



Associazione Medici
Endocrinologi

**Primo Congresso
Interregionale
AME Sud - Italia**

**Primo Congresso
Interregionale
ANIED Sud - Italia**

Responsabile Scientifico Vincenzo Triggiani



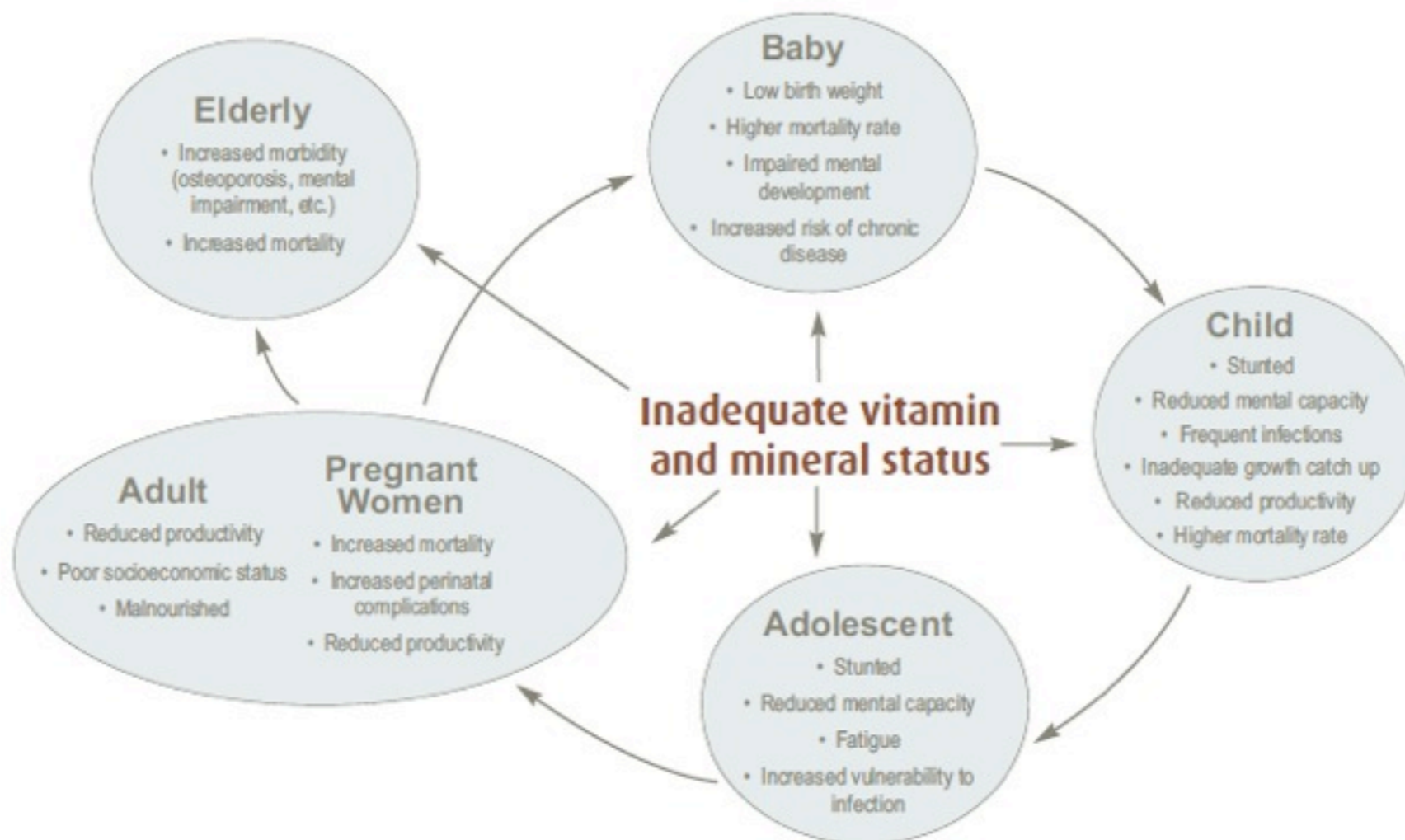
Matera, 9-10 Maggio 2014 - HILTON GARDEN INN

Micronutrienti e tiroide

Daniela Agrimi

10 Maggio 2014

Figure 1. Consequences of vitamin and mineral deficiencies during the life cycle



Adapted from the United Nations Administrative Committee on Coordination Sub-Committee on Nutrition (ACC/SCN), Fourth Report on the World Nutrition Situation, 2000, Geneva: ACC/SCN in collaboration with IFPRI.



Working for a World Free of Hidden Hunger

Strategic Plan
2013-2018

SALUTE PUBBLICA



World Malaria Day
Invest in the future.
Defeat malaria



World Health
Organization

عربي 中文 English Français Русский Español



Home Health topics Data Media centre Publications Countries Programmes About WHO

 Search

Vitamin and Mineral Nutrition Information System (VMNIS)

Vitamin and Mineral Nutrition
Information System

[Micronutrients database](#)

[Indicators](#)

[Laboratory capacity](#)

[Surveillance tools](#)

[Publications](#)

About VMNIS

The Vitamin and Mineral Nutrition Information System (VMNIS), formerly known as the Micronutrient Deficiency Information System (MDIS), was established in 1991 following a request by the World Health Assembly to strengthen surveillance of micronutrient deficiencies at the global level. Part of WHO's mandate is to assess the micronutrient status of populations, monitor and evaluate the impact of strategies for the prevention and control of micronutrient malnutrition, and to track related trends over time. The Evidence and Programme Guidance Unit of the Department of Nutrition for Health and Development manages the VMNIS through WHO's network of regional and country offices, and in close collaboration with national health authorities.

[Join the WHO nutrition mailing list](#)

[WHA resolutions on micronutrients](#)

[Department of nutrition for health and development](#)



SEARCH

A-Z Index [A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#) <#>

IMMPaCt - International Micronutrient Malnutrition Prevention and Control Program

IMMPaCt

[About the Program](#)

[What We Do](#)

[Tools](#)

[Partners](#)

[Micronutrient Facts](#)

[Global Health & Nutrition Resources](#)

Related Links

- [Nutrition Basics](#)
- [Division of Nutrition, Physical Activity, and Obesity](#)

[Recommend](#) 18 [Tweet](#) 1 [Share](#)



The International Micronutrient Malnutrition Prevention and Control (IMMPaCt) Program works with global partners to contribute CDC skills and resources to eliminate vitamin and mineral deficiencies (micronutrient malnutrition) among vulnerable populations throughout the world. Established by the CDC in 2000, IMMPaCt focuses primarily on helping eliminate deficiencies in iron, vitamin A, iodine, folate, and zinc.

[Email page link](#)

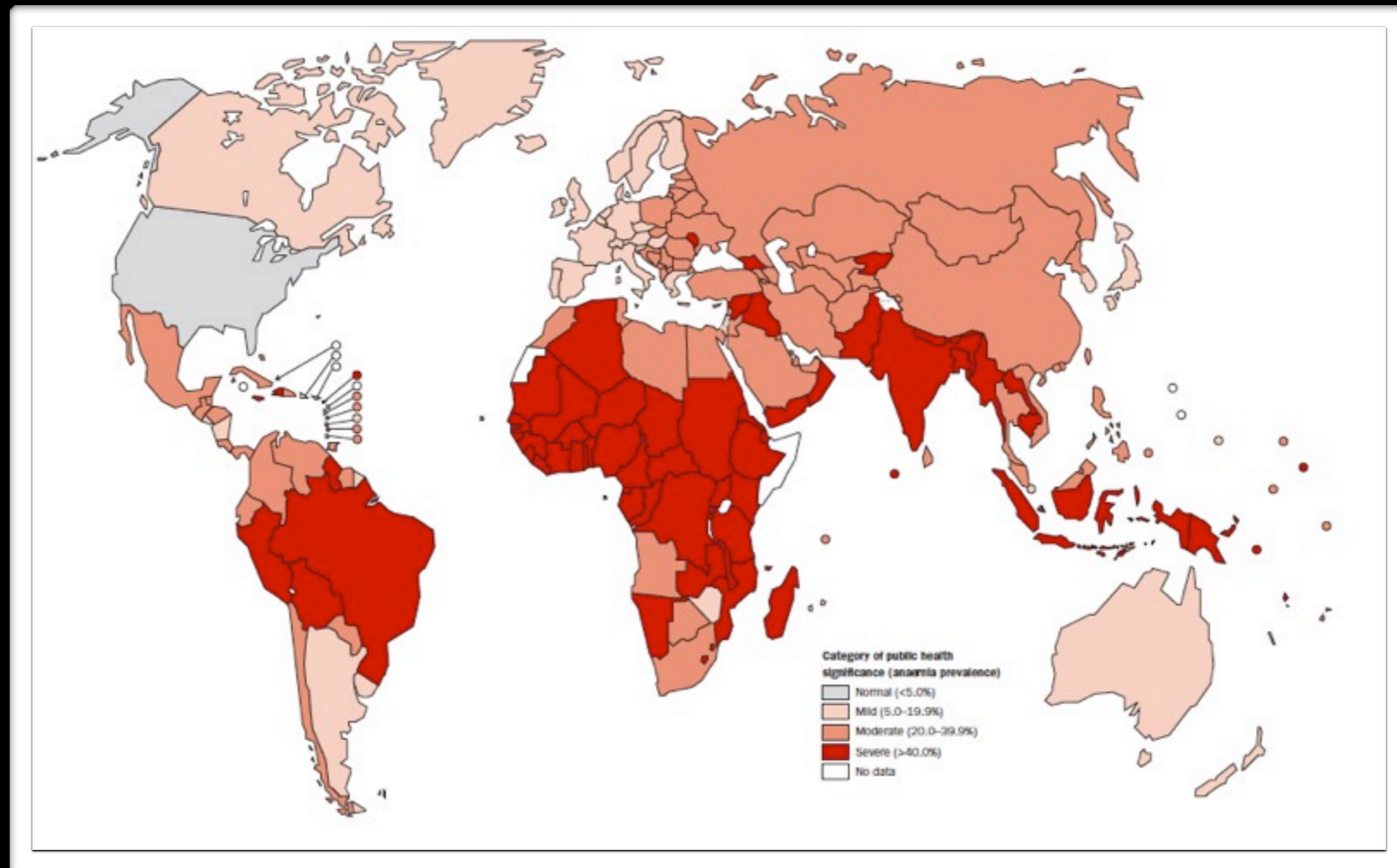
[Print page](#)

[Get email updates](#)

Contact Us:

- [Centers for Disease Control and Prevention
1600 Clifton Rd
Atlanta, GA 30333](#)
- [800-CDC-INFO
\(800-232-4636\)
TTY: \(888\) 232-6348
8am-8pm
ET/Monday-Friday
Closed Holidays](#)
- [Contact CDC-INFO](#)

