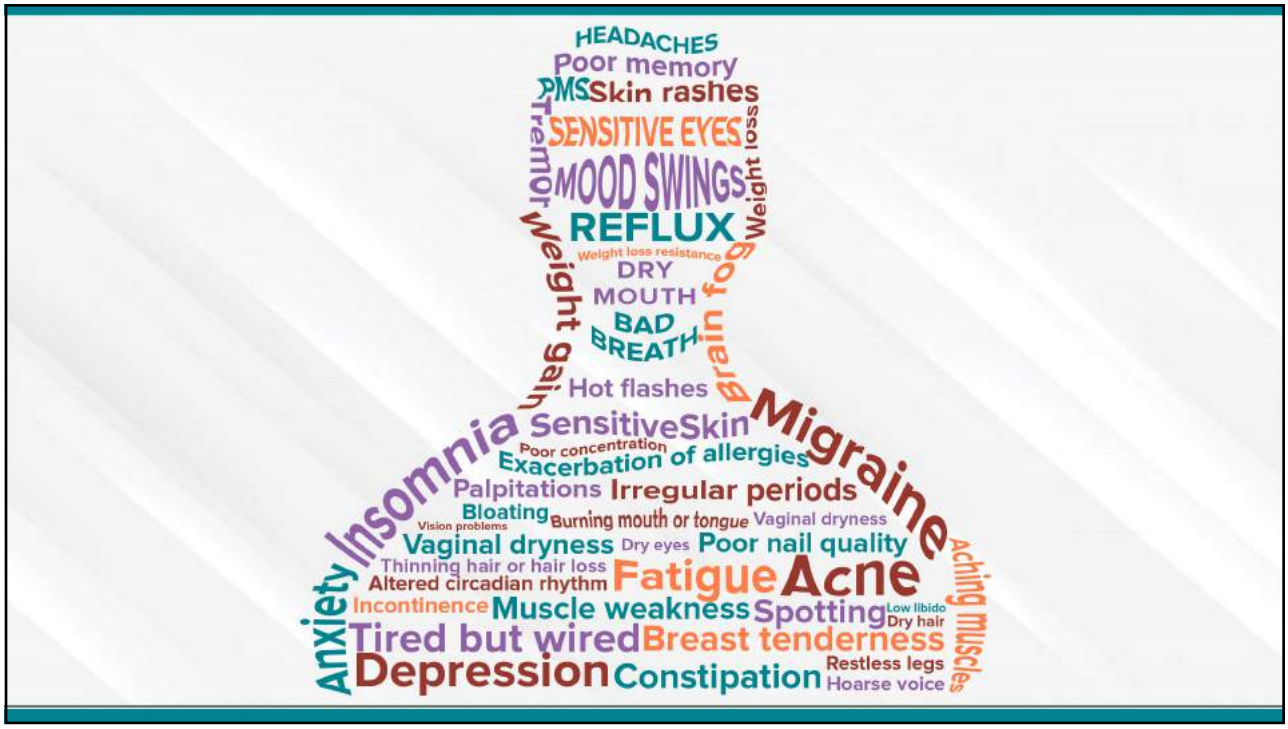
THYROID AND WHOLE BODY HEALTH

Optimizing Function with Nutrition and Immune Modulation

Ciara Wright PhD DipNT

Glenville NUTRITION
COURSES CLINICS CENTRES

1



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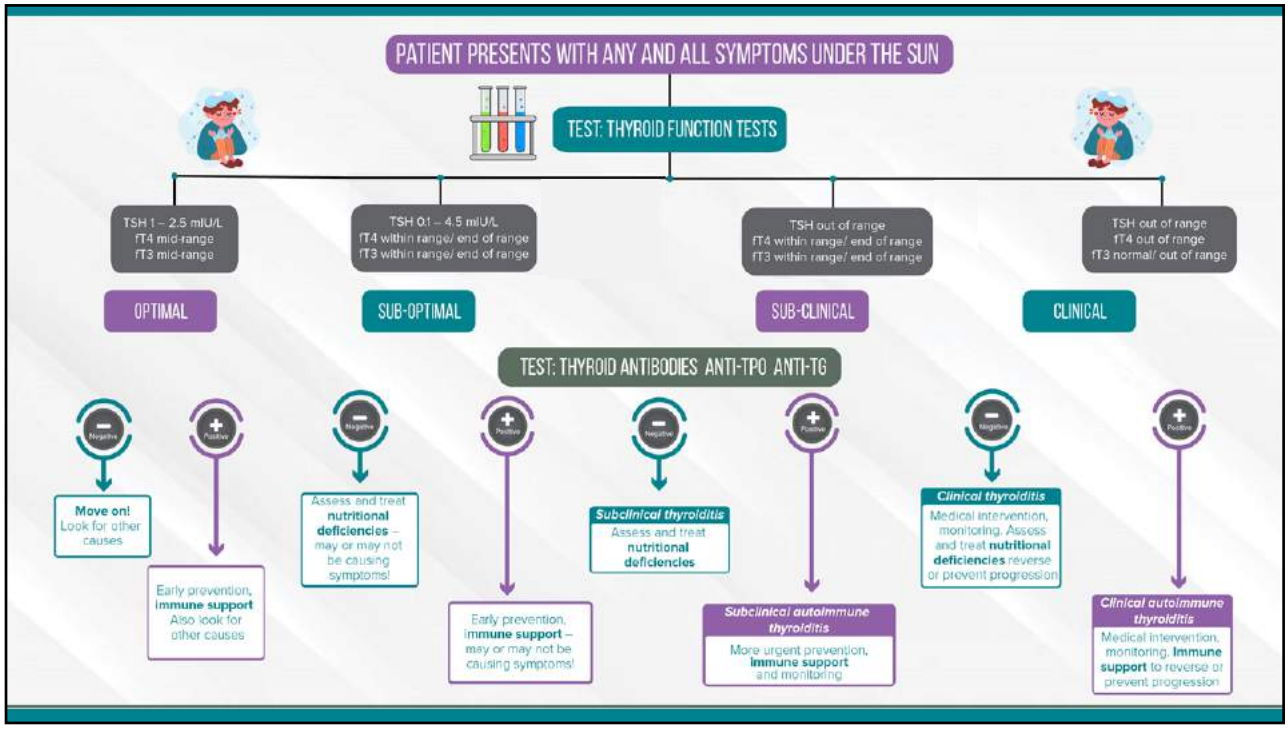
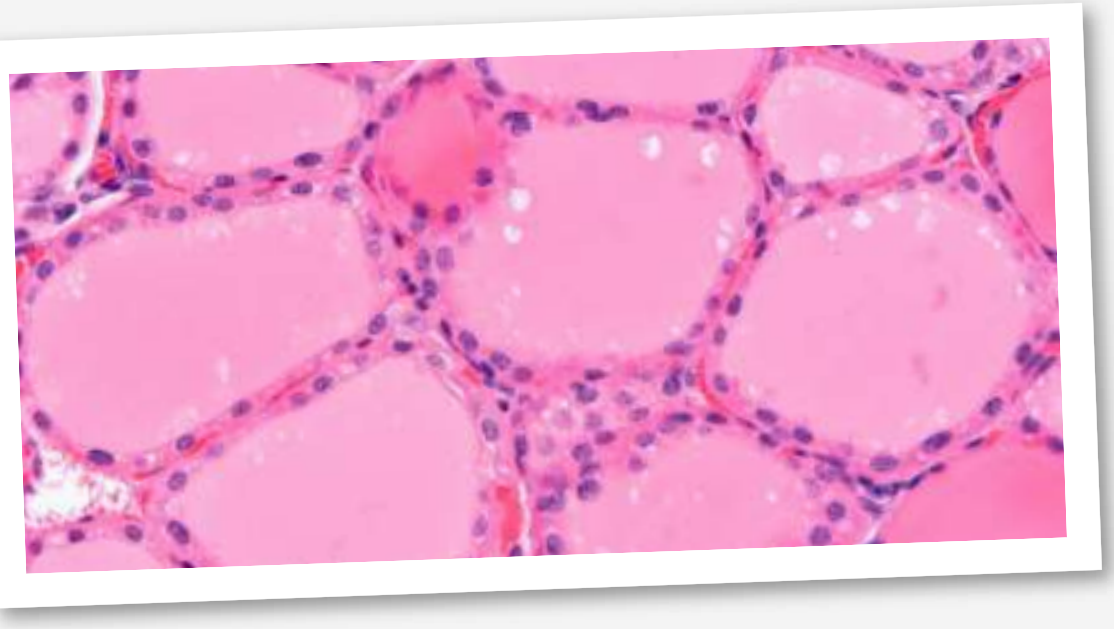


3

Essential Nutrients for Thyroid Function…?

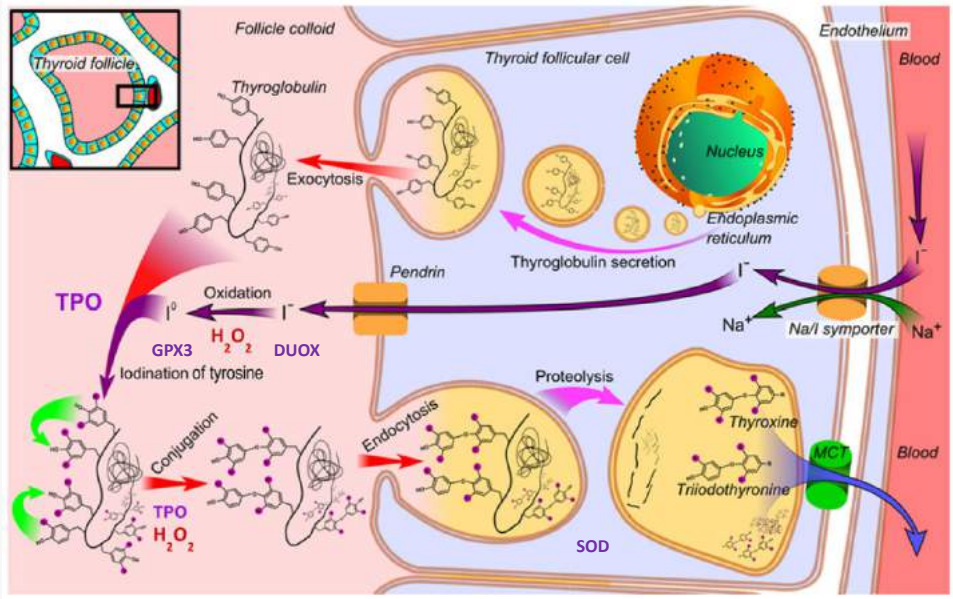
- IODINE
- SELENIUM
- IRON
- ZINC
- MAGNESIUM
- TYROSINE
- PHENYLALANINE
- B VITAMINS
- VITAMIN D
- VITAMIN A
- OMEGA-3

