Iodine Deficiency in Pregnancy

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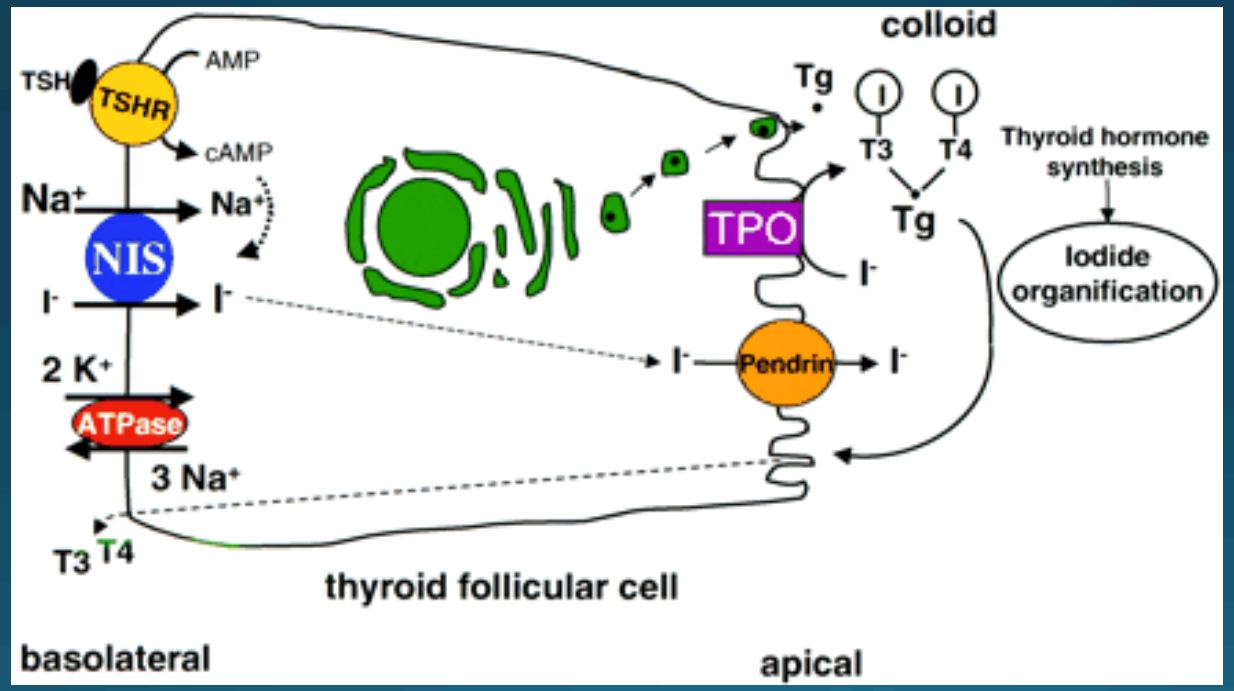
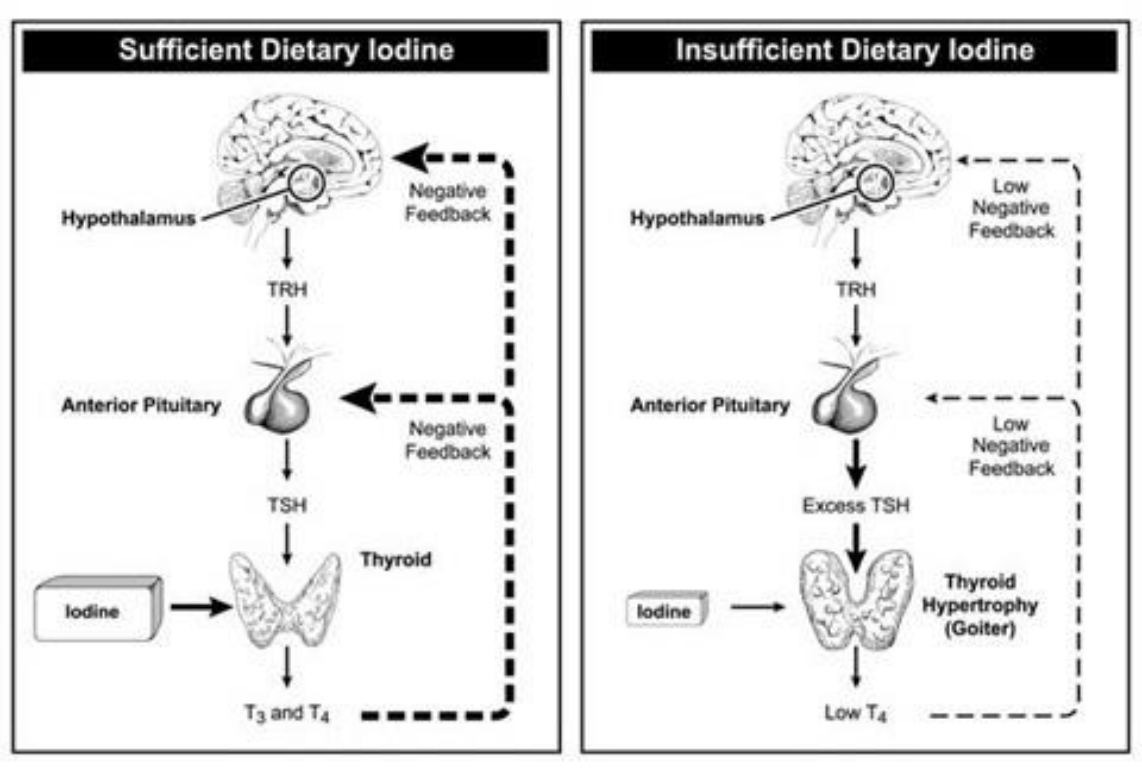
Iodine and Thyroid Hormones