Anaemia as a public health problem by country: Preschool-age children

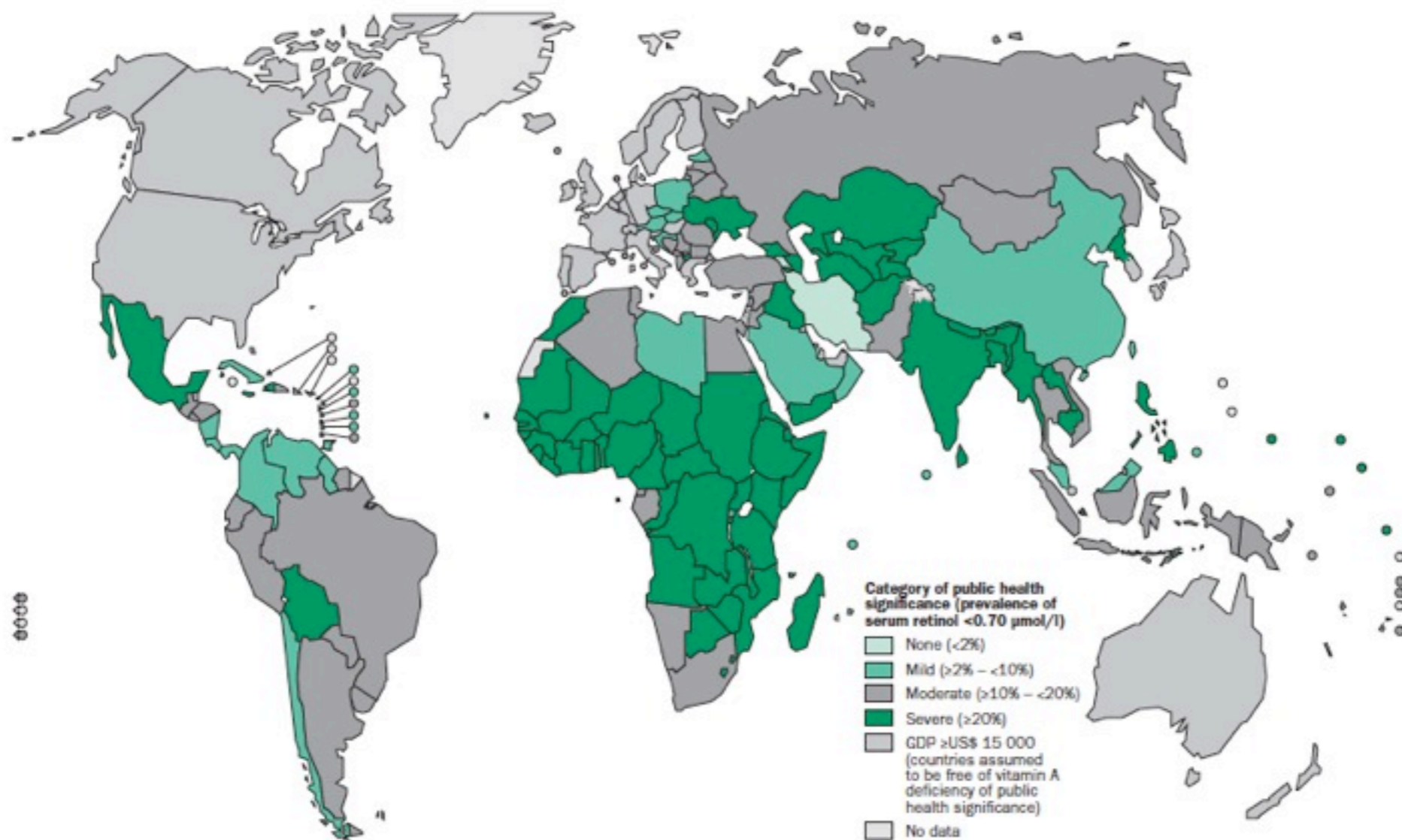


**Worldwide
prevalence of anaemia
1993-2005**

WHO Global Database
on Anaemia

**Biochemical vitamin A deficiency (retinol) as a public health problem by country 1995–2005:
Preschool-age children**

b) Countries and areas with survey data and regression-based estimates



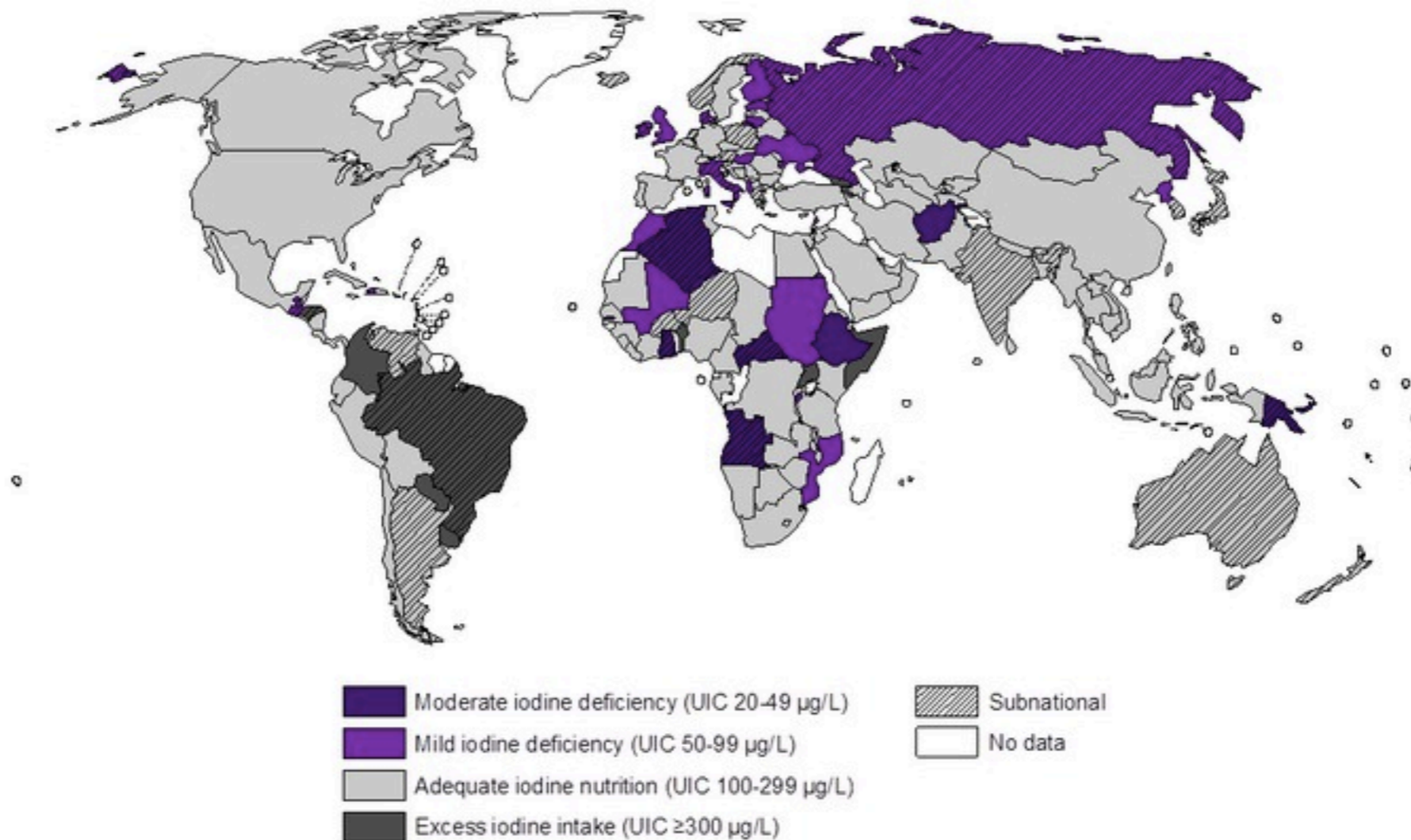
**Global prevalence
of vitamin A deficiency
in populations at risk
1995–2005**

WHO Global Database
on Vitamin A Deficiency



ICCIDD Global Network:
Leading the global fight to eliminate
brain damage due to iodine deficiency.

National iodine status in 2014



Millennium Development Goals



MILLENNIUM DEVELOPMENT GOAL	MICRONUTRIENT ROLE
GOAL 1 – ERADICATE EXTREME POVERTY AND HUNGER	<ul style="list-style-type: none"> iron intake can reduce anaemia – leading to greater productivity and earning potential salt iodization reduces iodine deficiency disorders – increasing learning ability and intellectual potential, and leading ultimately to better-educated citizens earning higher wages zinc reduces stunting among children
GOAL 2 – ACHIEVE UNIVERSAL PRIMARY EDUCATION	<ul style="list-style-type: none"> salt iodization reduces iodine deficiency – improving cognitive development and learning potential iron in young children improves cognitive development to help them succeed academically later in life zinc reduces the frequency and severity of diarrhoea – decreasing the number of school days lost vitamin A prevents childhood blindness folic acid prevents disability due to neural tube defects
GOAL 3 – PROMOTE GENDER EQUALITY AND EMPOWER WOMEN	<ul style="list-style-type: none"> iron improves women’s economic productivity addressing under-nutrition empowers women more than men: improved micronutrient intake by women can help to correct inequalities in their access to adequate and nutritious food
GOAL 4 – REDUCE CHILD MORTALITY	<ul style="list-style-type: none"> vitamin A significantly improves child survival rates zinc reduces the frequency and severity of diarrhoea, a major cause of child mortality salt iodization reduces iodine deficiency – lowering rates of miscarriage, stillbirth and neonatal death
GOAL 5 – IMPROVE MATERNAL HEALTH	<ul style="list-style-type: none"> iron improves maternal survival rates salt iodization prevents iodine deficiency disorders and its consequences such as spontaneous abortion, stillbirth, and impaired mental function

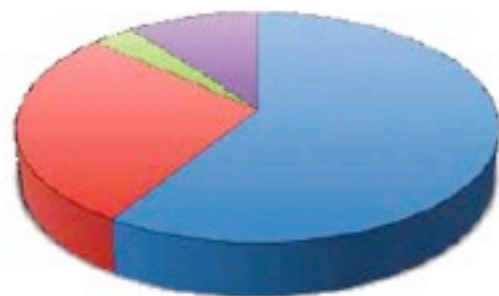
SUMMARIZED FINANCIAL STATEMENTS

SUMMARIZED STATEMENT OF NET ASSETS AS AT MARCH 31, 2013

(expressed in U.S. dollars)

PROGRAM EXPENSES BY REGION

(\$43.9 MILLION)



Africa	25.8 million
Asia	12.1 million
Americas & Middle East	1.5 million
Global Programs	4.5 million

TOTAL EXPENSES

(\$47.5 MILLION)



Vitamin A procurement and interventions	19.8 million
Iron	3.6 million
Iodine	5.8 million
Zinc	8.7 million
Acute malnutrition	1.6 million
Community-based MNCH	2.4 million
Management & administration	3.6 million
Other interventions	2.0 million

Low Cost: High Return Investment

Cost-effectiveness data for a range of micronutrient interventions

INTERVENTION	REGION	COST/PERSON /YEAR (US\$)	BENEFIT: COST RATIO
Vitamin A Supplementation	South Asia, Sub-Saharan Africa, East Asia	\$1.20	17:1
	Central Asia	\$1.60	<13:1
	Latin America and the Caribbean	\$2.60	<8:1
Zinc Supplementation	South Asia, Sub-Saharan Africa, East Asia	\$1.00	13.7:1
	Central Asia	\$1.35	<10:1
	Latin America and the Caribbean	\$2.20	<6:1
Salt Iodization		\$0.05	30:1
Flour Fortification		\$0.12	8:1

Source: Copenhagen Consensus best practices paper on Micronutrient supplements for child survival (Vitamin A and Zinc), Horton et al., 2008; and Copenhagen Consensus best practices paper on Food fortification (Iron and Iodine). Horton et al., in press.