4



US Dept of Health and Human Services

5



Häggström 2014 Wiki J of Medicine

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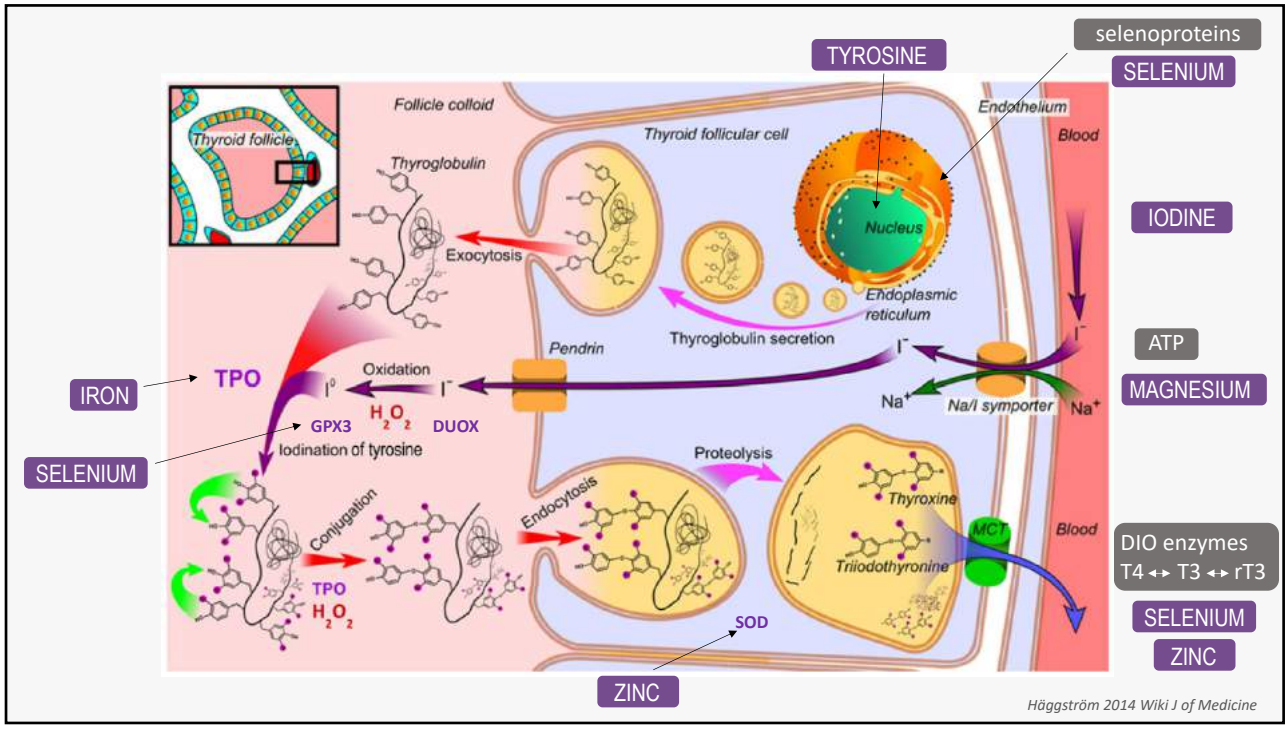
TYROSINE
selenoproteins
SELENIUM
Follicle colloid
Thyroid follicle
Thyroglobulin
Exocytosis
Thyroid follicular cell
Endothelium
Blood
Nucleus
Endoplasmic reticulum
IODINE
Thyroglobulin secretion
Pendrin
ATP
IRON
TPO
Oxidation
I^0
I^-
H_2O_2
GPX3
DUOX
Iodination of tyrosine
Na^+
Na/I symporter
MAGNESIUM
SELENIUM
Proteolysis
Conjugation
Endocytosis
Thyroxine
Triiodothyronine
MCT
Blood
DIO enzymes
T4 ↔ T3 ↔ rT3
TPO
H_2O_2
SOD
SELENIUM
ZINC
ZINC
Häggström 2014 Wiki J of Medicine

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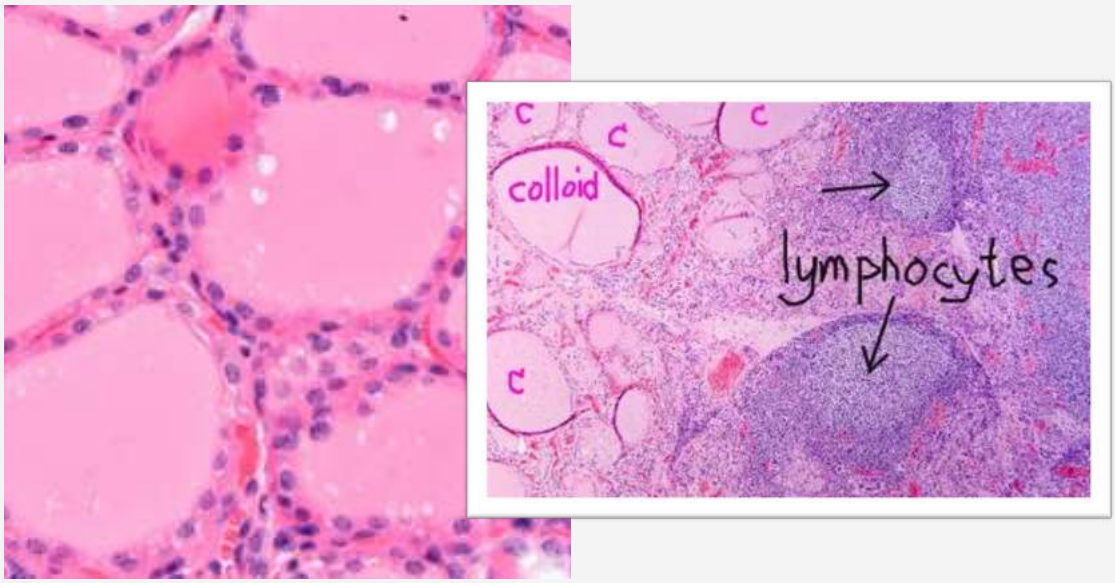

C
C
C
colloid
lymphocytes
C

8

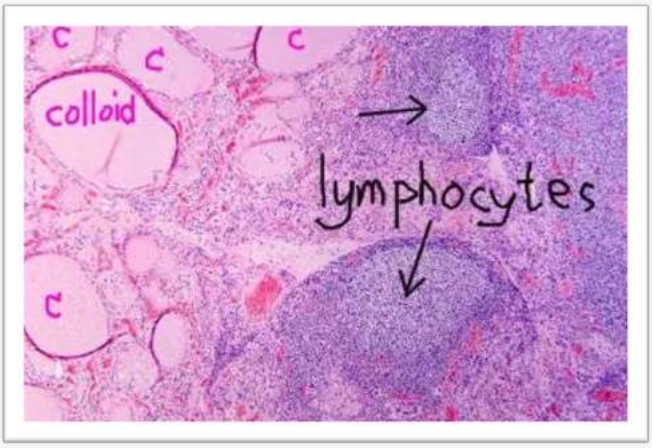
Anti-TPO

Anti-Tg

Anti-TRAb

IMMUNE SUPPORT

- SELENIUM
- ZINC
- VITAMIN D
- VITAMIN A
- OMEGA-3



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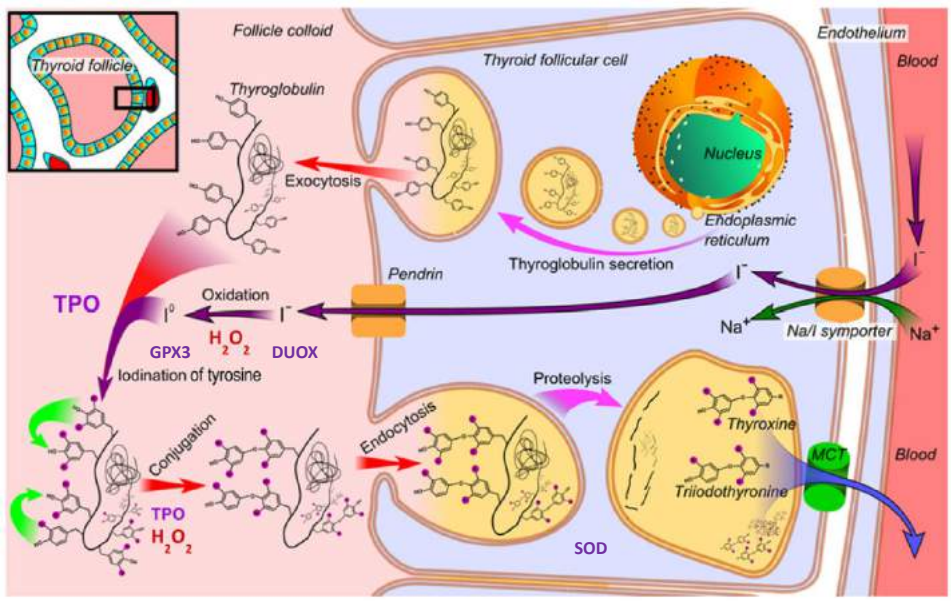
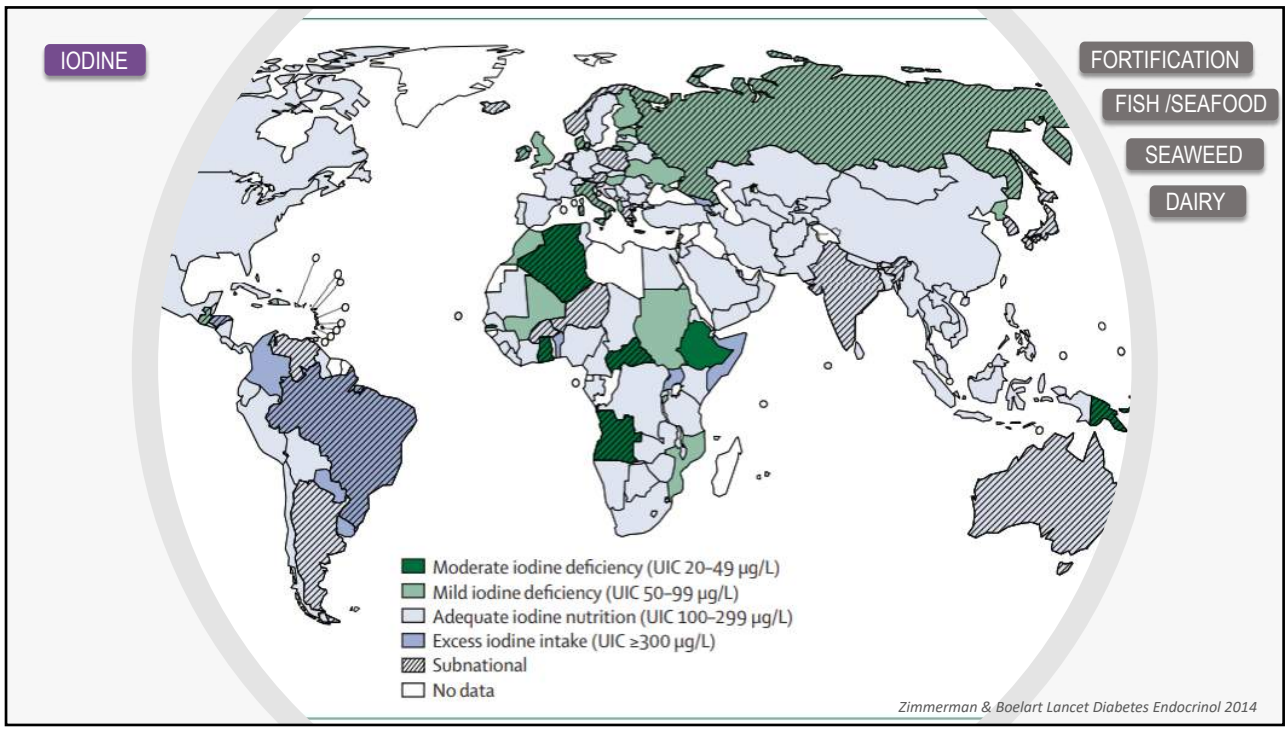