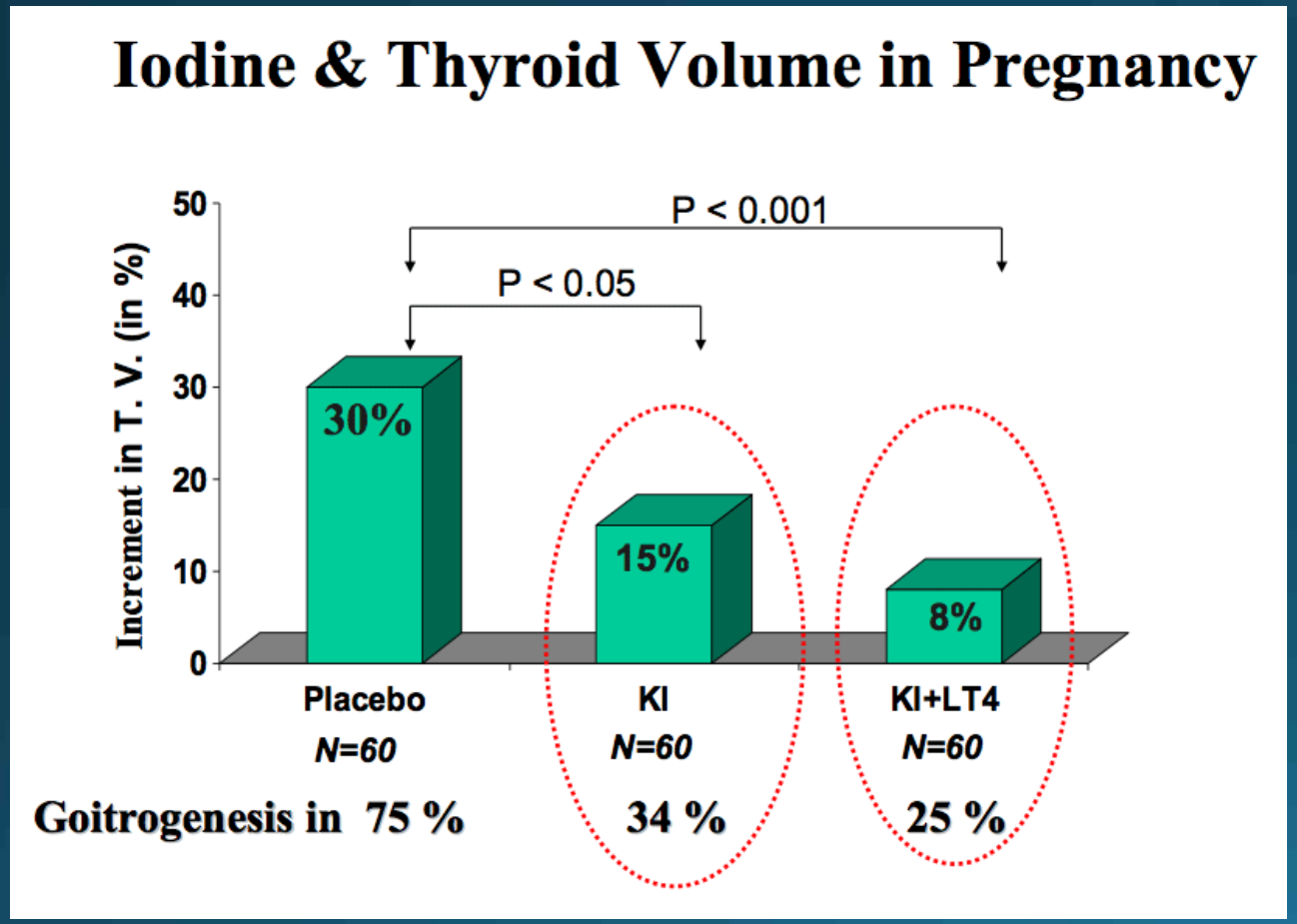
Iodine and Thyroid Hormones feed-back



Iodine Deficiency Characteristics

Iodine Deficiency	None	Mild	Mode	Severe
Median urine iodine (mcg/dL)	>100	50-99	20-49	<20
Goiter prevalence	<5%	5-20%	20-30%	>30%

From the World Health Organization (WHO)/United Nations Children's Fund (UNICEF)/International Council for Control of Iodine Deficiency Disorders (ICCIDD)



Increased Thyroglobulin

Increased T3/T4 ratio

Physiologic Changes during Pregnancy
Increased renal I- clearance
Decreased plasma I- and placental I- transport to the fetus
First-trimester increase in hCG
Increased serum TBG
Inner-ring deiodination of T_4 and T_3 by placenta

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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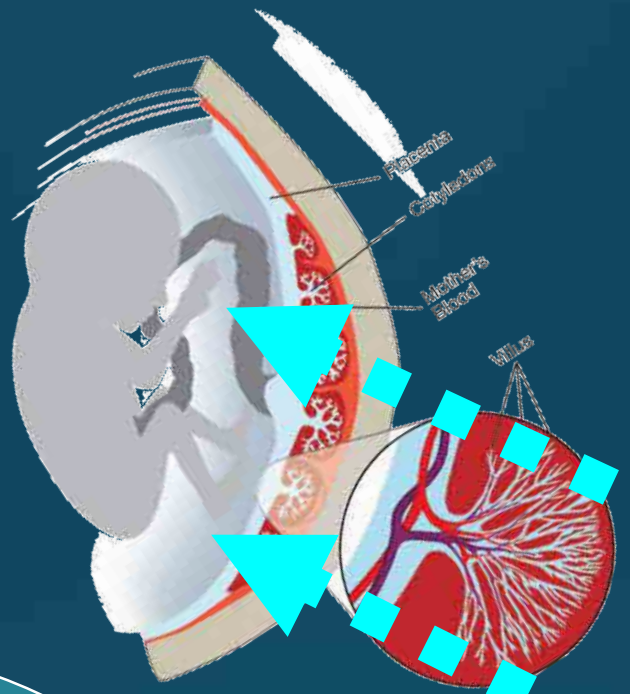
Neonatal TSH (>5 IU/mL)	<3%	3-20%	20-40%	>40%
Cretinism	No	No	Yes	Yes

From the World Health Organization (WHO)/United Nations Children's Fund (UNICEF)/International Council for Control of Iodine Deficiency Disorders (ICCIDD)



Placental Deiodinase Activity

Iodine

Thyroxine

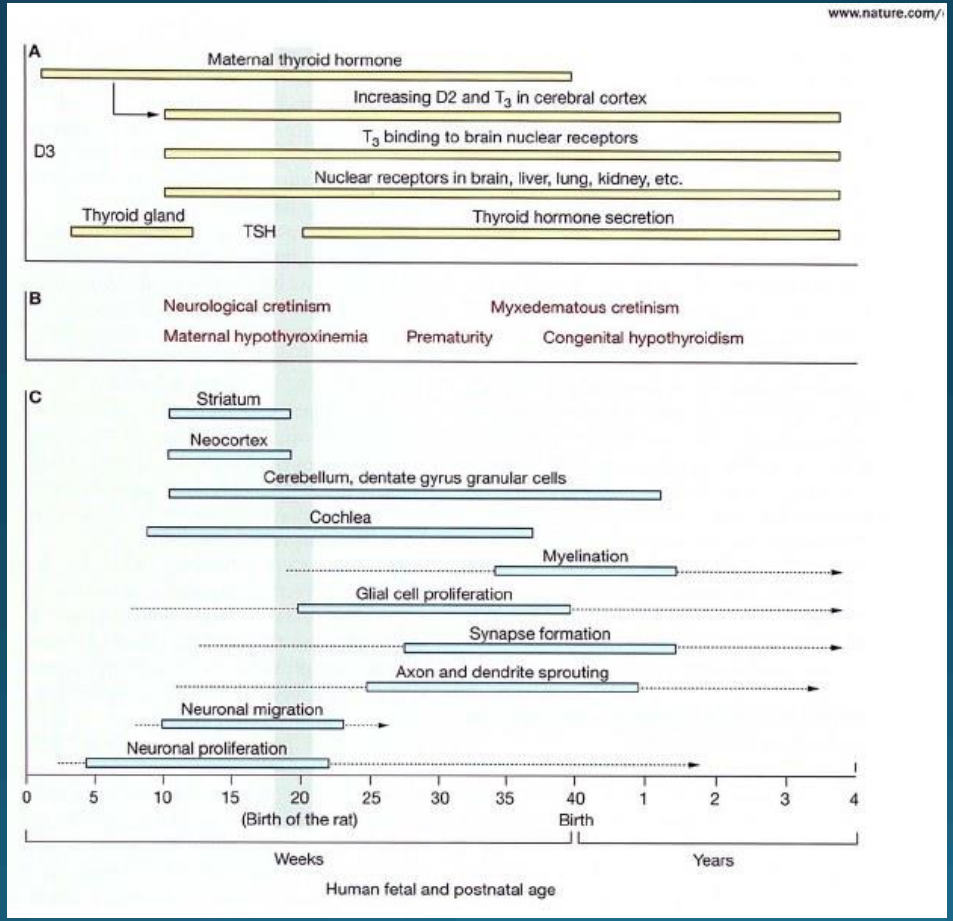
Morreale de Escobar G. et al. J Clin Endocrinol Metab 2000; 85: 3975-87

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?