HEALTH AND CONSUMERS

European Commission

European Commission > DGs > Health and Consumers

- HOME
- ABOUT US
- OUR TOPIC WEBSITES
- CONSULTATIONS
- FUNDING
- INFORMATION SOURCES
- EVENTS



Health and Consumers related agencies

- ⌘ **European Food Safety Authority**
- ⌘ **European Medicines Agency**
- ⌘ **European Centre for Disease Prevention and Control**
- ⌘ **Community Plant Variety Office**
- ⌘ **Consumers, Health and Food Executive Agency**

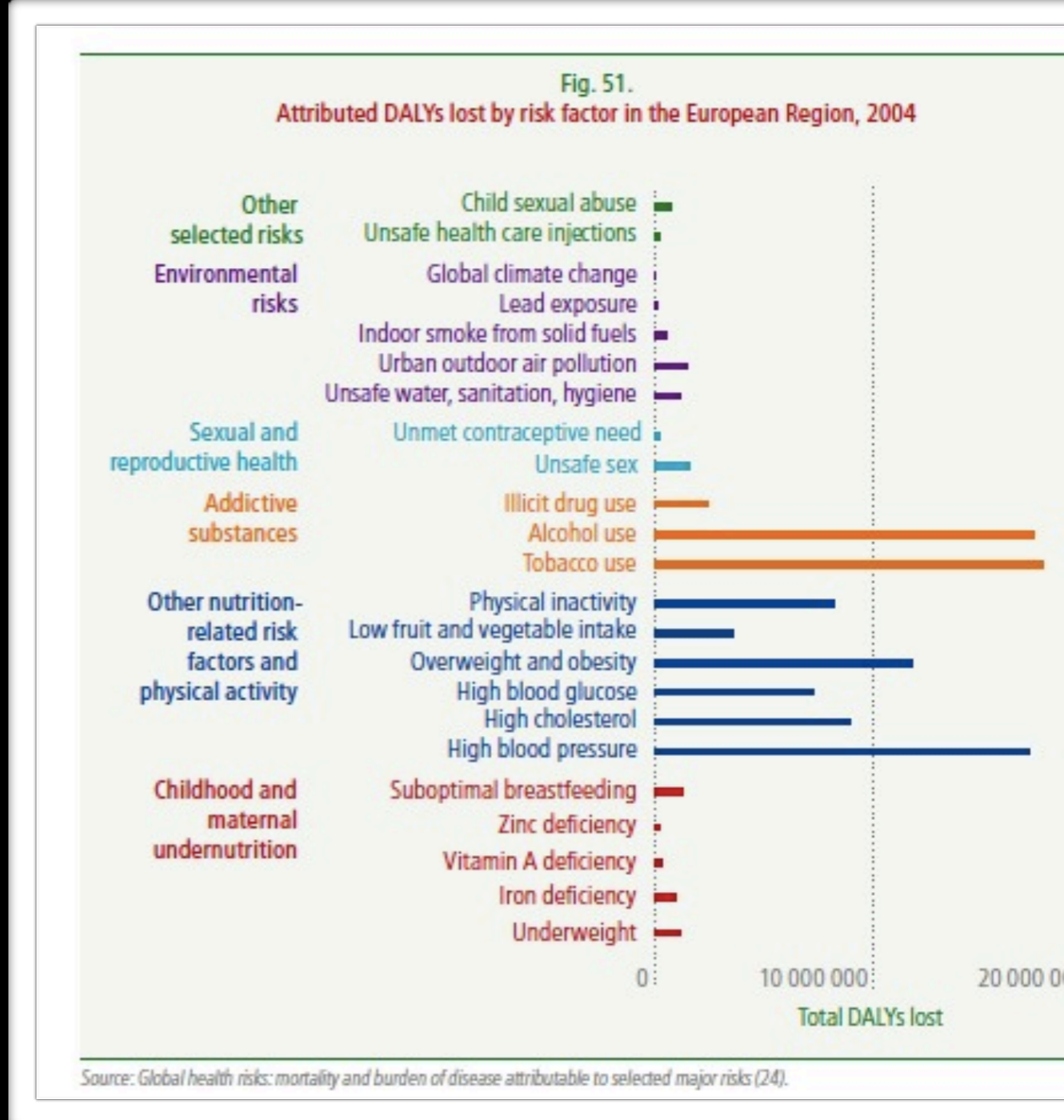
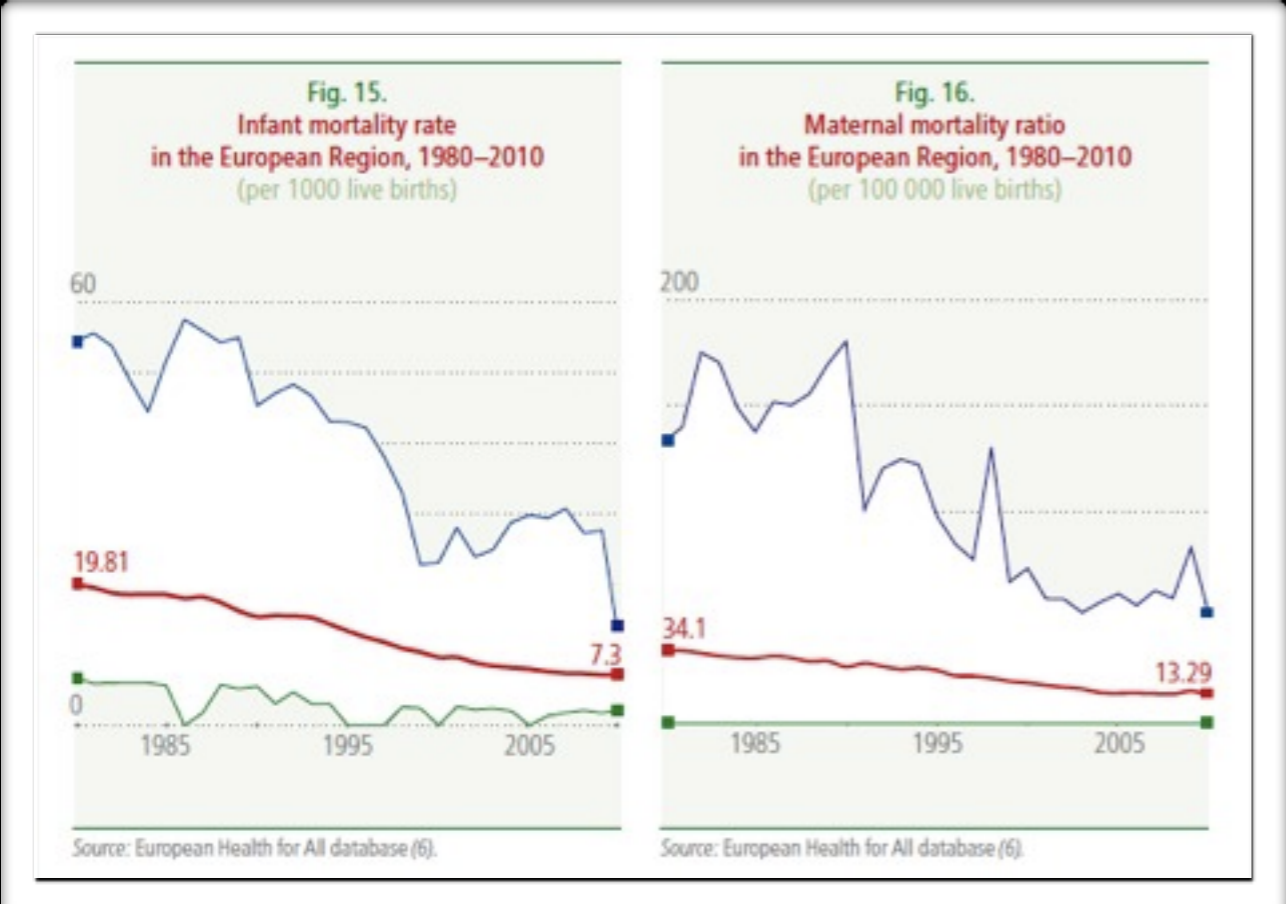
The **Consumers, Health and Food Executive Agency - Chafea** - has started its activities on **1 January 2014**.

Chafea is the successor of the **Executive Agency for Health and Consumers - EAHC** - which was created by the European Commission in 2006 to manage the technical and financial implementation of the Public Health Programme and from 2008 the Consumers Programme and the Better Training for Safer Food Initiative.



Contact | Sitemap | Links

European Centre for Disease Prevention and Control



Health topics > Disease prevention > Nutrition > Country work

Nutrition

- [News](#)
- [Events](#)
- [Policy](#)
- [Activities](#)
- [Country work](#)**
- [Data and statistics](#)
- [Publications](#)
- [Partners](#)

Country work

The country profiles on nutrition, physical activity and obesity provide an overview of country data on a selected list of monitoring and surveillance indicators:

- overweight and obesity for adults, adolescents and children
- exclusive breastfeeding during the first six months of life
- saturated fat intake
- fruit and vegetable supply
- salt intake
- iodine status
- physical inactivity.