IODINE

10


IODINE
FORTIFICATION
FISH /SEAFOOD
SEAWEED
DAIRY
Moderate iodine deficiency (UIC 20–49 µg/L)
Mild iodine deficiency (UIC 50–99 µg/L)
Adequate iodine nutrition (UIC 100–299 µg/L)
Excess iodine intake (UIC ≥300 µg/L)
Subnational
No data
Zimmerman & Boelart Lancet Diabetes Endocrinol 2014

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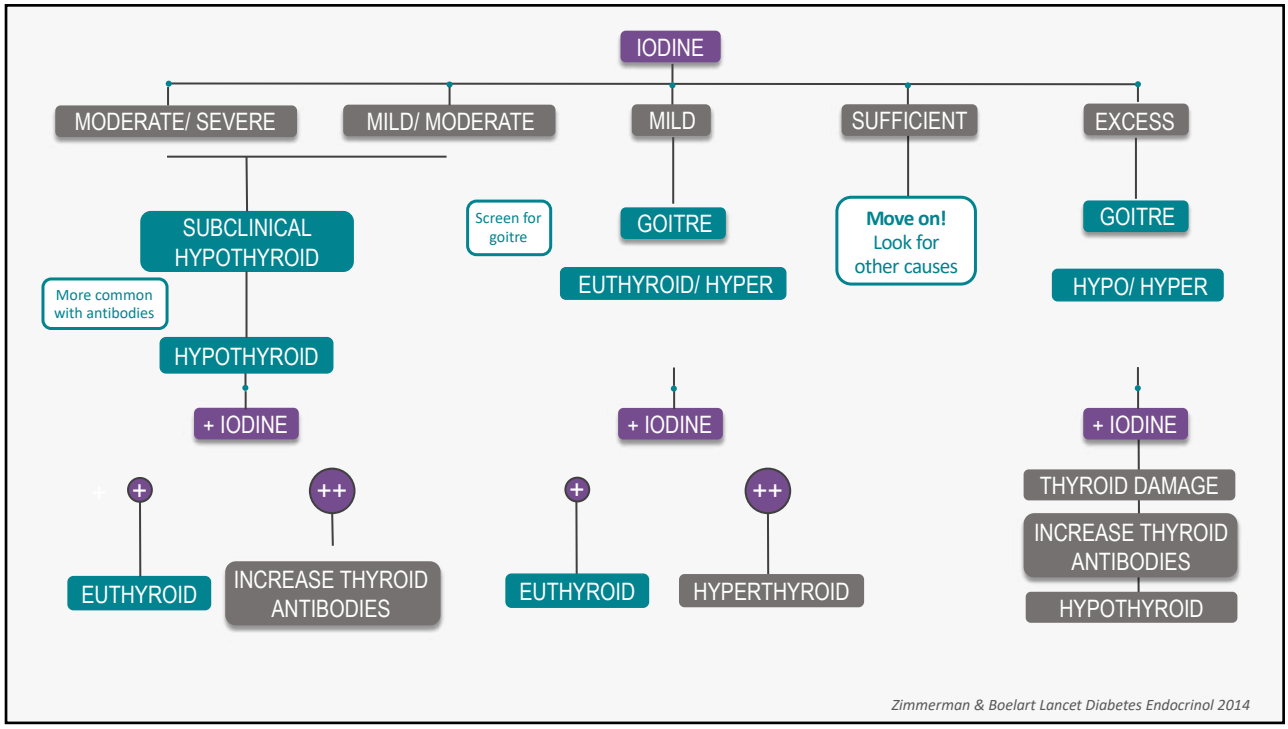
IODINE
MODERATE/ SEVERE
MILD/ MODERATE
MILD
SUFFICIENT
EXCESS
SUBCLINICAL HYPOTHYROID
More common with antibodies
HYPOTHYROID
+ IODINE
+
EUTHYROID
++
INCREASE THYROID ANTIBODIES
Screen for goitre
GOITRE
EUTHYROID/ HYPER
+ IODINE
+
EUTHYROID
++
HYPERTHYROID
Move on! Look for other causes
GOITRE
HYPO/ HYPER
+ IODINE
THYROID DAMAGE
INCREASE THYROID ANTIBODIES
HYPOTHYROID
Zimmerman & Boelart Lancet Diabetes Endocrinol 2014

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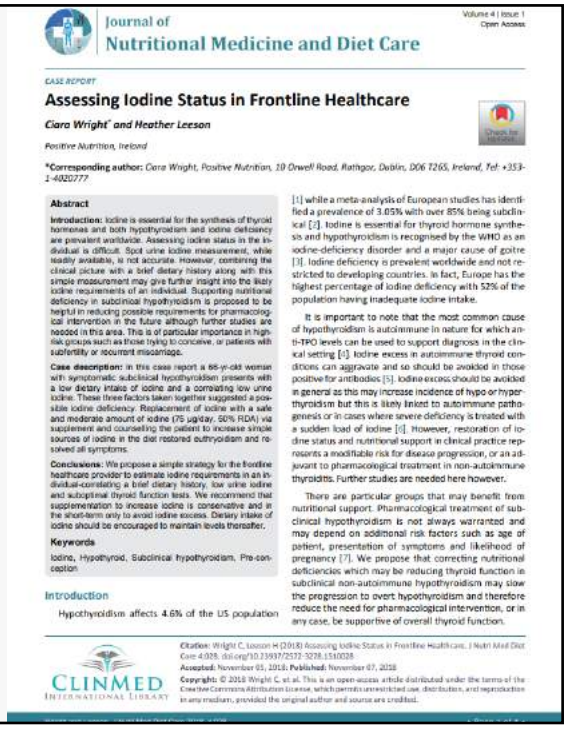
URINE IODINE

DIETARY IODINE

THYROID DYSFUNCTION



Journal of Nutritional Medicine and Diet Care

CASE REPORT

Assessing Iodine Status in Frontline Healthcare

Ciara Wright and Heather Leeson*

Positive Nutrition, Ireland

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Abstract

Introduction: Iodine is essential for the synthesis of thyroid hormones and both hypothyroidism and iodine deficiency are prevalent worldwide. Assessing iodine status in the individual is difficult. Spot urine iodine measurement, while readily available, is not accurate. However, combining the clinical picture with a brief dietary history along with this simple measurement may give further insight into the likely iodine requirements of an individual. Supporting nutritional deficiency in subclinical hypothyroidism is proposed to be helpful in reducing possible requirements for pharmacological intervention in the future although further studies are needed in this area. This is of particular importance in high-risk groups such as those trying to conceive, or patients with subfertility or recurrent miscarriage.

Case description: In this case report a 66-yr-old woman with symptomatic subclinical hypothyroidism presents with a low dietary intake of iodine and a correlating low urine iodine. These three factors taken together suggested a possible iodine deficiency. Replacement of iodine with a safe and moderate amount of iodine (75 µg/day, 50% RDA) via supplement and counselling the patient to increase simple sources of iodine in the diet restored euthyroidism and resolved all symptoms.

Conclusions: We propose a simple strategy for the frontline healthcare provider to estimate iodine requirements in an individual-correlating a brief dietary history, low urine iodine and suboptimal thyroid function tests. We recommend that supplementation to increase iodine is conservative and in the short-term only to avoid iodine excess. Dietary intake of iodine should be encouraged to maintain levels thereafter.

Keywords

Iodine, Hypothyroid, Subclinical hypothyroidism, Pre-conception

Introduction

Hypothyroidism affects 4.6% of the US population [1] while a meta-analysis of European studies has identified a prevalence of 3.05% with over 85% being subclinical [2]. Iodine is essential for thyroid hormone synthesis and hypothyroidism is recognised by the WHO as an iodine-deficiency disorder and a major cause of goitre [3]. Iodine deficiency is prevalent worldwide and not restricted to developing countries. In fact, Europe has the highest percentage of iodine deficiency with 52% of the population having inadequate iodine intake.