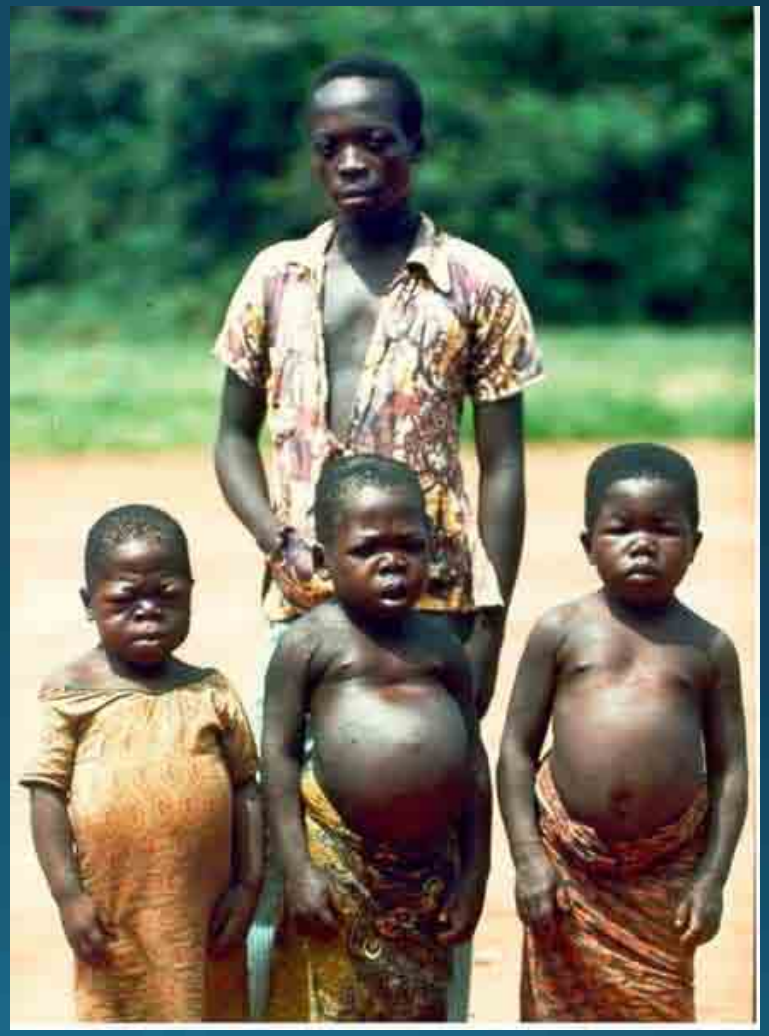


Morreale de Escobar G. et al. J Clin Endocrinol Metab 2000; 85: 3975-87

- 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

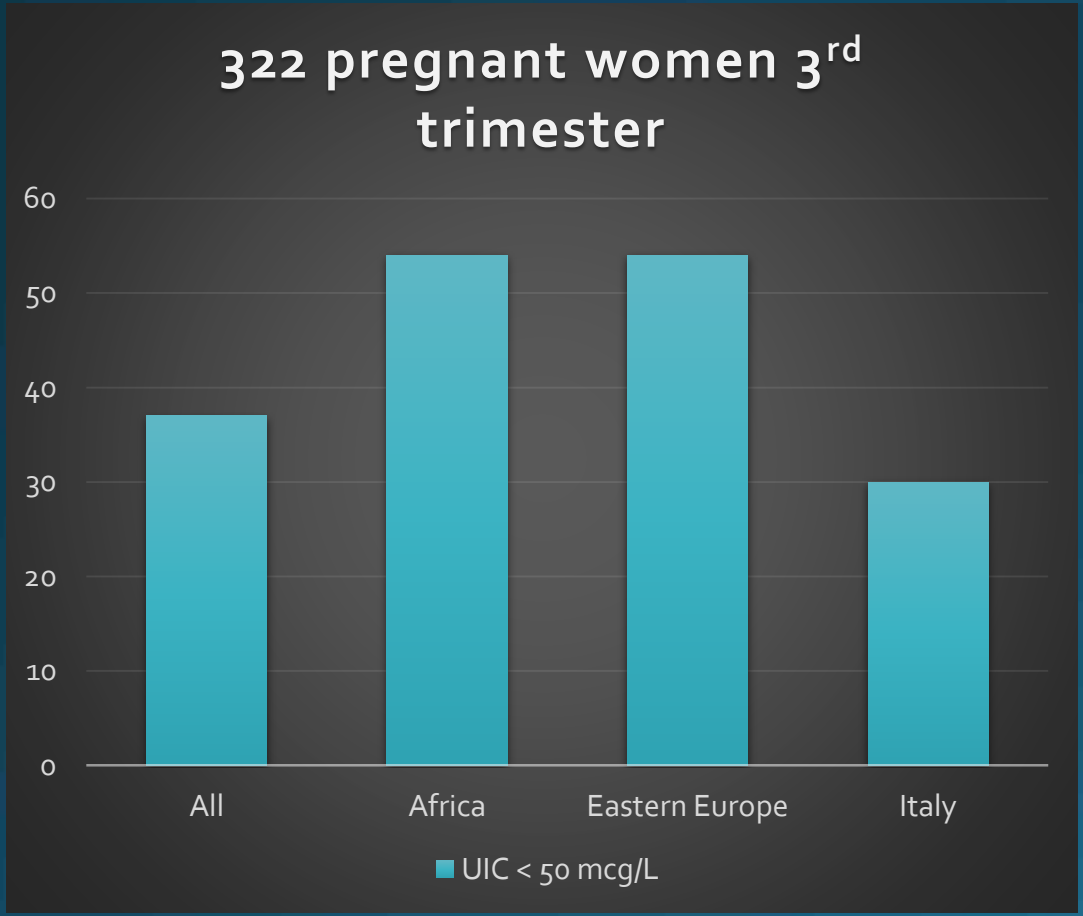


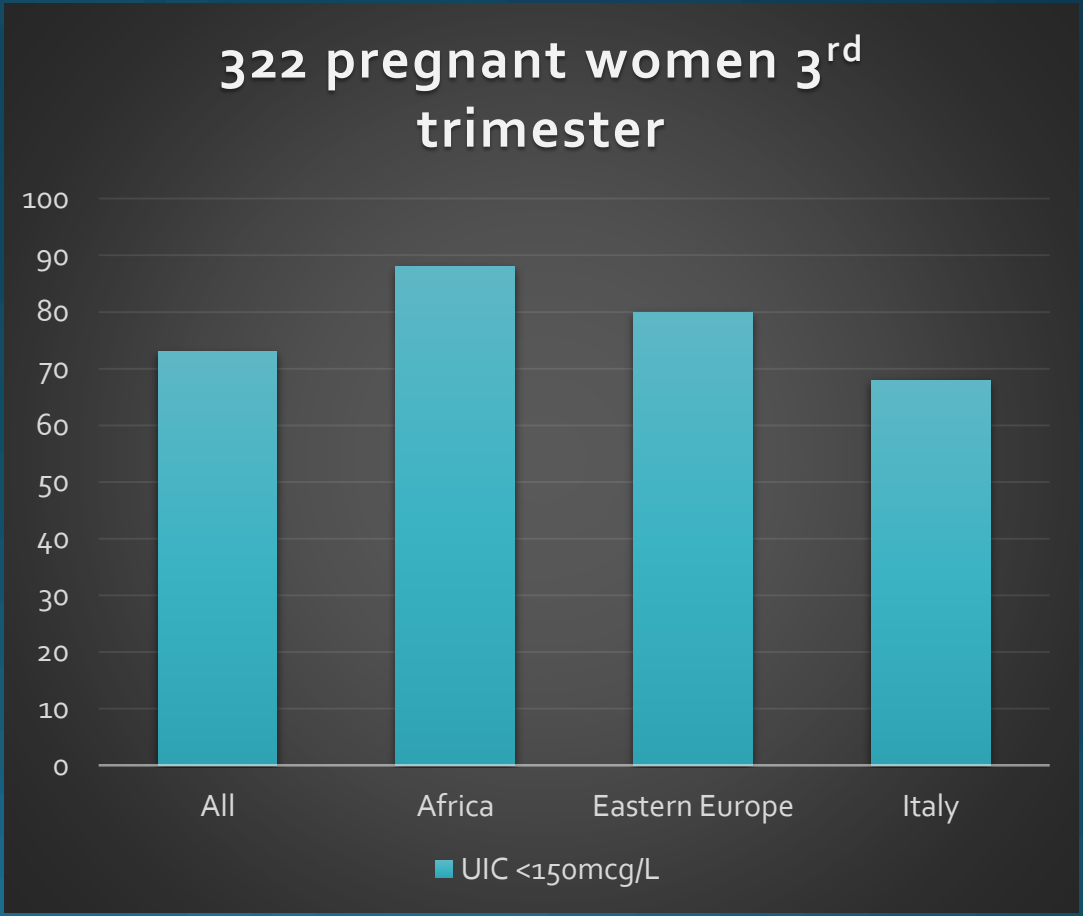
Iodine deficiency

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