Policies and action networks

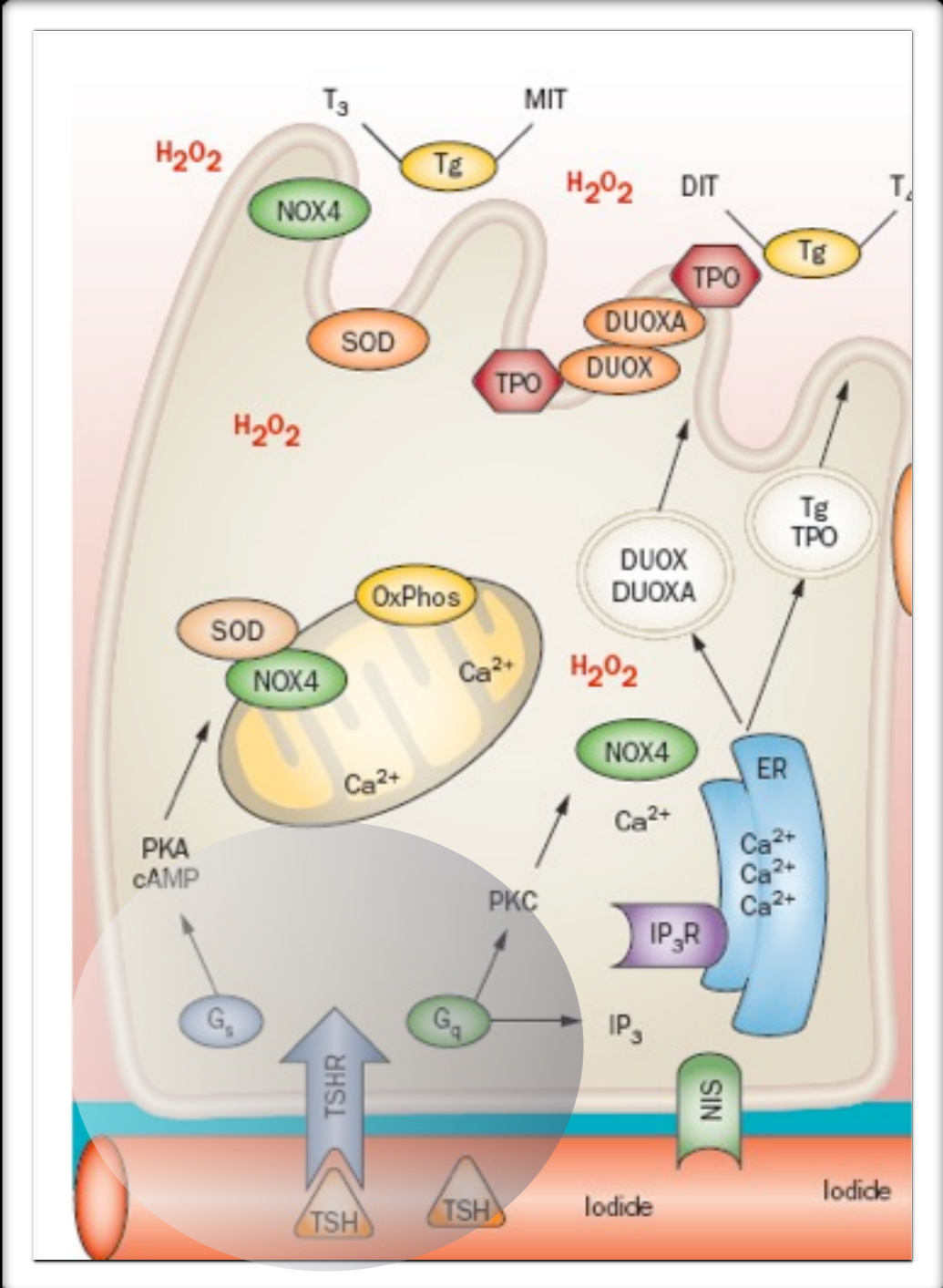
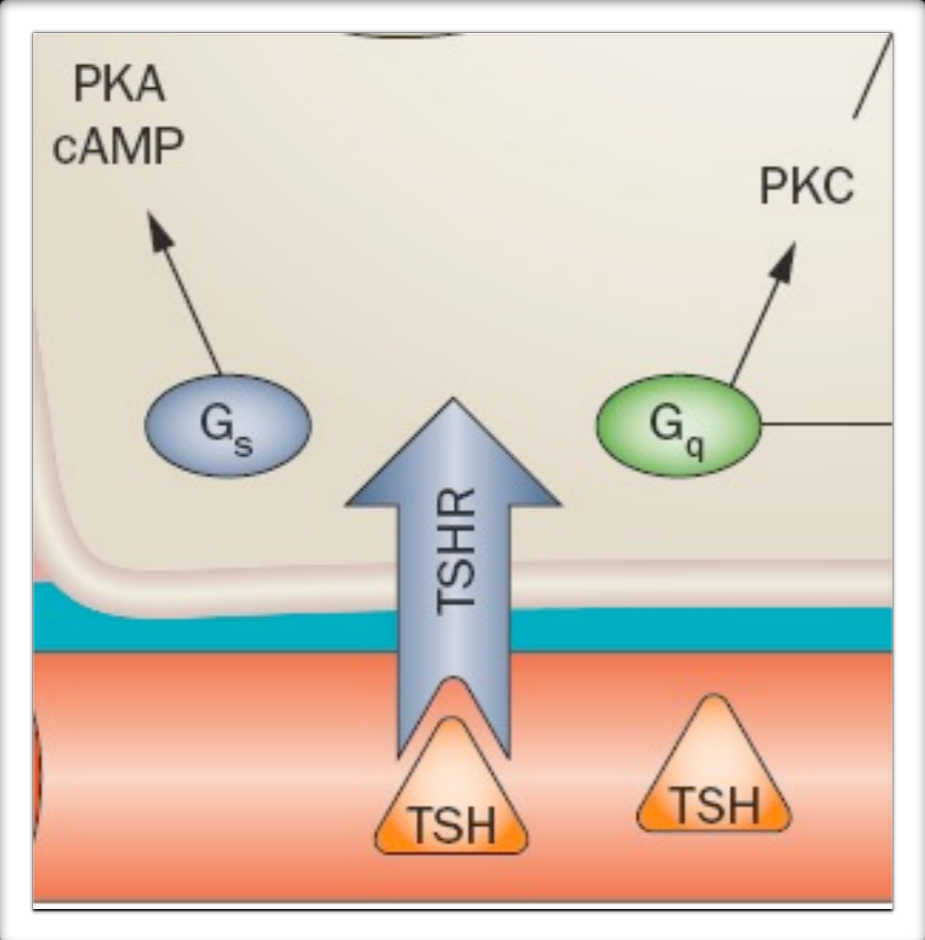
59		60		61		62		63		64		65	
TOBACCO POLICY				NUTRITION (Member States action networks)									
Ratified WHO Framework Convention on Tobacco Control (FCTC)**	Signed Protocol to Eliminate Illicit Trade in Tobacco Products***	Childhood obesity surveillance	Reducing marketing pressure on children	Reducing salt intake in the population	School nutrition	Hospital nutrition	Obesity and health inequalities						



L'UNITA' FUNZIONALE TIROIDEA

Secreted TSH is the major stimulating hormone for thyrocytes

TSH-receptor (TSHR) stimulation activates two intracellular G-proteins (Gs and Gq) and protein kinases (PKA and PKC) and promotes biosynthesis of the sodium/iodide symporter (NIS), thyroglobulin (Tg) and iodinating enzymes



Minireview: The Sodium-Iodide Symporter NIS and Pendrin in Iodide Homeostasis of the Thyroid

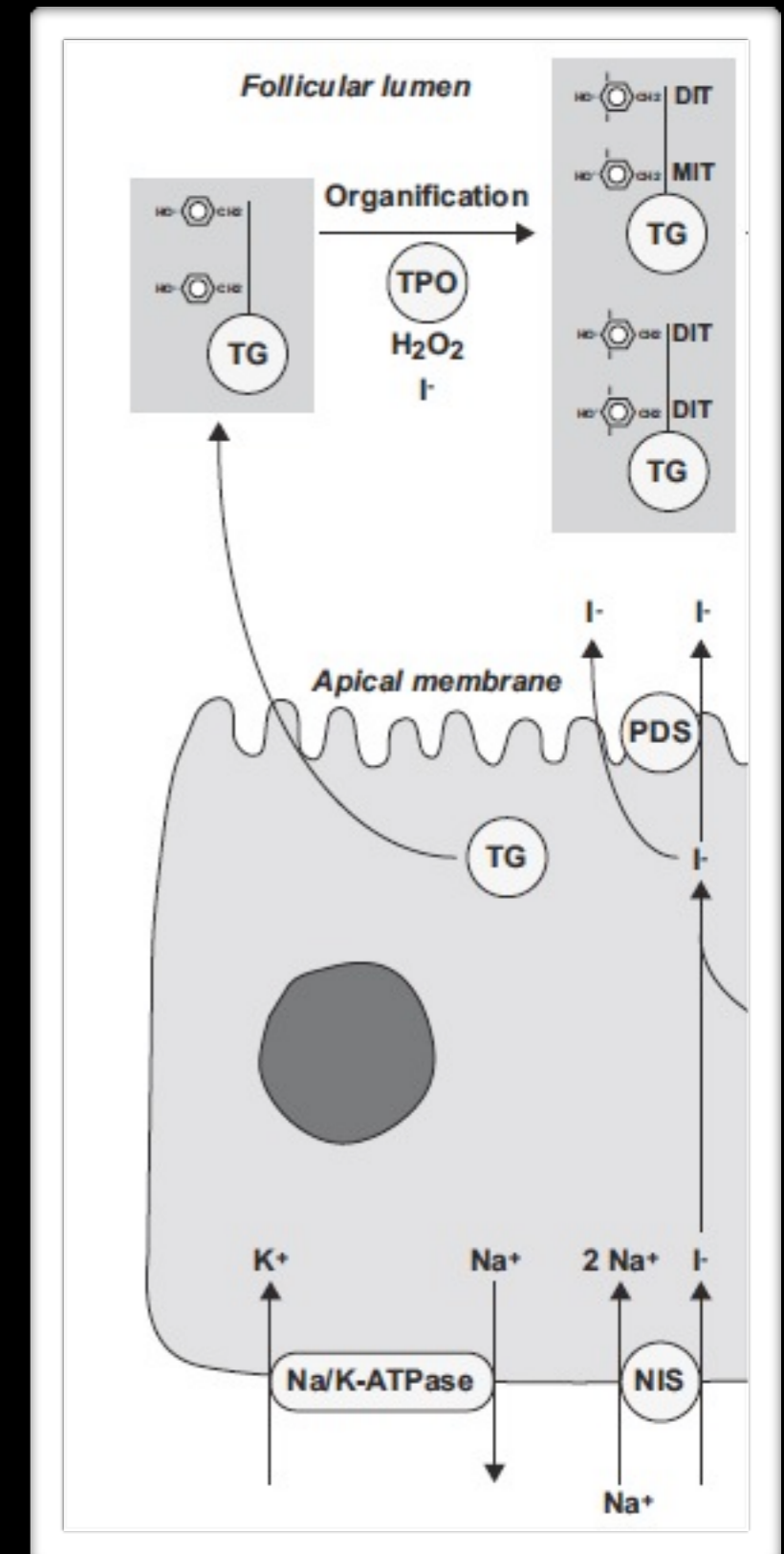
Aigerim Bizhanova and Peter Kopp (Endocrinology 150: 1084–1090, 2009)

Thyroglobulin (TG), which is secreted into the follicular lumen, serves as matrix for synthesis of T4 and T3.