It is important to note that the most common cause of hypothyroidism is autoimmune in nature for which anti-TPO levels can be used to support diagnosis in the clinical setting [4]. Iodine excess in autoimmune thyroid conditions can aggravate and so should be avoided in those positive for antibodies [5]. Iodine excess should be avoided in general as this may increase incidence of hypo or hyperthyroidism but this is likely linked to autoimmune pathogenesis or in cases where severe deficiency is treated with a sudden load of iodine [6]. However, restoration of iodine status and nutritional support in clinical practice represents a modifiable risk for disease progression, or an adjuvant to pharmacological treatment in non-autoimmune thyroiditis. Further studies are needed here however.

There are particular groups that may benefit from nutritional support. Pharmacological treatment of subclinical hypothyroidism is not always warranted and may depend on additional risk factors such as age of patient, presentation of symptoms and likelihood of pregnancy [7]. We propose that correcting nutritional deficiencies which may be reducing thyroid function in subclinical non-autoimmune hypothyroidism may slow the progression to overt hypothyroidism and therefore reduce the need for pharmacological intervention, or in any case, be supportive of overall thyroid function.

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Citation: Wright C, Leeson H (2018) Assessing Iodine Status in Frontline Healthcare. J Nutri Med Diet Care 4:028. doi.org/10.23937/2572-3278.1510028

Accepted: November 05, 2018; Published: November 07, 2018

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FEMALE 66 years

Onset 2yrs: lethargy, extreme fatigue, weight loss resistance, constipation, distension and hot flashes

SUBCLINICAL HYPOTHYROID

TSH 4.82 (0.27-4.2 mIU/L)

free T4 14.3 (12.0-22.0 pmol/L)

Anti-TPO antibodies undetectable

Dietary Iodine: Low intake, almost dairy free, no fish

Urine Iodine: 22 ug/L, borderline severe deficiency

Table 1: Epidemiological criteria from the WHO for assessment of iodine status in a population using urine iodine measurement [3].

Urine Iodine µg/L	Iodine Intake	Iodine Status
< 20	Insufficient	Severe deficiency
20-49	Insufficient	Moderate deficiency
50-99	Insufficient	Mild deficiency
100-199	Adequate	Adequate iodine nutrition
200-299	Above requirements	Slight risk of more than adequate intake in the overall population
> 300	Excessive	Risk of adverse health consequences (iodine-induced hyperthyroidism, autoimmune thyroid diseases)

Wright & Leeson J Nut Med Diet Care 2018

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FEMALE 66 years

Gently restore iodine, supplement with 37.5ug/day increasing to 75ug/day only, increase fish in diet

EUTHYROID

TSH 2.17 (0.27-4.2 mIU/L)

free T4 14.2 (12.0-22.0 pmol/L)

Anti-TPO antibodies undetectable

Dietary Iodine: fish x 4 per week

Urine Iodine: 132 ug/L, adequate iodine

"After three months, the patient reported that her energy and wellbeing was markedly improved, she was no longer fatigued, was beginning to lose weight and there was complete cessation of hot flashes. Her digestion had also markedly improved with a daily well-formed bowel movement."

Wright & Leeson J Nut Med Diet Care 2018

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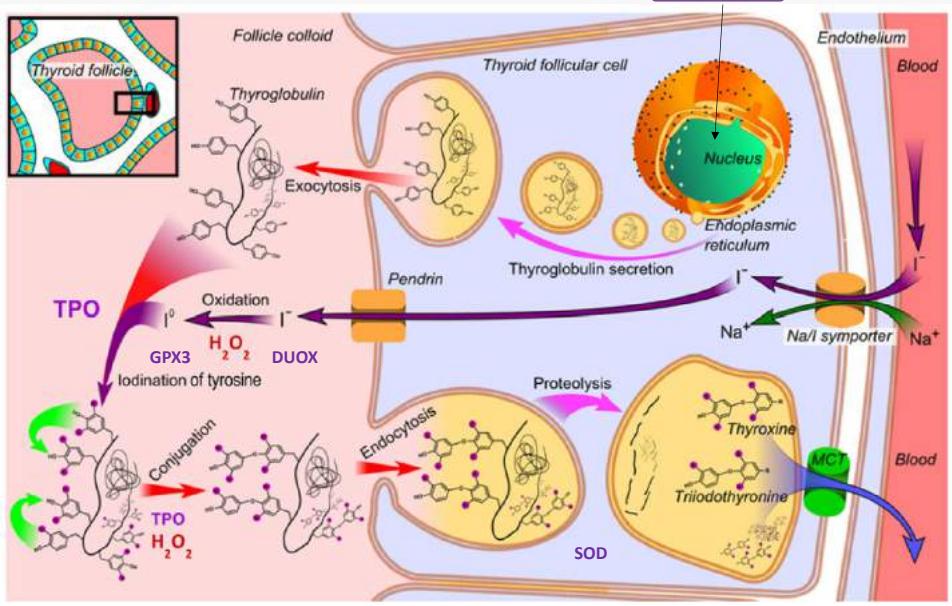
PHENYLALANINE

TYROSINE

Eat Protein



Häggström 2014 Wiki J of Medicine

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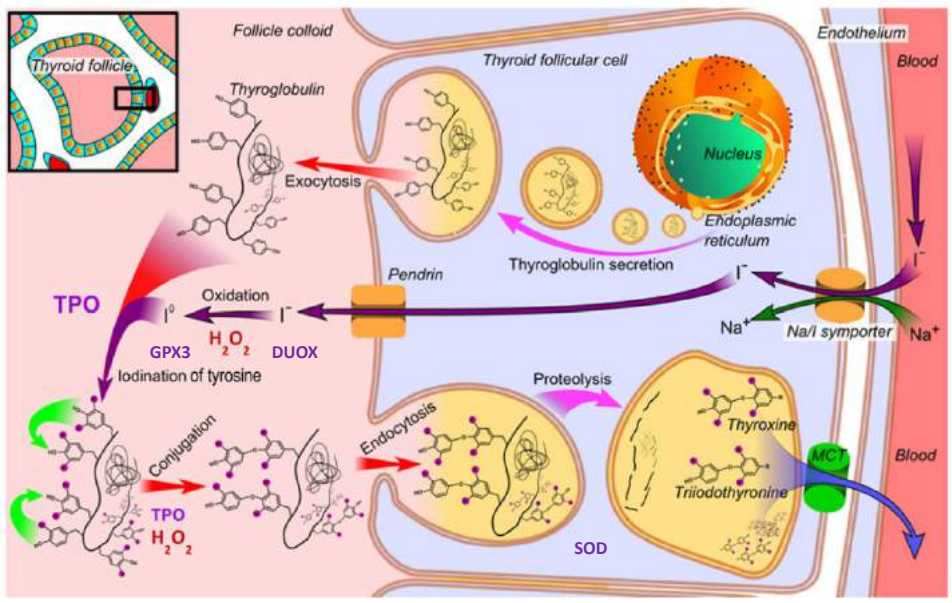

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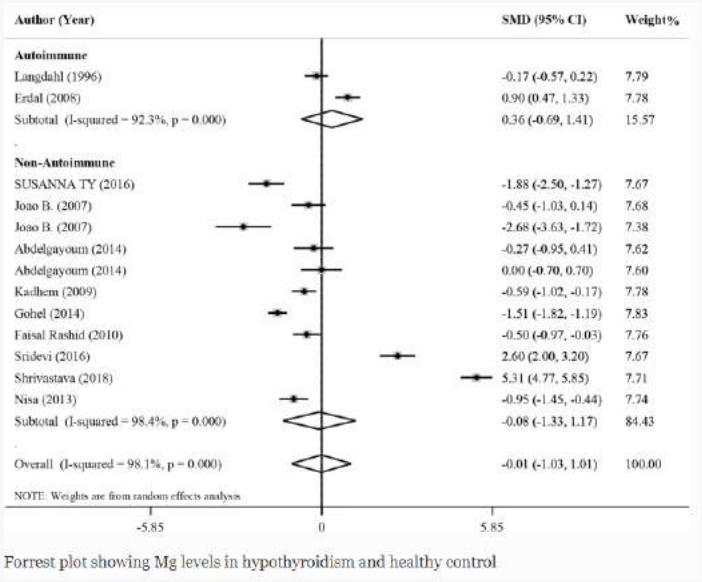
Serum magnesium and hypothyroidism

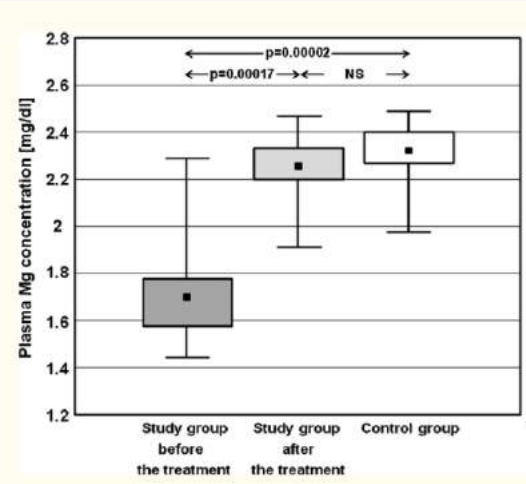


Forrest plot showing Mg levels in hypothyroidism and healthy control

Talebi 2020 Biological Trace Element Research

18

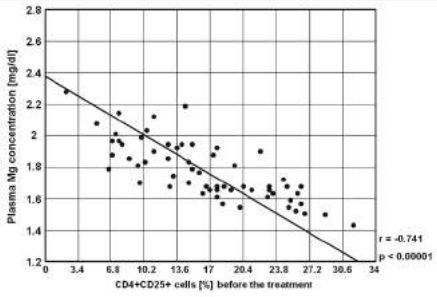
n=60 Grave's disease, tx methimazole



Immune activation
Free T3

After treatment

Magnesium levels



Klatka 2013 Biol Trace Elem Res

19

n=17 hyperthyroidism, tx methimazole

Endocrine Journal 1996, 43 (4), 397–402

Magnesium Metabolism in Hyperthyroidism#

TUMBA DISASHI, TAISUKE IWAOKA, JUNNOSUKE INOUE, SHOJIRO NAOMI, YASUKO FUJIMOTO, TERUHISA UMEDA*, AND KIMIO TOMITA

Urinary excretion of magnesium

Serum Magnesium levels

After treatment with methimazole

Table 1. The change in variables before and after treatment with methimazole in 17 patients with hyperthyroidism

	before	after
Thyroid function		
T_4 (μg/l)	184 ± 44	68 ± 27***
T_3 (μg/l)	3.6 ± 1.5	1.0 ± 0.4***
free T_4 (ng/l)	64 ± 34	11 ± 5***
free T_3 (ng/l)	15.9 ± 6.1	4.2 ± 1.5***
TSH (mU/l)	<0.06	1.62 ± 1.37***
Erythrocyte		
Mg (mmol/l cells)	2.00 ± 0.18	2.08 ± 0.24*
Na (mmol/l cells)	10.7 ± 2.6	8.1 ± 1.1***
Erythrocyte: Serum		
Mg ratio	2.85 ± 0.57	2.52 ± 0.43**
Na ratio	0.08 ± 0.02	0.06 ± 0.01***
Serum		
Mg (mmol/l)	0.72 ± 0.12	0.84 ± 0.11***
Mg (mmol/l)¶	0.73 ± 0.12	0.84 ± 0.11***
Na (mmol/l)	140.9 ± 1.9	140.9 ± 2.1
Urine		
Mg (mmol/3 h)	0.38 ± 0.19	0.25 ± 0.23***
Na (mmol/3 h)	29.2 ± 8.2	23.7 ± 7.8*
Renal function		
C_{Cr} (ml/min)	105.3 ± 29.7	90.7 ± 27.9
C_{Mg} (ml/min)	2.97 ± 1.31	1.62 ± 1.38***
C_{Na} (ml/min)	1.15 ± 0.29	0.92 ± 0.31*
FE_{Mg} (%)	2.92 ± 1.33	1.96 ± 1.96*
FE_{Na} (%)	1.21 ± 0.56	1.11 ± 0.48