•Andersson M. J Nutr 2012 ;142:744-750.

Iodine status in pregnancy: dietary habits and geographical origin





Mian C et al. Clin Endocrinol 2009

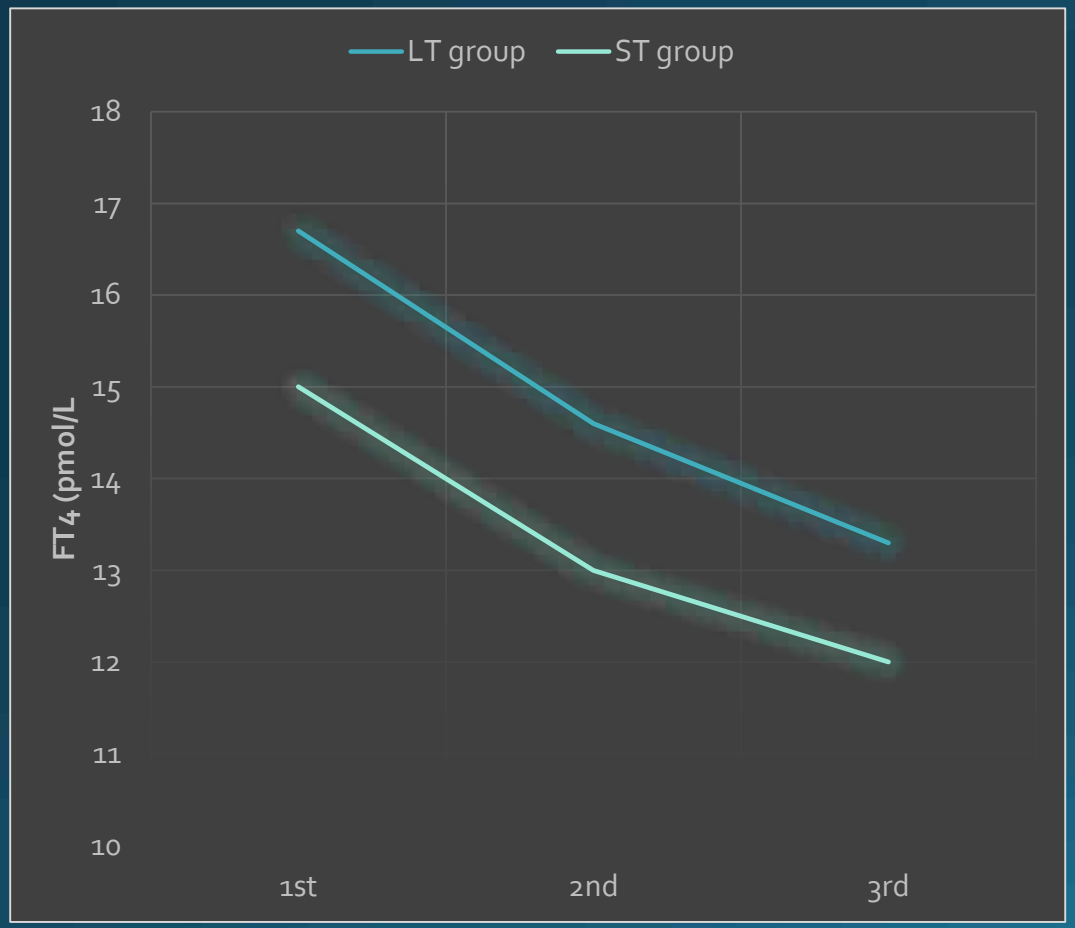
Iodine Prophylaxis and Risk of Maternal Thyroid Failure in Conditions of Mild Iodine Deficiency

