<150 \ \mu g/L$
- Children evaluated 9yr

Mild iodine deficiency during pregnancy is associated with reduced educational outcomes in the offspring

Results
Children whose mothers had UIC <150 μg/L had reduction
10.0% in spelling
7.6% in grammar
5.7% in English-literacy

Low Urinary Iodine Excretion during Early Pregnancy Is Associated with Alterations in Executive Functioning in Children

- 692 children 4 yr tested for impairment of executive functioning (Behavior Rating Inventory of Executive Function: inhibition, shifting, emotional control, working memory, planning, global executive composite).

- The children of mothers with low urinary iodine (<10th percentile) showed higher scores on the problem scales of inhibition, and working memory

Iodine supplementation

- 133 women supplemented with 300mcg of potassium iodine (<10w)
- 61 women not supplemented
- Children 3-18 months tested

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<tr>
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<th>Iodine 300</th>
<th>P value</th>
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<tbody>
<tr>
<td>MDI</td>
<td>108.9</td>
<td>109.2</td>
<td>ns</td>
</tr>
<tr>
<td>PDI</td>
<td>102.6</td>
<td>108.6</td>
<td>0.02</td>
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Velasco I J Clin Endocrinol Metab 2009;94:3234-41.
Forest plots showing effect of iodine supplementation on cognitive function (global cognitive index) in school-age children in mild-to-moderate iodine deficiency.

Gordon et al. 2009
Zimmermann et al. 2006

Unadjusted
P=0.005

Adjusted
P=0.002

Optimal UIC in Pregnancy

TSH, FT₄, and Tg in different UIC groups

Shi X et al. J Clin Endocrinol Metab 2015
Optimal UIC in Pregnancy

Shi X et al. J Clin Endocrinol Metab 2015
Optimal UIC in Pregnancy

Prevalence of Thyroid Antibody Positivity according to UIC

Shi X et al. J Clin Endocrinol Metab 2015
Iodine supplementation in pregnancy

• According to the WHO, pregnant and lactating women should be provided with 250 μg iodine daily.

• This may be achieved by administering iodine supplements containing 150–250 μg of iodine in the form of potassium iodide (vitamin supplements).

• Adequate iodine intake during pregnancy (250 μg of iodine daily) should be preferably achieved before conception.

• In countries with successful salt iodization programmes, pregnancy-desiring women should be additionally supplemented with 50 μg of iodine. The daily intake of iodine should not exceed 500 μg.
Multivitamin pills

- Integral mamma 0
- Elevit 0
- Multicentrum materna DHA 150
- Agena mamma 175
- Neogravigil 175
- Gynefam mamma 175
- Natalben 200
- Thirodium 100/225