Data are expressed as the mean ± SD. *P<0.05, **P<0.01, ***P<0.001, *vs.* before treatment. ¶ Value corrected for low serum albumin according to Kroll and Elin.

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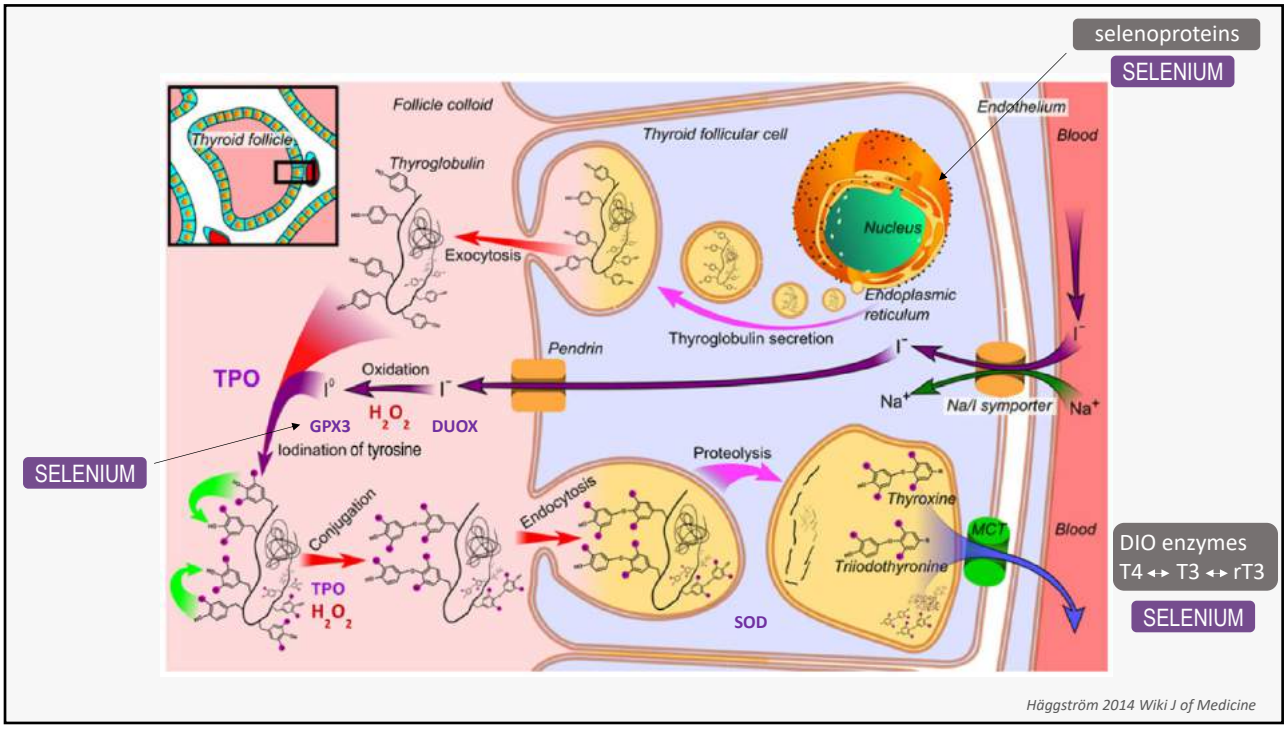

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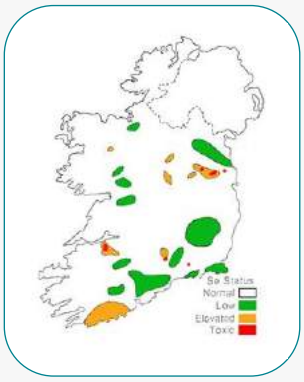
SELENIUM

BRAZIL NUTS

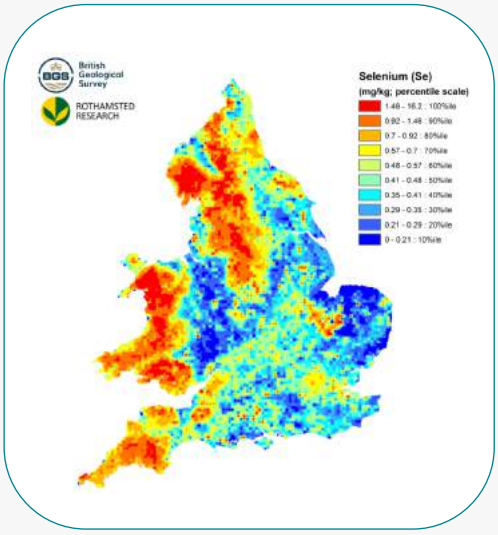
SEAFOOD

MEAT

WHOLEGRAINS



Teagasc



UK soil observatory

36% of adults in UK take in less than LNRI in food *NDNS 2015-2016*

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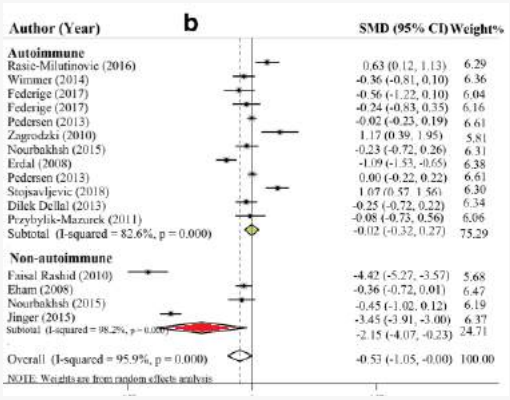
Selenium and thyroid conditions



Lower selenium status correlates with non-autoimmune thyroid conditions

Talebi et al 2020 Biological Trace Element Research

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Selenium supplementation in deficiency

n=52 children
Severely deficient in selenium
Moderately deficient in iodine

Sub-optimal thyroid function
fT4 low normal, TSH high normal

50ug selenomethionine
2 months

Hypothyroid – T4 low, T3 increased
fT4 low, TSH decreased

DIO enzymes
T4 ◂▸ T3 ◂▸rT3

No increase in thyroxine production at thyroid

Contempre et al 1992 Clin Endocrinol

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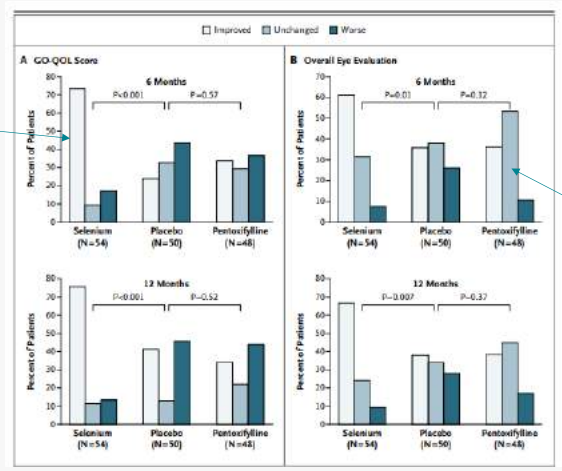
Selenium supplementation in Grave's, n=159

Over 70% patients improved QOL on selenium at 6 and 12 months

No improvement of QoL on pentoxyfylline



Over 60% patients improved on eye evaluation at 6 and 12 months

Most patients unchanged on pentoxyfylline

Marocci et al 2011 N Eng J Med

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Selenium supplementation in Hashimoto's

n=70 Mildly deficient in selenium Euthyroid on T4 replacement	n=75 Low normal/ borderline selenium Subclinical, started T4 replacement	n=88 Low normal/ borderline selenium Euthyroid on T4 replacement
200ug sodium selenite 3 months	200ug selenomethionine 3 months	200ug/ 100ug selenomethionine 3 months
TPO reduced from 900 to 600 IU/ml	TPO reduced from 1900 to 1000 in 3 mo and to 844 IU/ml in 6mo	TPO reduced from 800 to 570 in 3 mo
¼ of patients in treatment group had complete normalisation of their antibodies and thyroid ultrasound echogenicity	Note that T4 replacement may have contributed to improvement – placebo reduced 1800 to 1300 IU/ml in 6 months	TPO antibodies actually increased with 100ug selenium which was then reversed after increasing the dose to 200ug again
Gärtner et al 2002 J Clin Endocrinol Metab	*Duntas et al 2003 Eur J Endocrinol*	*Turker et al 2006 J Endocrinol*

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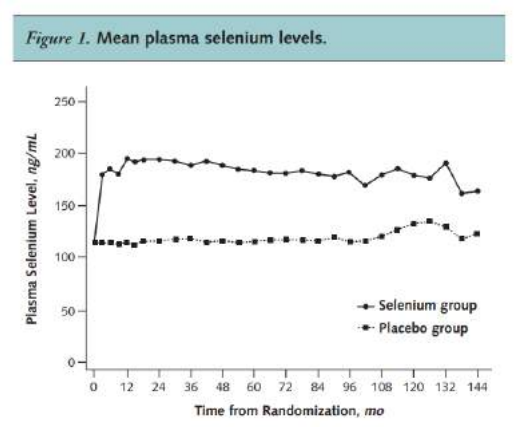
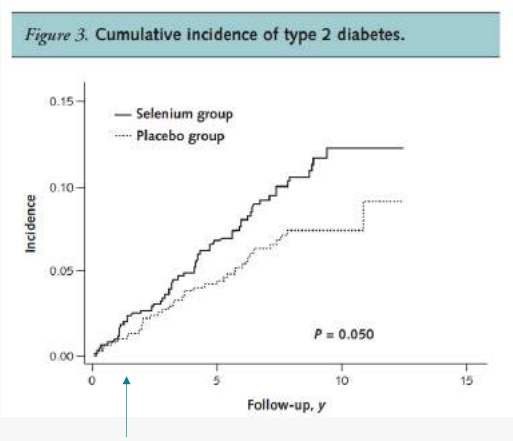
Risks of selenium supplementation





Risk levels diverging at 1 yr?