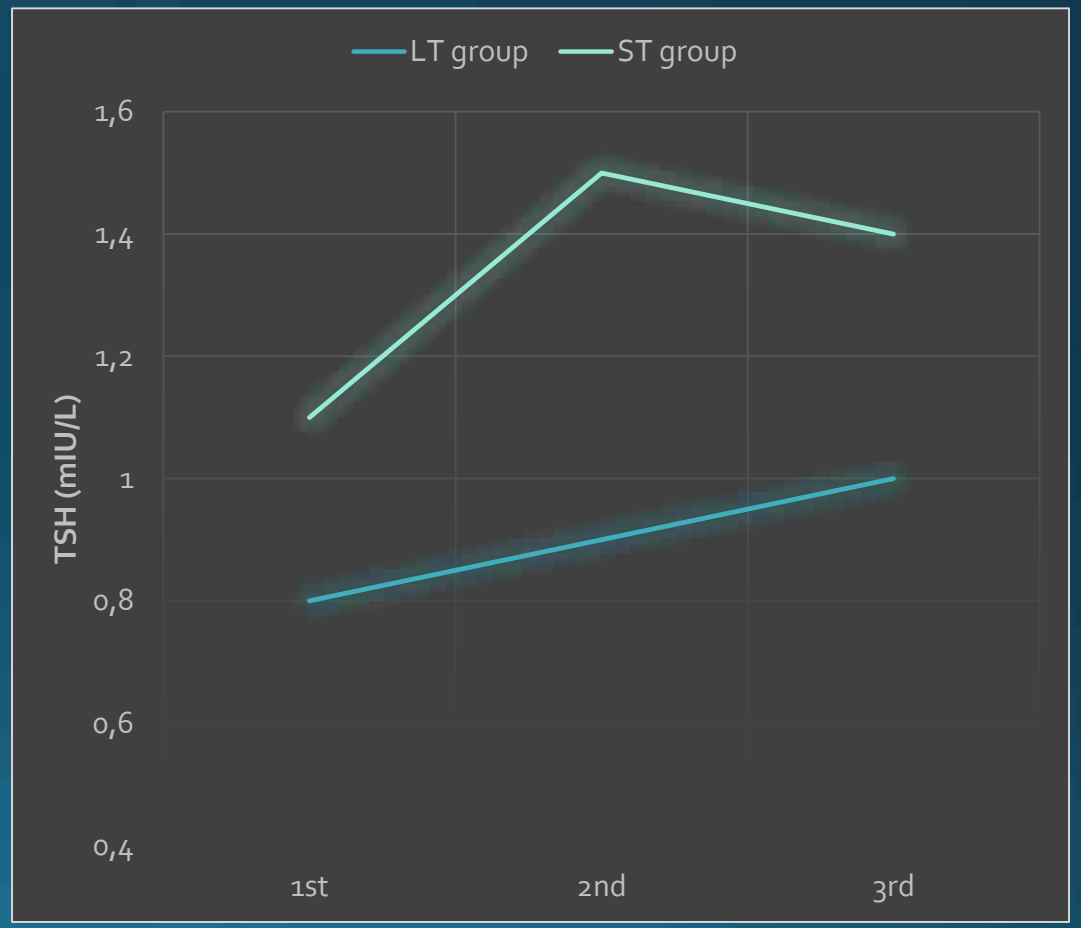
100 consecutive thyroperoxidase antibody-negative pregnant women from a mildly iodine-deficient area.

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)

Moleti M et al. J Clin Endocrinol Metab 2008

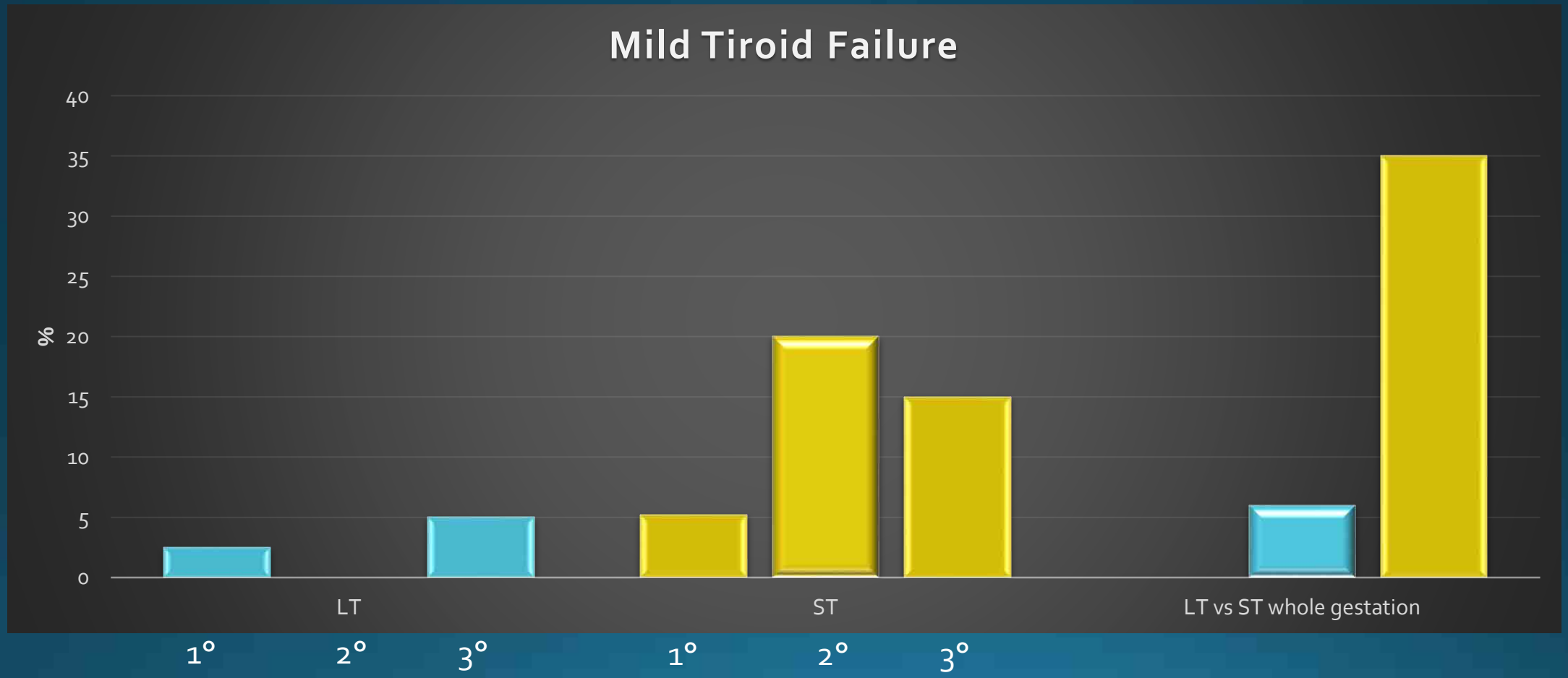
Iodine Prophylaxis and Risk of Maternal Thyroid Failure in Conditions of Mild Iodine Deficiency