At the cell-colloid interface, iodide is oxidized by TPO in the presence of H₂O₂ (2 ioduro + H₂O₂ + 2 H⁺ ⇌ diioduro + 2 H₂O; organification) with formation of MIT and DIT.

The efflux of iodide across the apical membrane is mediated, at least in part, by pendrin

The synthesis of thyroid hormones requires uptake of iodide across the basolateral membrane into the thyrocytes, transport across the cell, and efflux through the apical membrane into the follicular lumen. Uptake of iodide is mediated by the sodiumiodide symporter (NIS), which cotransports two sodium ions along with one iodide ion, with the sodium gradient serving as the driving force.



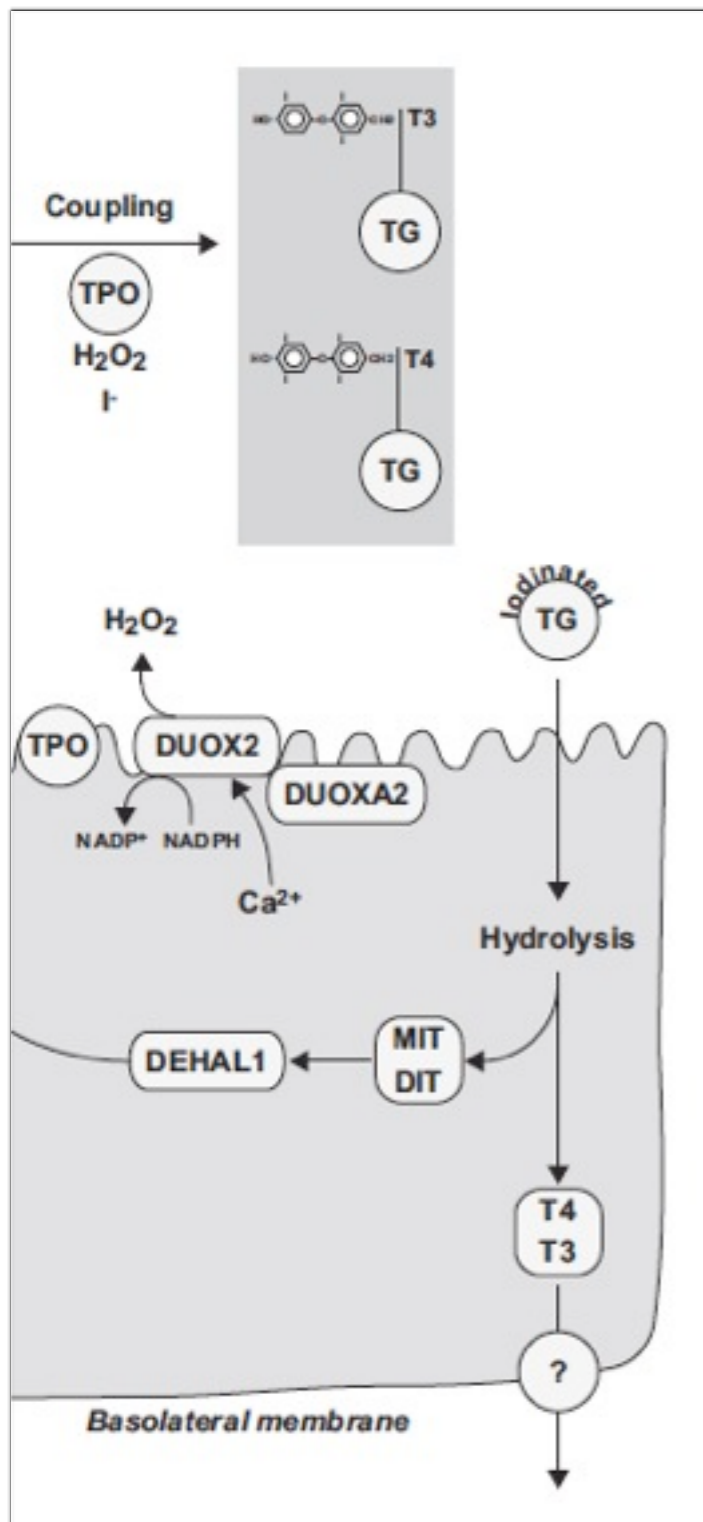
Minireview: The Sodium-Iodide Symporter NIS and Pendrin in Iodide Homeostasis of the Thyroid

Aigerim Bizhanova and Peter Kopp (Endocrinology 150: 1084–1090, 2009)

Two iodotyrosines are coupled to form either T4 or T3 in a reaction that is also catalyzed by TPO (coupling).

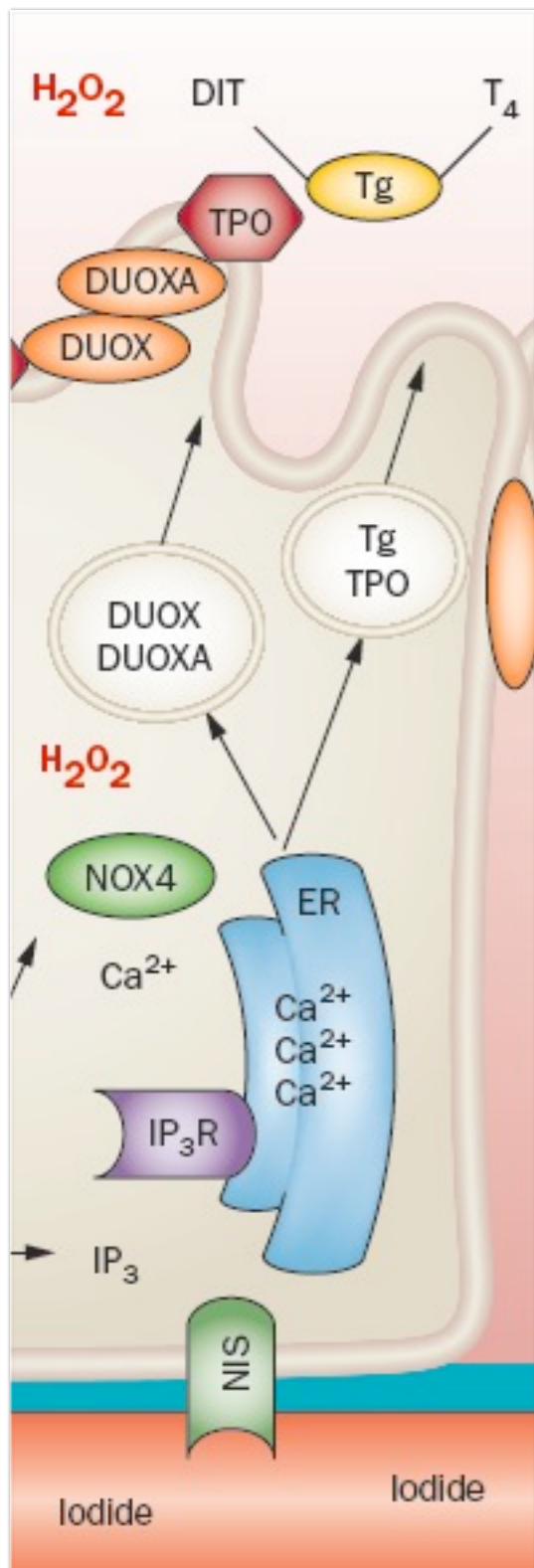
Iodinated thyroglobulin is stored as colloid in the follicular lumen. Upon a demand for thyroid hormone secretion, thyroglobulin is internalized into the follicular cell by pinocytosis and digested in lysosomes, which generates T4 and T3 (proteases of the cathepsin family).

The unused MIT and DIT are retained in the cell and deiodinated by the iodotyrosine dehalogenase 1 (DEHAL1) (iodide recycled)



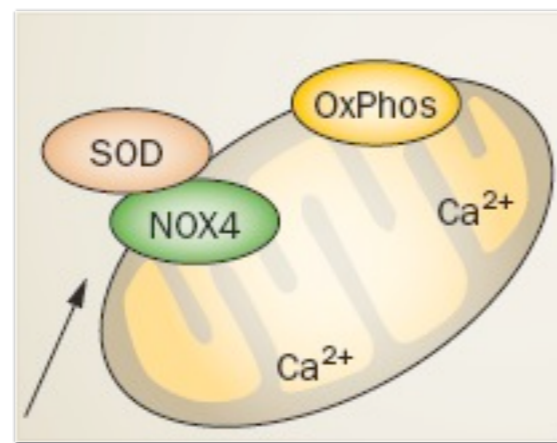
Selenium, selenoproteins and the thyroid gland: interactions in health and disease

Schomburg, L. Nat. Rev. Endocrinol. 8, 160–171 (2012); published online 18 October 2011; doi.10.1038/nrendo.2011.174



The two thyroid-specific NOX isozymes DUOX1 and DUOX2 (apical membrane), are responsible for generating adequate concentrations of ROS (reactive oxygen species) for regular, continuous and physiological adequate thyroid hormone biosynthesis.

Optimum spatial arrangement of dual oxidase (DUOX/DUOXA)–thyroperoxidase (TPO) complexes along with superoxide dismutases (SOD) improves extracellular usage of H₂O₂ and limits its diffusion.