Stranges et al 2002 Annals Intern Med

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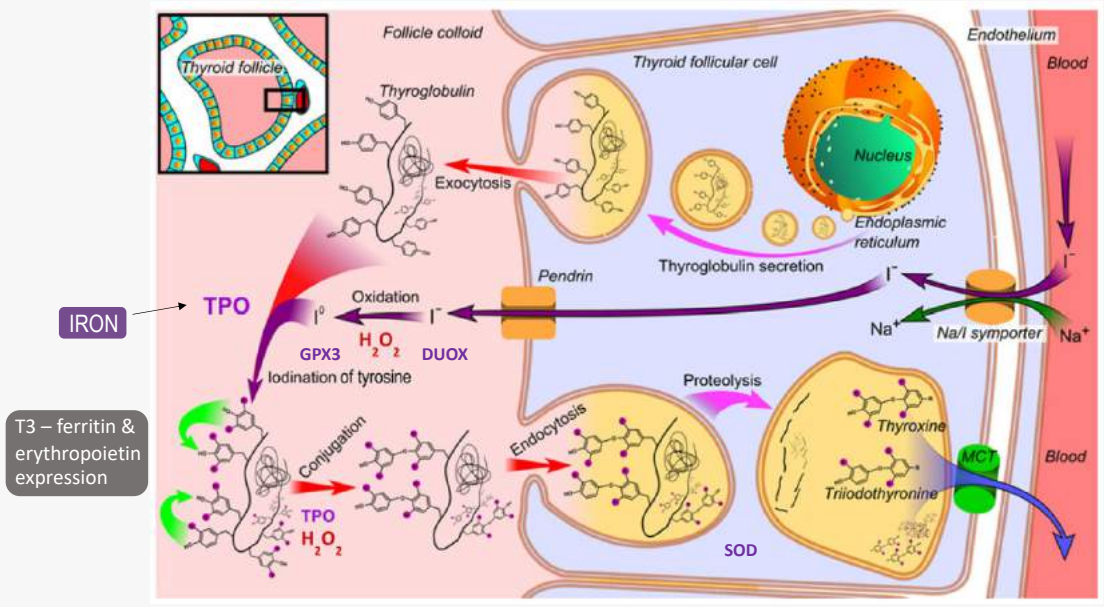

Häggström 2014 Wiki J of Medicine

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Iron supplementation in hypothyroidism

n=90 IDA, 38 controls

Correlation: Low T4 and low T3

n=227 school children

RR for hypothyroidism 5.5 in IDA

n= 118 hypothyroid, 40 controls

Correlation: High TSH, low T4 in IDA

n= 94 IDA adolescent females

Correlation: Low T4, high rT3

Ashraf et al 2017 Acta Biochem

n=60

Subclinical hypothyroidism, IDA

65mg ferrous sulphate +/- T4 replacement
3 months

Anaemia rectified and TSH reduced when iron + T4 given

No improvement in ferritin or TSH with iron alone for 3 months??

Ravanbod et al 2013 Am J Med

n=42 IDA and 38 controls

Suboptimal thyroid function in IDA

200mg ferrous sulphate
2 months

TSH reduced from 3.32 to 1.02 IU/mL
fT4 increased from 11.7pmol/L to high

Suboptimal thyroid function improved with iron replacement and reversal of anaemia

Gökdeniz et al 2010 J Clin Exp Investigations

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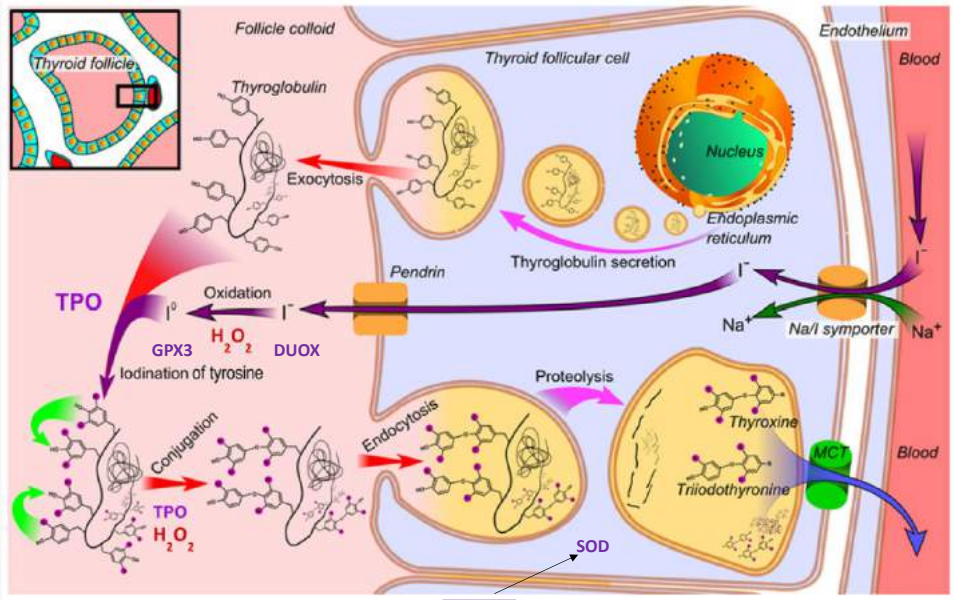

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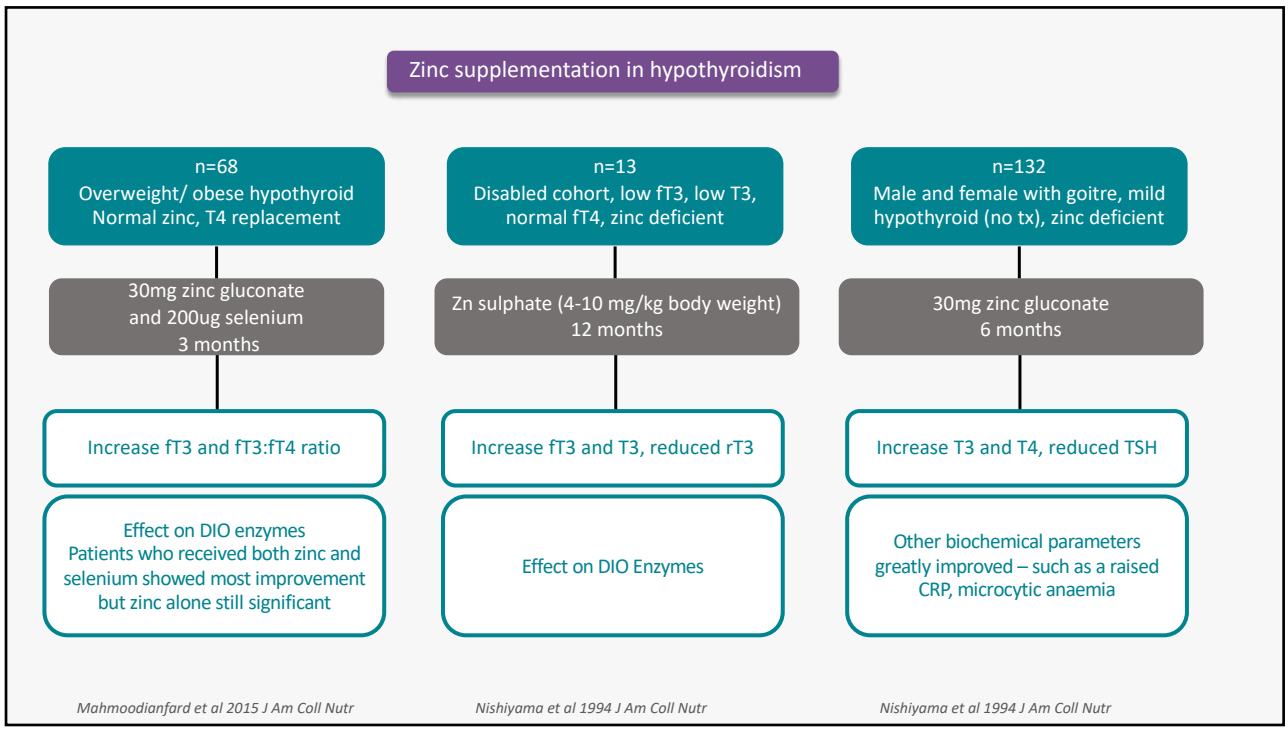

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Essential Nutrients for Thyroid Function…?