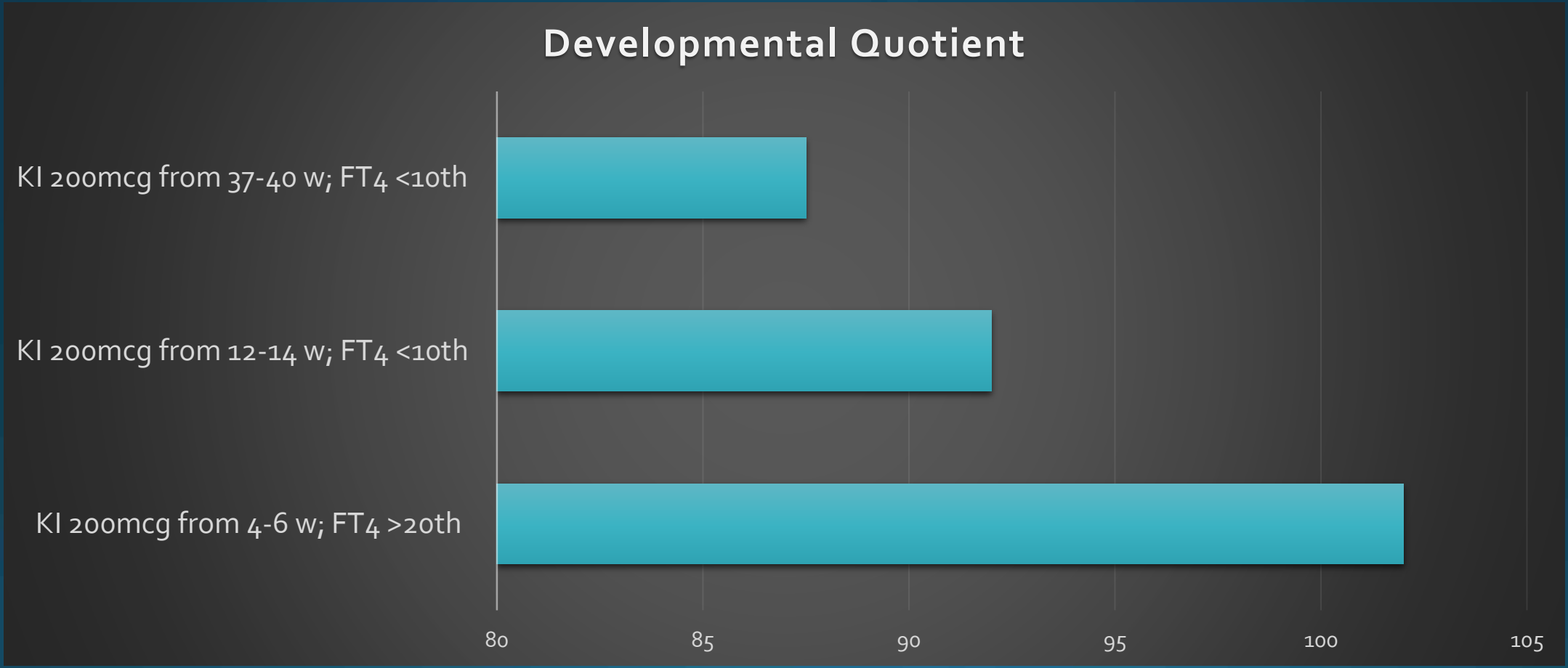
Moleti M et al. J Clin Endocrinol Metab 2008

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



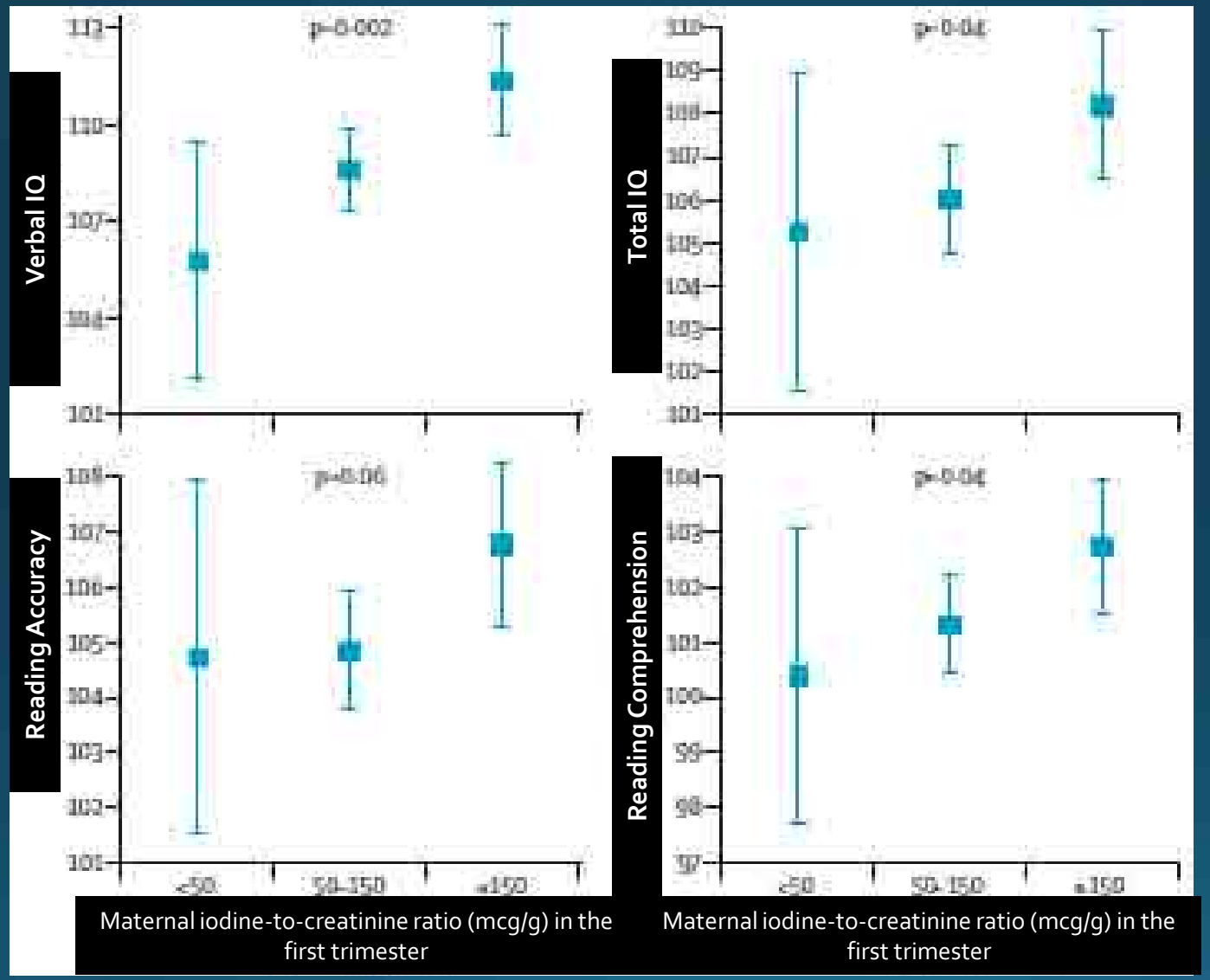
Berbel P et al. Thyroid 2009;19: 511-19

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 off spring 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.