NOX4 (intracellular) was the third member of the NOX family to be detected in human thyroid tissue

The generation of hydrogen peroxide (H₂O₂) is mediated by the calcium-dependent reduced nicotinamide adenine dinucleotide phosphate (NADPH) oxidase NOX4 activities and mitochondrial oxidative phosphorylation (OxPhos) (source of intracellular hydrogen peroxide)

Thyroid selenoproteins

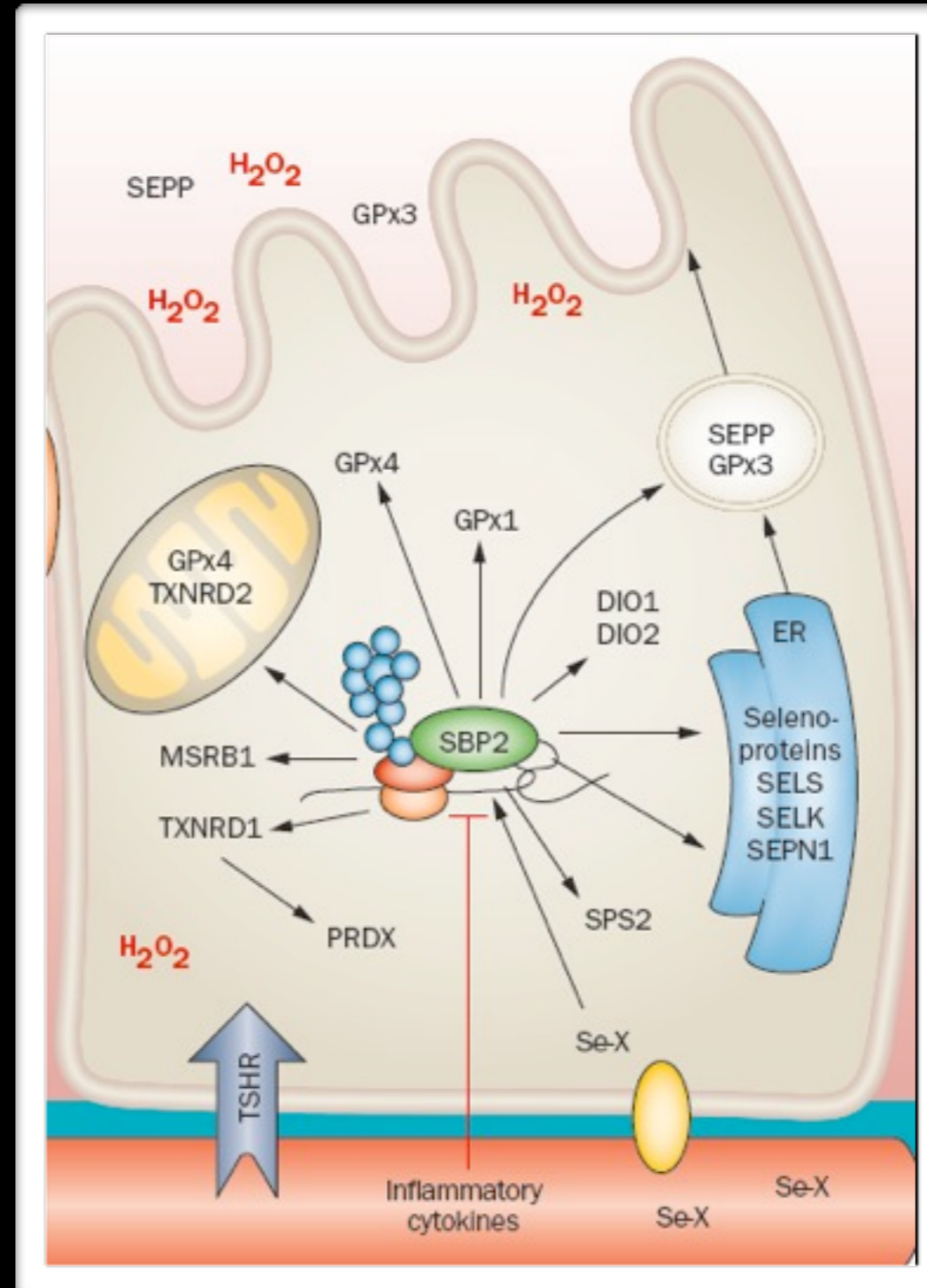
The families of selenoproteins

Glutathione peroxidases
(GPxs)

Thioredoxin reductase
(TRs)

Iodothyronine deiodinases
(DIOs)

Seleno-proteins
(SEL)



Published in final edited form as:

Cell Mol Life Sci. 2009 August ; 66(15): 2457–2478. doi:10.1007/s00018-009-0032-4.

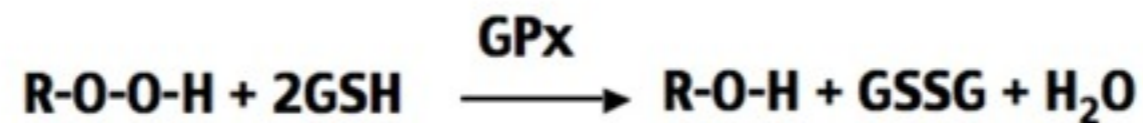
The human selenoproteome: recent insights into functions and regulation

M. A. Reeves and P. R. Hoffmann

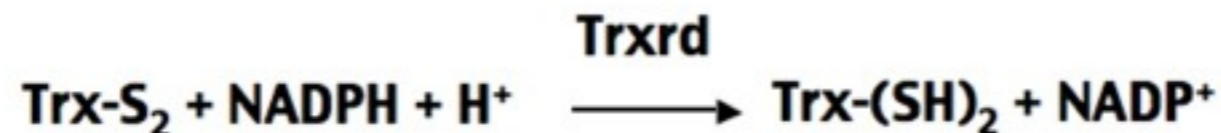
Department of Cell and Molecular Biology, John A. Burns School of Medicine, University of Hawaii, 651 Ilalo Street, Honolulu HI 96813 USA. Fax: (808) 692-1968

Antioxidant/Redox Reactions Involving Selenoproteins

1. *Detoxification of peroxides:*



2. *Regeneration of reduced thioredoxin:*



3. *Reduction of oxidized methionine residues:*

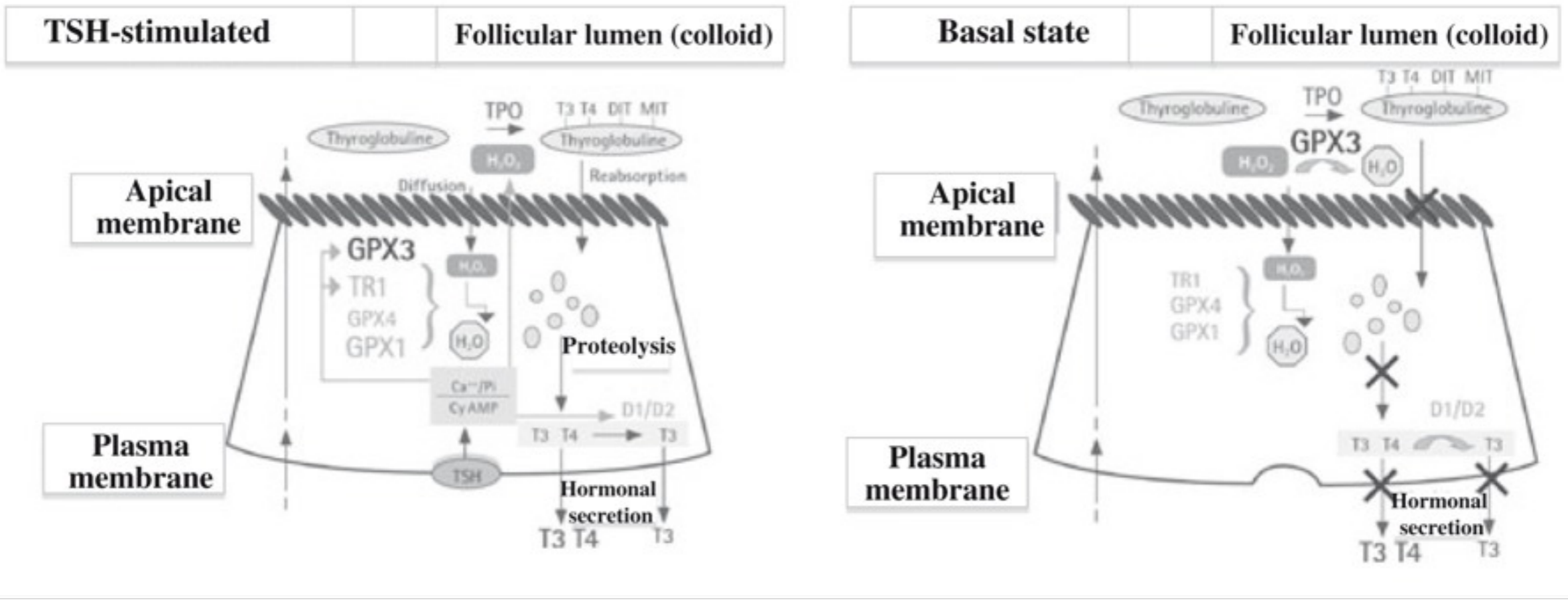


REVIEW ARTICLE

Selenium and the thyroid gland: more good news for clinicians

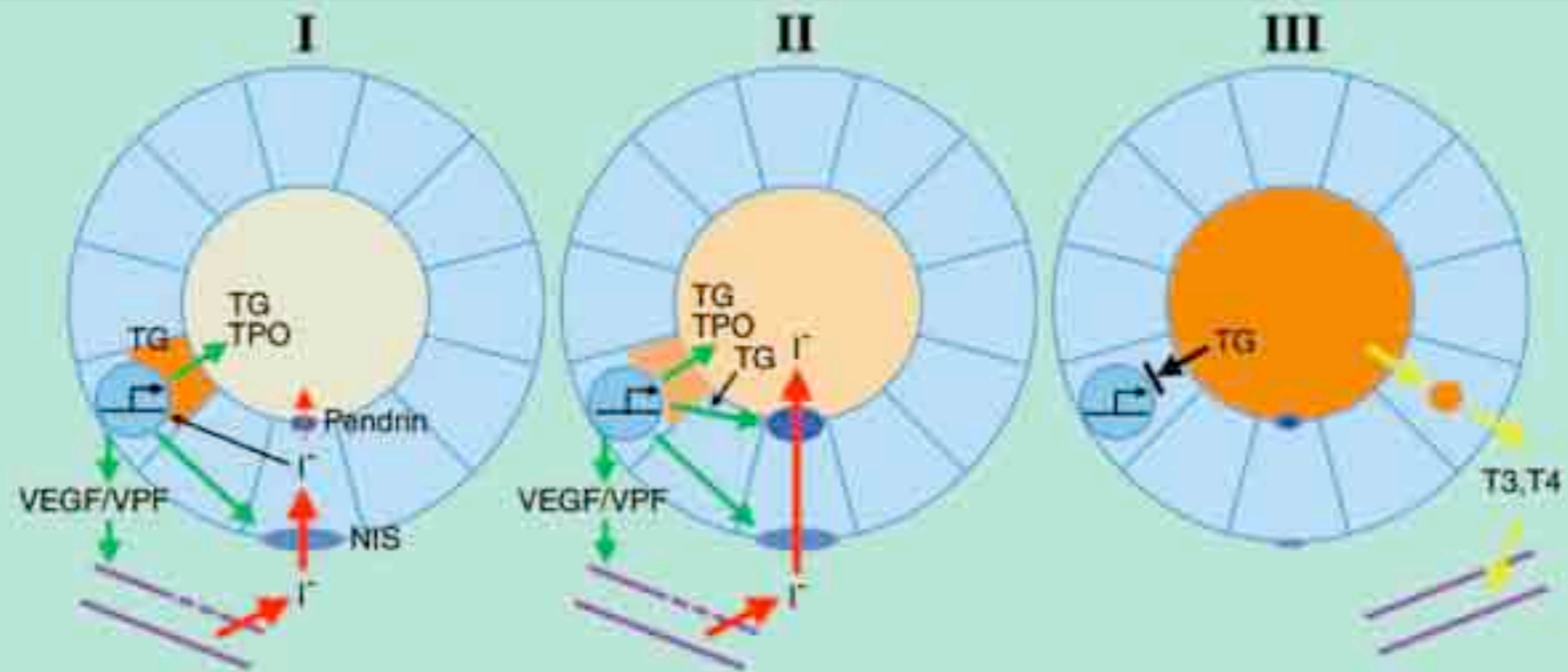
Anne Drutel*, Françoise Archambeaud* and Philippe Caront