- IODINE
- SELENIUM
- IRON
- ZINC
- MAGNESIUM
- TYROSINE
- PHENYLALANINE
- B VITAMINS
- VITAMIN D
- VITAMIN A
- OMEGA-3

32

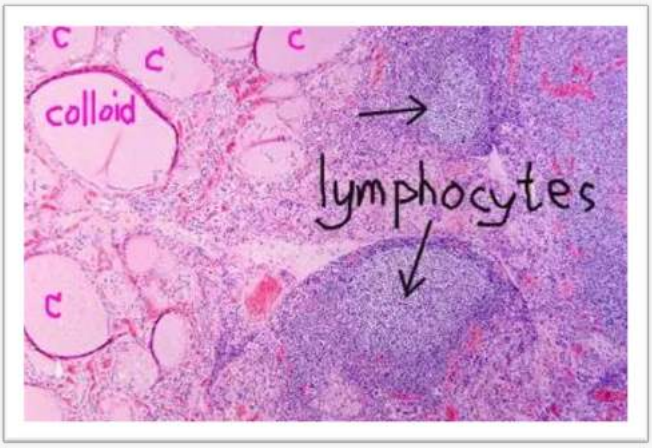
Anti-TPO

Anti-Tg

Anti-TRAb

IMMUNE SUPPORT

- SELENIUM
- ZINC
- VITAMIN D
- OMEGA-3



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HASHIMOTO's

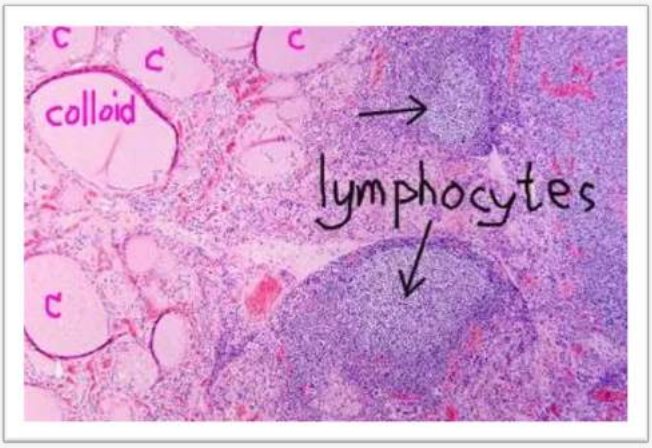
- Anti-TPO
- Anti-Tg

- Th1
- IL-1β
- IFNγ
- Th17

GRAVES

- Anti-TRAb
- Anti-TPO
- Anti-Tg

- Th2
- IL-4
- Th17



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Vitamin D and Autoimmune Thyroid Disease

Th1

IL-1β

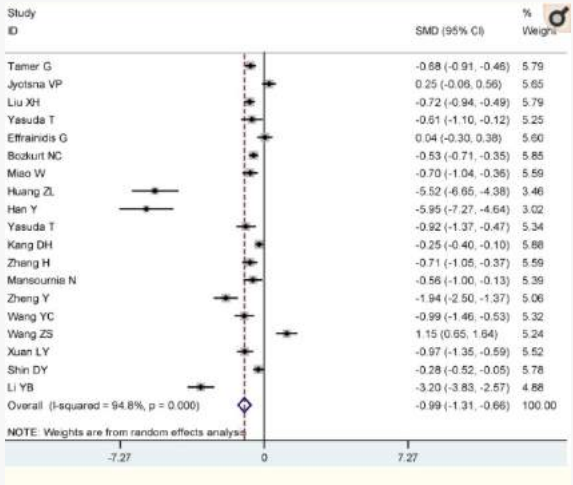
IFNγ

Th17

Th2

IL-4

Th17



Vitamin D deficiency more likely in AITD

Wang et al 2015 Nutrients

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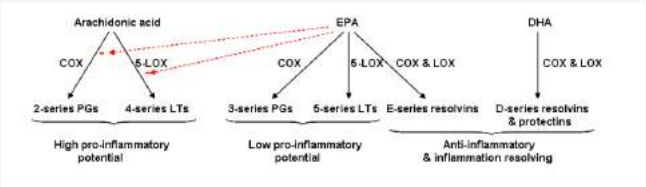
Omega-3 and Autoimmune Thyroid Disease



Reduce adhesion molecules on lymphocytes
Regulate transcription of NFκB and PPARδ
Inhibit IL-6, TNFα, IL-1β
Dosage – 2g per day

Calder 2010 Nutrients

n=239
Euthyroid pregnant women

Groups: mostly oily fish, mostly swordfish, controls

Omega-3 oily fish consumption in pregnancy reduced risk of developing AITD postpartum

Higher risk of autoimmune issues or thyroid antibodies in the swordfish group before study period

Benvenga et al 2016 Endocrine

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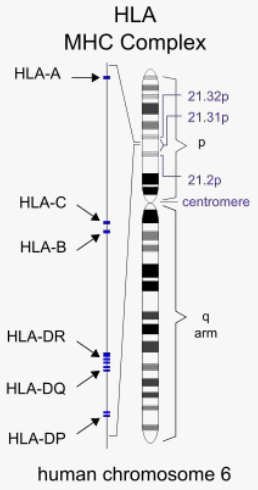
Gluten and Autoimmune Thyroid Disease

Prevalence of celiac disease (CD) in autoimmune thyroid disorders.

Author (year of publication)	Population screened	Prevalence of CD
Collin et al (1994)[41]	83 autoimmune thyroid disease	4.8%
Sategna-Guidetti et al (1998)[76]	152 autoimmune thyroid disease	3.3%
Cuoco et al (1999)[78]	22 Hashimoto's disease 23 Graves' disease	4.3%
Valentino et al (1999)[77]	150 autoimmune thyroid disease	3.3%
Berti et al (2000)[79]	172 autoimmune thyroid disease	3.5%
Volta et al (2001)[80]	220 autoimmune thyroid disease	3.2%
Larizza et al (2001)[81]	90 Pediatric autoimmune thyroid disease	7.8%
Meloni et al (2001)[82]	297 autoimmune thyroid disease	4.4%
Mainardi et al (2002)[83]	100 autoimmune thyroid disease	2%
Ch'ng et al (2005)[42]	115 Graves' disease	4.5%



Lye Ch'ng 2007 Clin Med Res

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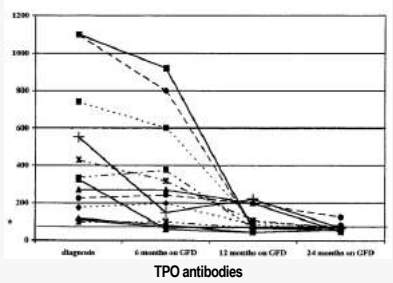
Coeliac and Autoimmune Thyroid Disease

n=34 Subclinical coeliac High thyroid antibodies, euthyroid	n=128 Untreated coeliac Subclinical thyroid disease	n=13 Newly diagnosed coeliac
Gluten free diet v gluten containing 6 months	Gluten free diet 12 months	Gluten free diet Followed from age 10-20 yrs
TPO abs reduced from 900 to 700 Tg Abs reduced from 830 to 630	Some individual improvements in TSH, from subclinical to euthyroid	
All had relatively low vit D at 50 nmol/L starting, tx group increased to 62.5 nmol/L after 6 months	On GFD, nutritional indices improved - Improvements in non-autoimmune thyroid conditions were attributed to improved nutrition	TPO antibodies
Krysiak et al 2019 Exp Clin Endocrinol Diabetes	*Sategna-Guidetti et al 2001 Am J of Gastroenterol*	*Ventura et al 2000 J Pediatr*

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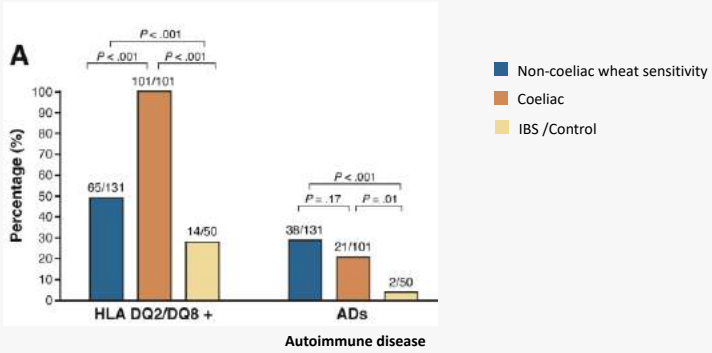
Wheat sensitivity and Autoimmune Thyroid Disease



Carocci et al 2015 J Gastroenterol

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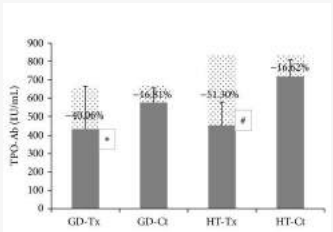
Medicinal Mushrooms and Autoimmune Thyroid Disease

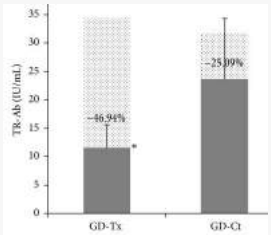
n=44 Grave's disease
n=56 Hashimoto's
All on T4 replacement or methimazole

Cordyceps 6g per day, 6 months

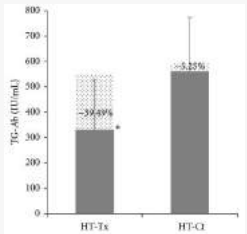


Grave's + Cordyceps

Hashimoto + Cordyceps



Grave's + Cordyceps



Hashimoto + Cordyceps

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Medicinal Mushrooms and Autoimmune Thyroid Disease

n=44 Grave's disease
n=56 Hashimoto's
All on T4 replacement or methimazole

Cordyceps 6g per day, 6 months

Reduction of anti-TPO – 820 to 450 in HT
Reduction of anti-Tg and antiTRAb

Grave's higher CD4+ - normalised
Hashimoto's higher CD8+ - normalised

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Medicinal Mushrooms and Autoimmune Thyroid Disease

CD4+ T Cells	CD4+	53.3% H
	Expected Range	34.000 - 47.000
CD8+ T Cells	CD8+	17.2%
	Expected Range	16.000 - 28.000
CD4 to CD8 Ratio	eq	3.1 H
	Expected Range	1.400 - 2.800

1.5g Cordyceps and 1.5g Coriolus for 3 months, 1.5g mesima already

CD4+ T Cells	CD4+	49.6% H
	Expected Range	34.000 - 47.000
CD8+ T Cells	CD8+	17.2%
	Expected Range	16.000 - 28.000
CD4 to CD8 Ratio	eq	2.9 H
	Expected Range	1.400 - 2.800

Reduced CD4+ T Cells

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Case Studies and Autoimmune Thyroid Disease

Female 33yrs TTC, IVF
Dx hypothyroid by GP
Euthyroid on T4 replacement

June 2020

TSH	0.61	µIU/mL	[0.27 - 4.20]
Free T3	4.38	pmol/L	[3.10 - 6.80]
Free T4	17.60	pmol/L	[12.00 - 22.00]
Anti-TPO	10.60	IU/mL	[0.00 - 34.00]
Anti TG Abs	230.00	IU/mL	[0.00 - 115.00]