Bath .S et al. Lancet 2013; 27: 331-7



Bath .S et al. Lancet 2013; 27: 331-7

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 µg/L

- Children evaluated 9yr

Hynes KL et al. J Clin Endocrinol Metab 2013; 98: 1954-62

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

Hynes KL et al. J Clin Endocrinol Metab 2013; 98: 1954-62

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

van Mil NH et al. J. Nutr. 2012;142:2167-2174

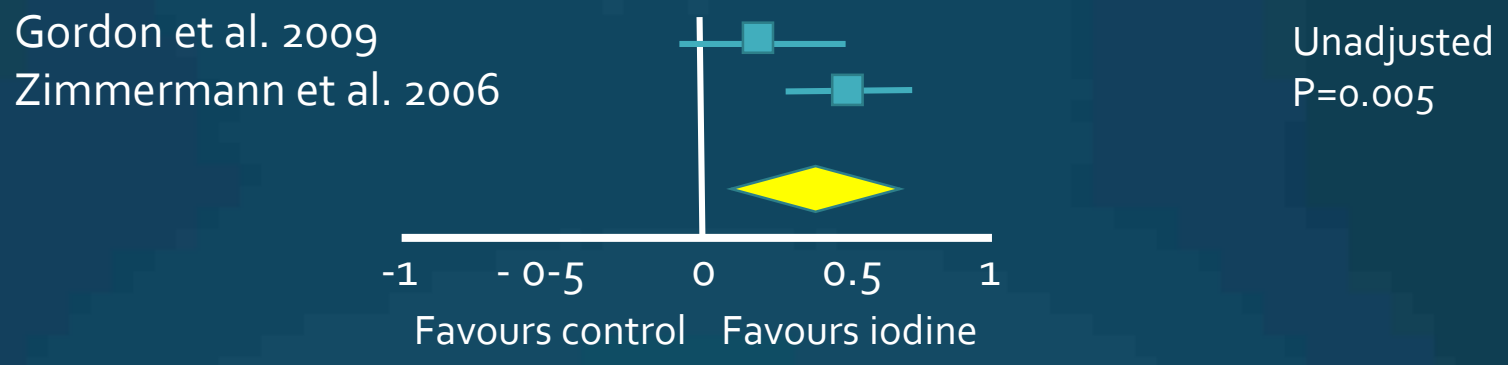
Iodine supplementation

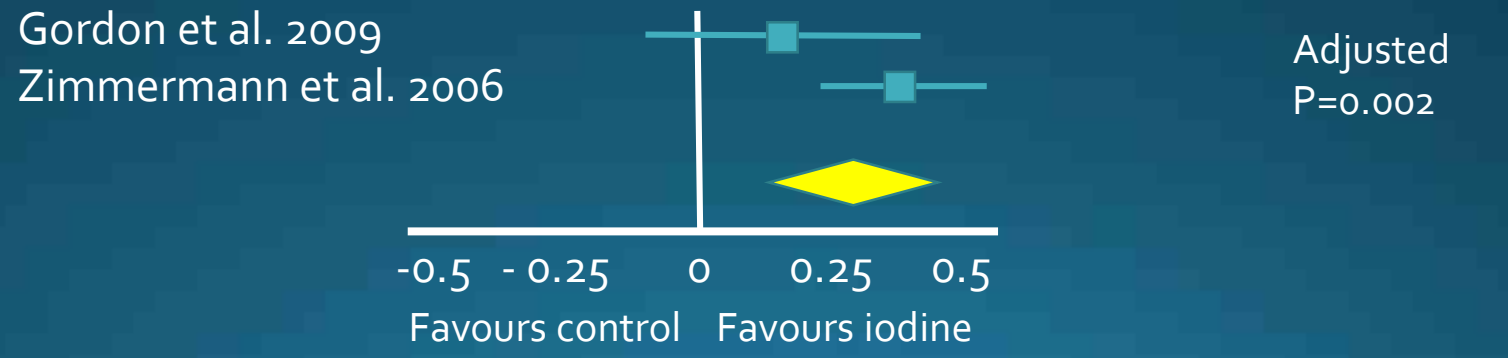
- 133 women supplemented with 300mcg of potassium iodine (<10w)
- 61 women not supplemented
- Children 3-18 months tested

	No Iodine	Iodine 300	P value
MDI	108.9	109.2	ns
PDI	102.6	108.6	0.02

Velasco I J Clin Endocrinol Metab 2009;94:3234-41.

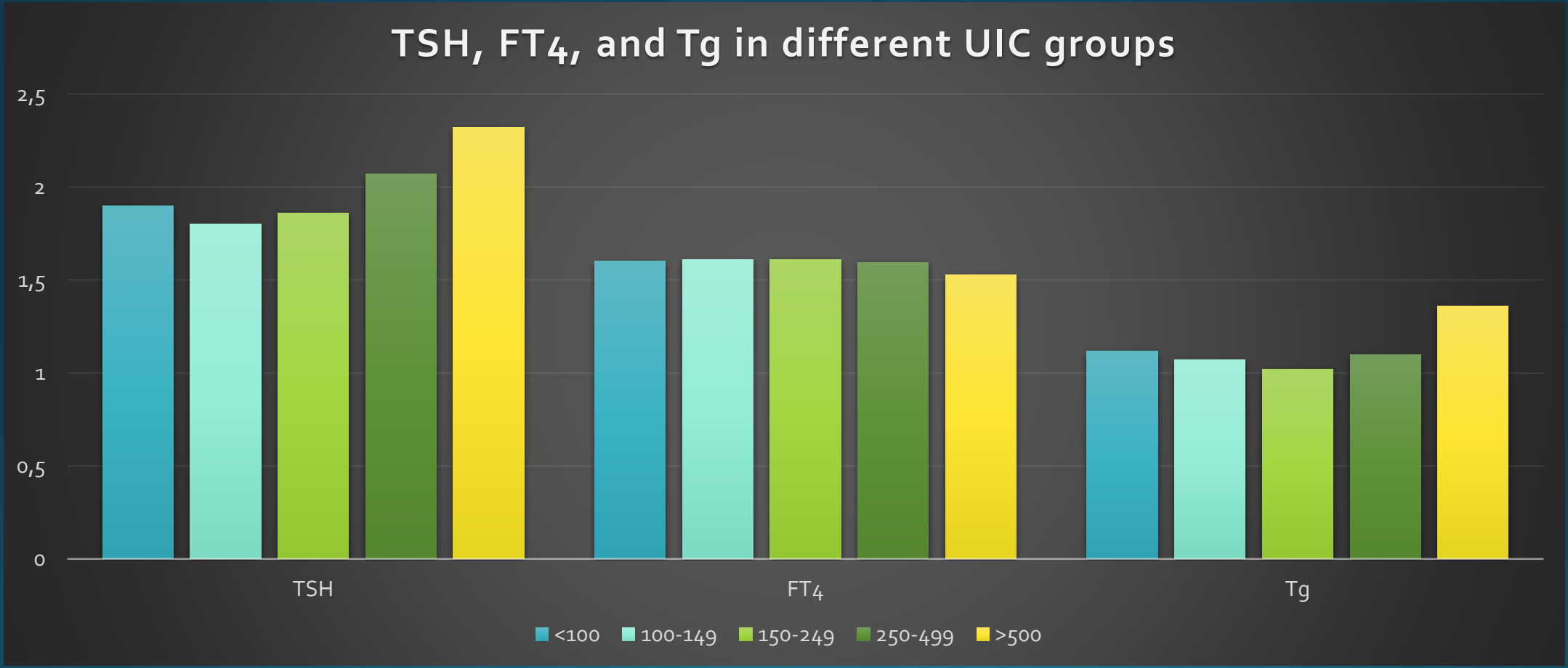
Forest plots showing effect of iodine supplementation on cognitive function (global cognitive index) in school-age children in mild-to-moderate iodine deficiency.