*Department of Endocrinology and Metabolic diseases, Hôpital du Cluzeau, Limoges Cedex and †Department of Endocrinology and Metabolic diseases, Pôle cardio-vasculaire et métabolique, CHU Larrey-Rangueil, Toulouse Cedex 9, France

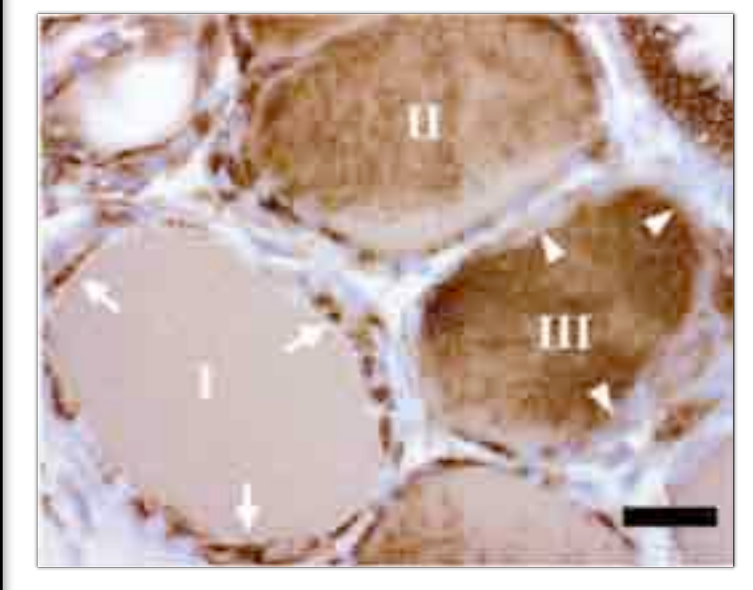


Differential regulation of apical and basal iodide transporters in the thyroid by thyroglobulin

Koichi Suzuki and Leonard D Kohn- Journal of Endocrinology (2006) 189, 247–255



Follicular TG accumulation	-/+	+	+++
Gene expression			
NIS, TG, TPO, VEGF/VPF	+++	++/+++	-/+
PDS	-/+	+++	-/+
Function			
TG synthesis	+++	++/+++	+
Vascular permeability	+++	+++	+
Iodide transport	+	+++	-/+
Hormone biosynthesis	+	+++	-/+
Hormone secretion	-/+	+	+++



Effect of selenium supplementation on thyroid hormone metabolism in an iodine and selenium deficient population.

Contempré B¹, Duale NL, Dumont JE, Ngo B, Diplock AT, Vanderpas J.

⊕ Author information

Abstract

OBJECTIVE: Severe selenium deficiency has been documented in northern Zaïre, already known as one of the most iodine deficient regions in the world and characterized by a predominance of the myxoedematous form of cretinism. This has been attributed to the double deficiency of essential trace elements. A short selenium supplementation programme was conducted in this area to evaluate the effects of a selenium supplementation on thyroid diseases.

DESIGN: Placebo or selenium 50 micrograms as selenomethionine was administered once daily for 2 months. Blood and urine samples were collected before and after supplementation.

PATIENTS: Fifty-two healthy schoolchildren from northern Zaire.

MEASUREMENT: Selenium status, thyroid function and urinary iodide were determined.

RESULTS: After 2 months of selenium supplementation, mean +/- SD serum T4 decreased from 73.1 +/- 45.4 to 48.3 +/- 23.7 nmol/l (P less than 0.001), serum FT4 from 11.8 +/- 6.7 to 8.4 +/- 4.1 pmol/l (P less than 0.01), and serum rT3 from 124 +/- 115 to 90 +/- 72 pmol/l (P less than 0.05), without significant change in serum T3 and serum TSH.

CONCLUSION: Deiodinase type I which has been shown to be a seleno-enzyme could account for the changes in thyroid hormones in our subjects. Our data show that selenium plays a definite role in thyroid hormone metabolism in humans. Selenium could be an important cofactor in the clinical picture of iodine deficiency in Central Africa and could be involved in the aetiology of both forms of cretinism.

The selenium supplementation should not be provided without concomitant iodine prophylaxis in an area of co-existing iodine and selenium deficiency

The impact of common micronutrient deficiencies on iodine and thyroid metabolism: the evidence from human studies

Sonja Y. Hess, Ph.D., Research Nutritionist *

Program in International and Community Nutrition, Department of Nutrition, University of California, Davis, CA, USA

Best Practice & Research Clinical Endocrinology & Metabolism 24 (2010) 117–132

Iron deficiency anaemia (IDA) reduces the efficacy of iodine prophylaxis, the co-fortification of iodised salt with iron was considered a potential solution, not only to prevent iron deficiency, but also to improve the efficacy of iodised salt in populations with a high prevalence of IDA.

Various mechanisms have been suggested for the interaction between iron and iodine deficiencies. Results from animal studies suggest that IDA may influence thyroid metabolism by **altering the central nervous system control**, decreasing **T3 binding to hepatic nuclear receptors** and **reducing thyroid peroxidase activity**, an enzyme essential for thyroid hormone synthesis. IDA could also impair thyroid metabolism **through lowered oxygen transport**. It is likely that these mechanisms jointly contribute to the impairment of thyroid function in iron deficiency.

Table 3
The impact of providing vitamin A in addition to iodine on iodine status and thyroid metabolism in randomized double-blind controlled intervention trials in school-aged children.

Study (Ref)	Study population characteristics	Age group (yrs)	Duration of intervention	Iodine intervention	Vitamin A intervention	Study group	Sample size ^a	Final urinary iodine concentration ($\mu\text{g/L}$) ^b	Final thyroid volume (mL) ^b	Final Total T ₄ concentration (nmol/L) ^b	Final TSH concentration (mIU/L) ^b	Final serum retinol concentration ($\mu\text{mol/L}$) ^b	Final retinol-binding protein concentration (mg/L) ^b
Zimmermann et al., 2004 ⁵⁰	School children with severe iodine deficiency and low vitamin A status ^c in Morocco	6-14	10 mo	IS (25 μg iodine/g salt)	Placebo capsule at 0 and 5 mo	Iodine	71	104 (22-1104)	6.2 (2.1-11.9)	119 \pm 22	1.6 (0.3-3.0)	0.79 \pm 0.11	20.6 \pm 8.8
				IS (25 μg iodine/g salt)	Vitamin A capsule (200,000 IU retinyl palmitate) at 0 and 5 mo	Iodine + Vitamin A	67	99 (21-1124) (ns)	5.3 (2.2-12.4) ($P < 0.05$) ^d	116 \pm 22 (ns)	0.9 (0.3-2.1) ($P < 0.01$) ^d	1.09 \pm 0.13 ($P < 0.01$) ^d	30.2 \pm 11.2 ($P < 0.05$) ^d
Zimmermann et al., 2007 ⁵¹	South Africa	5-14	6 mo	Placebo	Placebo	Placebo	88	88 (13-455)	3.29 (1.08-10.08)	99 \pm 19	1.7 (0.7-4.1)	0.91 \pm 0.21	RBP 20.5 \pm 10.1
				Placebo	Vitamin A capsule (200,000 IU retinyl palmitate)	Vitamin A	115	97 (15-470)	2.91 (0.88-8.96) ($P < 0.05$) ^f	97 \pm 16	1.1 (0.5-2.9) ($P < 0.05$) ^f	1.22 \pm 0.21 ($P < 0.05$) ^h	30.3 \pm 11.8 ($P < 0.05$) ^h
				191 mg single oral iodine dose	Placebo	Iodine	100	149 (1-1044) ($P < 0.05$) ^e	2.34 (0.87-9.97) ($P < 0.05$) ^g	100 \pm 17	0.6 (0.3-4.6) ($P < 0.05$) ^g	0.91 \pm 0.24	21.3 \pm 13.1
				191 mg single oral iodine dose	Vitamin A capsule (200,000 IU retinyl palmitate)	Iodine + Vitamin A	101	175 (4-1567) ($P < 0.05$) ^e	2.50 (1.01-8.18) ($P < 0.05$) ^g	102 \pm 18 (ns)	0.5 (0.4-2.9) ($P < 0.05$) ^g	1.19 \pm 0.22 ($P < 0.05$) ^h	29.6 \pm 14.3 ($P < 0.05$) ^h

The vitamin A deficiency has multiple effects on thyroid metabolism. Vitamin A status modulates thyroid gland metabolism, peripheral metabolism of thyroid hormone and production of TSH by the pituitary. At the thyroid, vitamin A deficiency causes **thyroid hypertrophy**, reduces thyroidal **iodine uptake**, impairs **synthesis of thyroglobulin** and **coupling of iodotyrosine residues** to form thyroid hormone and decreases **intrathyroidal T3 and T4**. In the periphery, vitamin A deficiency **increases total and free T4 and T3**, reduces **hepatic conversion of T4 to T3** and **decreases T3 uptake and binding**

Further research is required to better understand the impact of concurrent iodine and vitamin A deficiency on thyroid metabolism, in particular, in young children and pregnant women, the most vulnerable population groups.

SICUREZZA ALIMENTARE

SCIENTIFIC OPINION

Scientific Opinion on principles for deriving and applying Dietary Reference Values¹

EFSA Panel on Dietetic Products, Nutrition, and Allergies (NDA)^{2,3}

European Food Safety Authority (EFSA), Parma, Italy

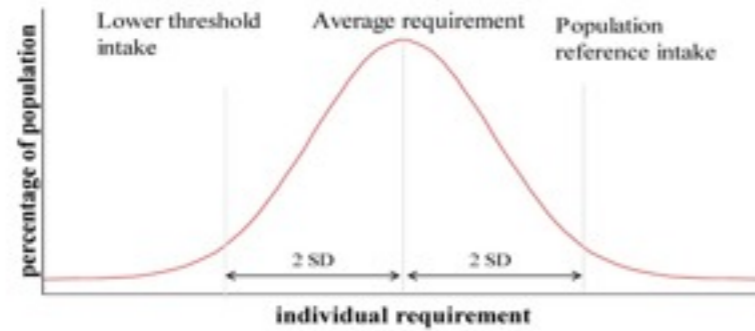
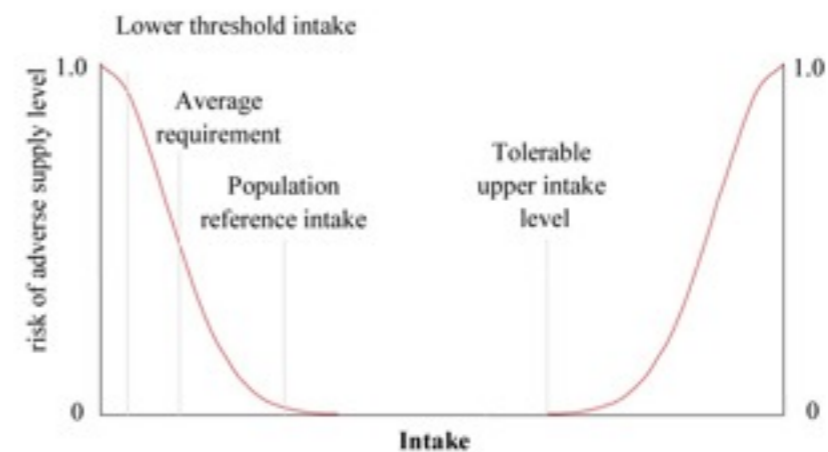


Figure 1: Population reference intakes (PRI) and average requirement (AR), if the requirement has a normal distribution and the inter-individual variation is known.