Plasma and Red Cell Elements

Element	Result	Units	Reference interval
Plasma:			
Calcium	2.20	mmol/L	2.10 - 2.60
Chromium	10.3	nmol/L	6.2 - 33.6
Copper	14.9	µmol/L	12.5 - 25.0
Iron (Female)	15.8	µmol/L	10.7 - 32.0
Magnesium	0.90	mmol/L	0.70 - 1.00
Manganese	10.4	nmol/L	9.0 - 40.0
Selenium	1.84	µmol/L	1.00 - 1.90
Zinc	13.3	µmol/L	11.5 - 20.0
Red Cells:			
Red Cell Magnesium	2.44	mmol/l	2.08 - 3.06
Total 25-hydroxy vitamin D	73	nmol/L (29 µg/L)	75 - 200 nmol/L (30 - 80 µg/L)

Urine Iodine 35 µg/L (0.28 µmol/L)

Interpretation
The urine iodine concentration is recommended as the best single indicator of iodine nutrition, with the following stratification of reference values:

Urine iodine µg/L	Iodine intake	Iodine nutritional status
<20	Insufficient	Severe deficiency
→ 20 - 49	Insufficient	Moderate deficiency
50 - 99	Insufficient	Mild deficiency
100 - 199	Adequate	Optimal
200 - 299	More than adequate	Risk of iodine-induced hyperthyroidism
> 299	Excessive	Risk of hyperthyroidism and autoimmune thyroid disease

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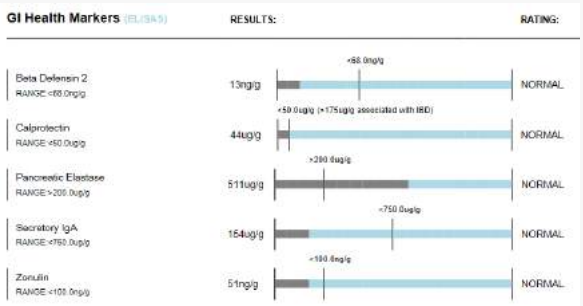
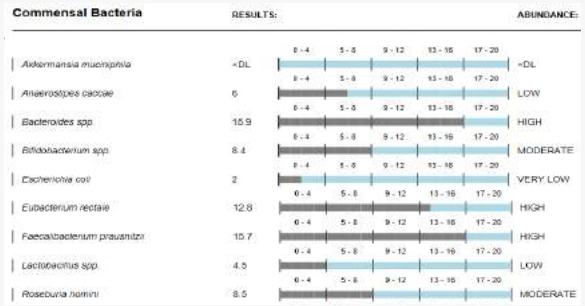
Case Studies and Autoimmune Thyroid Disease





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Case Studies and Autoimmune Thyroid Disease

Iodine – starting on 37.5ug and working up to 150ug

Fertility multi with zinc and selenium, omega-3, vitamin D

3g Coriolus per day

Gluten free, digestive supports, mucosal lining support

Restored iodine over 5 months to 190ug/L (optimal)

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Case Studies and Autoimmune Thyroid Disease

Reduction in anti-Tg from 230 to 54

June 2020

TSH	0.61	µIU/mL	[0.27 - 4.20]
Free T3	4.38	pmol/L	[3.10 - 6.80]
Free T4	17.60	pmol/L	[12.00 - 22.00]
Anti-TPO	10.60	IU/mL	[0.00 - 34.00]
Anti TG Abs	230.00	IU/mL	[0.00 - 115.00]

Sept 2020

TSH	1.23	uIU/mL	[0.27 - 4.20]
Anti-TPO	<9	IU/mL	[0.00 - 34.00]
Anti TG Abs	117.00	IU/mL	[0.00 - 115.00]

Oct 2020

TSH	0.42	uIU/mL	[0.27 - 4.20]
Free T3	4.44	pmol/L	[3.10 - 6.80]
Free T4	19.80	pmol/L	[12.00 - 22.00]
Anti-TPO	<9	IU/mL	[0.00 - 34.00]
Anti TG Abs	54.00	IU/mL	[0.00 - 115.00]

Successful IVF, now pregnant

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Case Studies and Autoimmune Thyroid Disease

Female 45yrs
Chronic constipation, fatigue, muscle ache
Euthyroid

Anti-TPO 213 mIU/L

200ug selenium for 9 months
Gluten free
Iodine levels are sufficient
Multi including zinc, omega-3, vitamin D
Coriolus for 6 months

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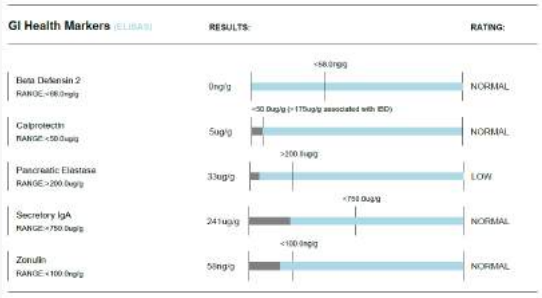
Case Studies and Autoimmune Thyroid Disease



Anti-TPO 213 mIU/L
to 221 mIU/L in 12 months!

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Case Studies and Autoimmune Thyroid Disease

Female 36yrs TTC, IVF
Dx hypothyroid by IVF clinic
T4 replacement

THYROID FUNCTION TEST			
sample type:	Blood		
TSH:	2.83	mU/L	0.3 - 4.2
Free T4:	12.7	pmol/L	12 - 22
TIBC			
sample type:	Blood		
iron:	4	umol/l	10 - 30
TIBC:	96.0	umol/l	50 - 80
transferrin:	4	%	15 - 50

Ferritin	L 6	ug/l	(14 - 200)
Vitamin B12	H 705	pg/ml	(200 - 660)
Serum Folate	H 18.1	ng/ml	(3.3 - 17.2)

FULL BLOOD COUNT			
HB	L 9.4	g/dl	(11.5- 16.5)
RCC	4.79	x10^12/L	(3.8 - 5.8)
HCT	L 0.319	L/L	(0.360 - 0.460)
MCV	L 66.6	fl	(80 - 96)
MCH	L 19.6	pg	(27.0 - 34.0)
MCHC	L 29.5	g/dl	(31.0 - 36.5)
RDW	H 17.0		(10.9 - 15.7)
PLT	276	x10^9/L	(150 - 450)
WCC	L 3.6	x10^9/L	(4.0 - 11.0)

Anti-Tg	19.96	IU/mL	HIGH	0.01 - 4.11
Anti-TPO	369.28	IU/mL	HIGH	0.01 - 5.61

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Case Studies and Autoimmune Thyroid Disease

Fertility multi with zinc and selenium, omega-3, vitamin D

3g Coriolus per day

Gluten free, probiotic

Iron complex + beetroot complex + vitamin C + lysine

+ 3 months

THYROID FUNCTION TEST			
sample type:	Blood		
TSH:TSH:	1.49	mU/L	0.3 - 4.2
T4F:Free T4:	21.0	pmol/L	12 - 22
THYROID PEROXIDASE ABS			
sample type:	Blood		
TPO:TPO Ab:	**189**	**IU/mL**	**0 - 35**
FREE T3			
sample type:	Blood		
T3F:Free T3:	4.4	pmol/L	3.1 - 6.8

IVF Successful, healthy baby boy

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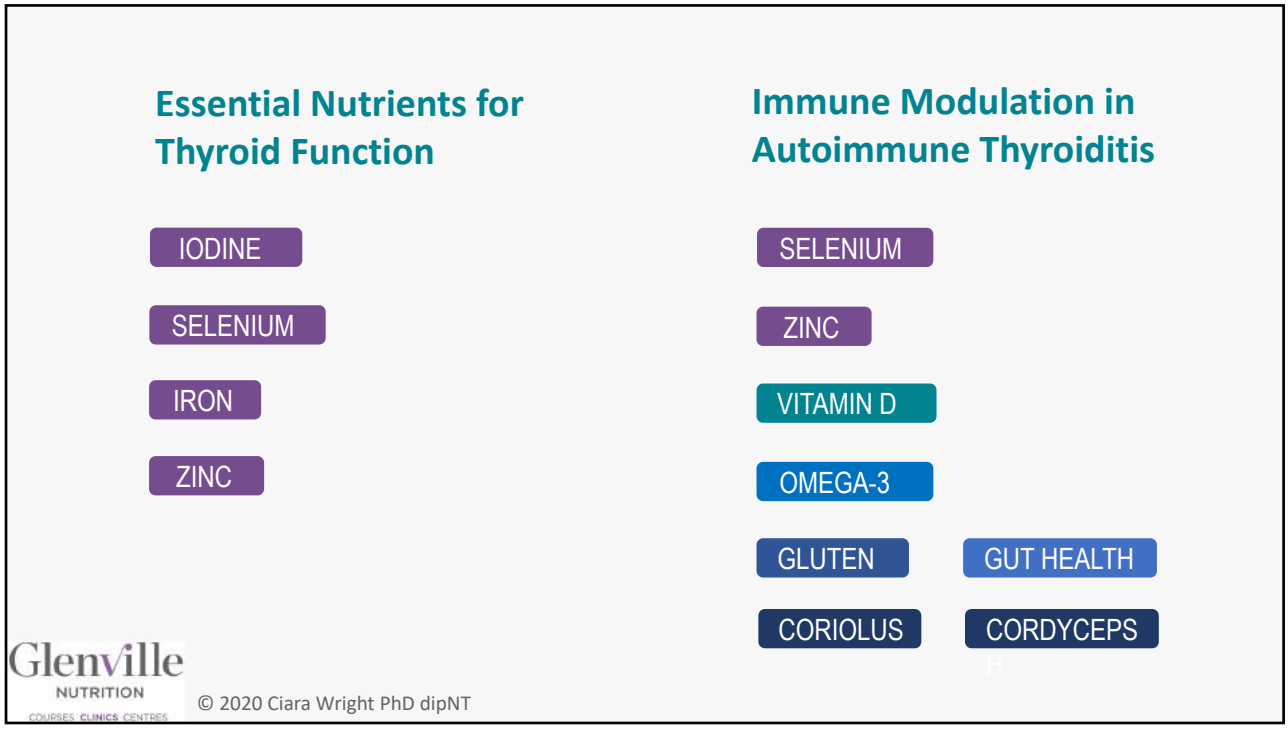
Essential Nutrients for Thyroid Function
IODINE
SELENIUM
IRON
ZINC
Immune Modulation in Autoimmune Thyroiditis
SELENIUM
ZINC
VITAMIN D
OMEGA-3
GLUTEN
GUT HEALTH
CORIOLUS
CORDYCEPS
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