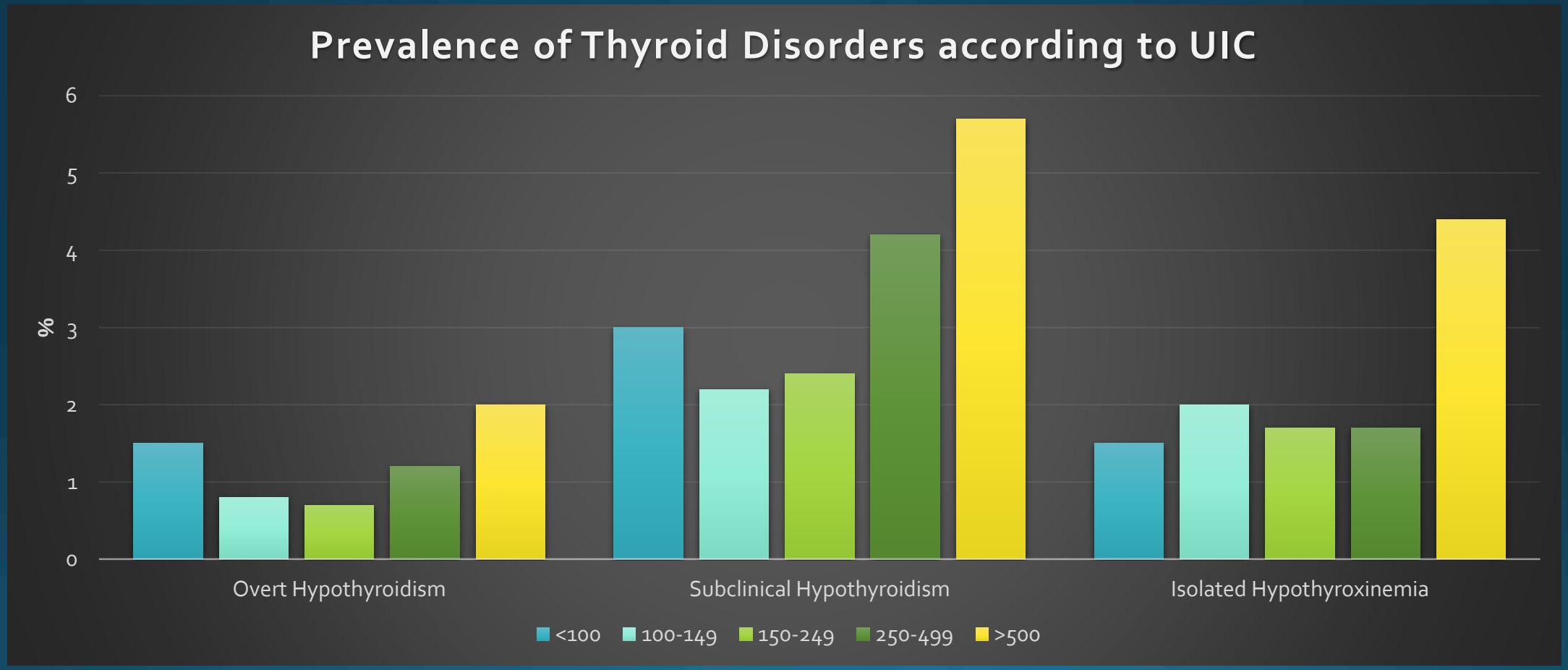
Taylor P N et al. Eur J Endocrinol 2014;170:R1-R15

Optimal UIC in Pregnancy



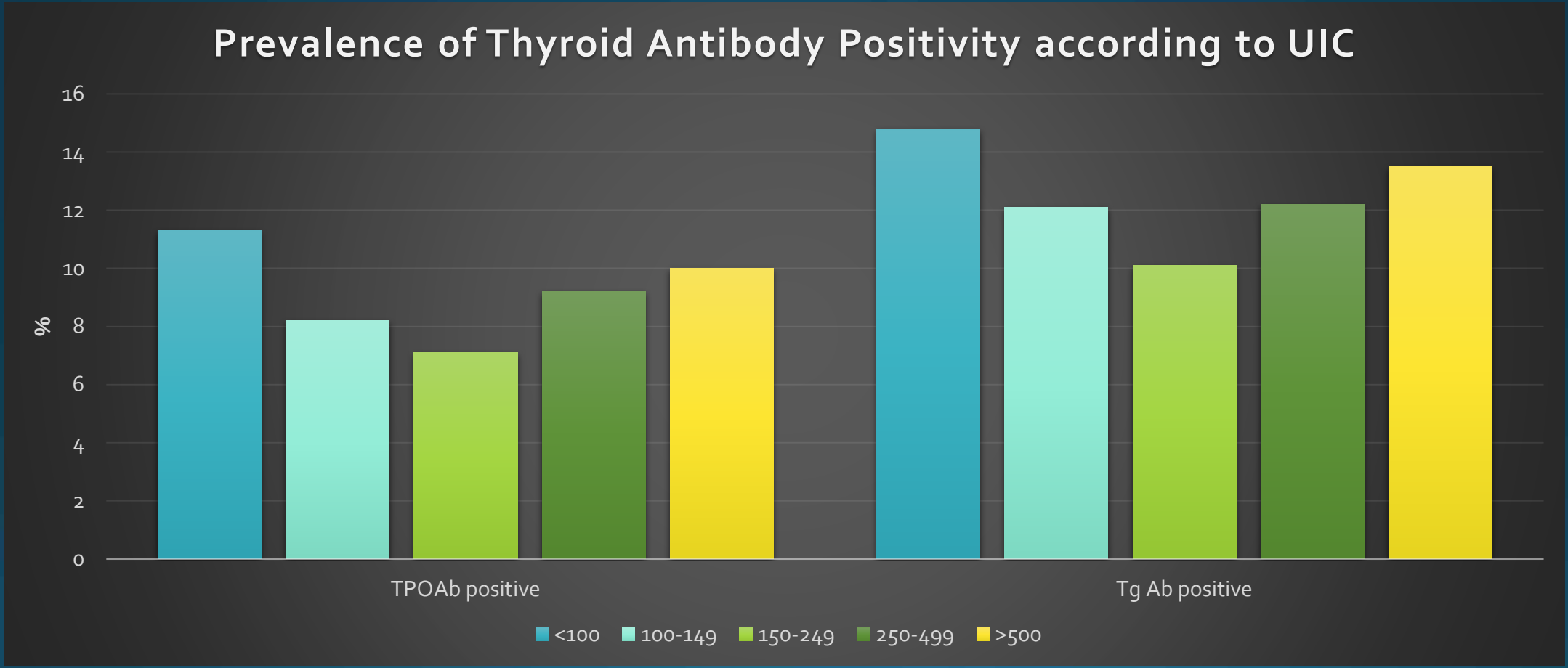
Shi X et al. J Clin Endocrinol Metab 2015

Optimal UIC in Pregnancy



Shi X et al. J Clin Endocrinol Metab 2015

Optimal UIC in Pregnancy



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.

WHO, Unicef, ICCIDD 2007

Andersson M et al. Pub Health Nutr 2007

Multivitamin pills

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