From: Health and Welfare, Canada, 1983; as adapted by Netherlands Health Council, 2000

Figure 2: Relationship between individual intake and risk of adverse effects due to insufficient or excessive intake.

Life-stage group	U.S. EAR	U.S. AI or RDA	Life-stage group	WHO (RNI)
Infants 0–12 months	-	110-130	Children 0-5 years	90
Children 1-8 years	65	90	Children 6-12 years	120
Children 9-13 years	73	120		
Adults 14 years	95	150	Adults >12 years	150
Pregnancy	160	220	Pregnancy	250
Lactation	200	290	Lactation	250



DRAFT SCIENTIFIC OPINION

Scientific Opinion on Dietary Reference Values for iodine¹

EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA)^{2,3}

European Food Safety Authority (EFSA), Parma, Italy

ABSTRACT

Following a request from the European Commission, the Panel on Dietetic Products, Nutrition and Allergies (NDA) derived Dietary Reference Values (DRVs) for iodine, which are provided as **Adequate Intake (AI)**. Iodine is essential for synthesis of thyroid hormones. Through these hormones, iodine has an important role in energy-yielding metabolism and many other physiological processes. Iodine deficiency is associated with an increased frequency of goitre and hypothyroidism in a population. The AI for iodine is based on a large epidemiological study in European school-aged children showing that goitre prevalence is lowest for a urinary iodine concentration above around 100 µg/L. From this figure, a threshold urinary iodine concentration of ≥ 100 µg/L indicating sufficient iodine intake has been derived for school-aged children. In the absence of similar suitable data for other age groups it is proposed that this threshold also be applied for adults, infants and young children. Taking into account urinary volume and an iodine absorption efficiency of 92 %, an **AI of 150 µg/day is proposed for adults**. For infants aged 7–11 months and for children, AIs range between 70 µg/day and 130 µg/day. For pregnant women, an AI of 200 µg/day is proposed, taking into account the additional needs due to increased maternal thyroid hormone production and the iodine uptake by the fetus, placenta and amniotic fluid. The proposed AI for lactating women of 200 µg/day takes into account the existence of large iodine stores in conditions of adequate iodine status before pregnancy and considers that a full compensation for the iodine secreted in breast milk is not justified for the derivation of DRVs for iodine for lactating women.

TOLERABLE UPPER INTAKE LEVELS FOR VITAMINS AND MINERALS

Scientific Committee on Food
Scientific Panel on Dietetic Products, Nutrition and Allergies

Daily requirements

The amount of dietary selenium (as DL-selenomethionine) required to saturate the selenium need of extracellular GSHPx was used as one of the approaches to define a Dietary Reference Intake for Selenium in the USA in 2000 (55 µg/day for adult men and women) (NAS; 2000). A so-called Population Reference Intake of 55 µg selenium per day for adults, but also other levels of intakes based on other criteria, were established by the Scientific Committee for Food of the European Commission (1993).

A joint FAO/IAEA/WHO Expert Consultation (WHO, 1996) gave several modes for the calculation of requirements of the individual and populations. For a 65 kg reference man the average normative requirement of individuals for selenium was estimated to be 26 µg/day, and from this value the lower limit of the need of population mean intakes was estimated to be 40 µg/day. The corresponding values for a 55 kg reference woman were 21 and 30 µg selenium/day, respectively. The latter value was estimated to increase to 39 µg/day throughout pregnancy and to attain the values of 42, 46 and 52 µg selenium/day at 0-3, 3-6 and 6-12 months of lactation, respectively. The Nordic Nutrition Recommendations (1996) have set a recommended intake of 50 µg/day for men, an average requirement of 35 µg/day and a lower limit of needed intake of 20 µg/day, the corresponding values for women being 40, 30 and 20 µg/day, respectively.

February 2006

CHARACTERISATION OF RISK

Based on the information on selenium toxicity, there are areas in the world where there is a human intake of selenium with no or only very small safety margins to levels where toxicity may occur. However, in most European countries the mean intake levels are much lower, in the lower range of 30-90 µg Se/day, except for Norway, that has a somewhat higher mean intake (60 µg Se/day) due to import of wheat rich in selenium. Finland has an intake of 100-110 µg Se/day because of selenium fertilisation. The margin between the present mean intake, excluding supplements, in the European population and an UL (adult) of 300 µg Se/day would be between 2.7 to 10. The 97.5 percentile intake was 81 and 90 µg Se/day in Italy and The Netherlands, respectively, giving a margin to the UL of about 2.7.



EuroDish

Study on the Need for Food and Health Research Infrastructures in Europe – EuroDISH

Total Budget: € 2,000,000
 Consortium: 15 partners
 Countries: 7
 Duration: 1 Sept 2012 – 31 Aug 2015
www.eurodish.eu

Background

Europe is facing major challenges in promoting health and reducing the disease burden of age- and diet-related noncommunicable diseases by means of lifestyle, food and nutrition. Research collaboration, innovation, and capacity building are essential to efficiently benefit from the – mainly public – research resources. To realise this, EU-wide Research Infrastructures (RIs) are essential.

Objectives

EuroDISH is focusing on the integration of existing food and health RIs, as well as the development of new ones. It will consider the needs of different stakeholders, such as EU and national policy makers, and researchers from a range of disciplines in both the public sector and industry. EuroDISH research will be organised around the 'DISH' model: 'Determinants, Intake, Status and Health'. This model represents four key building blocks of food and health research as well as different stages of RI development.



Table 2 Examples of research gaps and needs for selected micronutrients, by study approach

Micronutrient	Factorial approach	Dose–response approach
Folate	For all <i>population groups</i> , there are very limited data. <i>Bioavailability</i> : Interactions of other B-vitamins (B12, B6, riboflavin) and choline and bioavailability of folate.	<i>Intake</i> : Accurate data on folate intake, both natural food folate and folic acid (supplements, fortified foods). <i>Intake-health</i> : Standardization of health outcomes for CVD, cancer, and cognition would facilitate meta-analyses. <i>Status-health</i> : Data needed on folate status and health outcomes in infants, children, adolescents, pregnant and lactating women. <i>Health outcomes</i> : Adverse effects in addition to benefits, for example, in populations already with high folic acid intakes (fortified population, supplement users).
Vitamin B12	<i>Population groups</i> : There are no factorial data for children, adolescents, pregnant or lactating women. Reference values, where present, are currently based on scaling from adults and elderly.	<i>Intake-health</i> : Standardized measures for health outcomes are needed, particularly for cognitive outcomes and bone health. <i>Status-health</i> : Data needed on functional markers of vitamin B12 status (MMA and holoTC); relationship between B12 biomarkers and liver stores is not clear.
Iodine	<i>Population groups</i> : There are no factorial data for children, adolescents, pregnant or lactating women and elderly. <i>Bioavailability</i> : There was limited data of iodine absorption from whole diet.	<i>Intake</i> : Very limited data on iodine intake assessment. <i>Intake-health</i> : RCTs across all population groups and life stages with measuring relevant long-term health outcomes are needed to generate robust data. <i>Health outcomes</i> : Standardized measure of assessing cognitive function and reference ranges for thyroid function tests are needed.
Iron	<i>Population groups</i> : Effect of gender and menopausal status on obligatory losses and needs for lactation and in elderly are controversial. <i>Bioavailability</i> : Host-related factors that affect bioavailability and requirements are insufficiently studied, especially from whole diets.	<i>Intake-status</i> : Very few trials in the low-dose range. <i>Status markers</i> : Biomarkers of iron status need to be assessed in combination; the part of their variation due to infection/inflammation must be accounted for by measuring proper inflammatory markers. <i>Health outcomes</i> : Scarcely studied, little data on requirements for growth and development in the young.
Selenium	<i>Population groups</i> : Selenium demand for testes and prostate function during puberty and adolescence needs attention.	<i>Status-health</i> : The joint effect of selenium biomarkers, SNPs and status/health outcomes needs attention, for example, iodine and vitamin B12.
Zinc	<i>Population groups</i> : There are little data on young children, pregnant or lactating women. <i>Bioavailability</i> : Phytate, calcium, and iron need attention because they may be potent modifiers.	<i>Status-health</i> : Need for reliable and valid biomarkers and for better characterization of suboptimal intake.

Critical Reviews in Food Science and Nutrition

Publication details, including instructions for authors and subscription information:
<http://www.tandfonline.com/loi/bfsn20>

EURRECA—Principles and Future for Deriving Micronutrient Recommendations

Mandy Claessens^a, Laura Contor^a, Rosalie Dhonukshe-Rutten^b, Lisette Cpgm De Groot^b, Susan J. Fairweather-Tait^c, Mirjana Gurinovic^d, Berthold Koletzko^e, Ben Van Ommen^f, Monique M. Raats^g & Pieter Van't Veer^h

^a ILSI Europe a.i.s.b.l., Brussels, Belgium

^b Division of Human Nutrition, Wageningen University, Wageningen, The Netherlands

^c Department of Nutrition, Norwich Medical School, University of East Anglia, Norwich, UK

^d Department of Nutrition and Metabolism, Institute for Medical Research, University of Belgrade, Belgrade, Serbia

^e Division of Metabolic Diseases and Nutritional Medicine, Ludwig-Maximilians-University of Munich, Munich, Germany

^f Microbiology and Systems Biology Research Group, TNO, Zeist, The Netherlands

^g Food, Consumer Behaviour and Health Research Centre, Department of Psychology, University of Surrey, Norwich, UK

Accepted author version posted online: 05 Aug 2013. Published online: 16 Aug 2013.

Table 2 Examples of research gaps and needs for selected micronutrients, by study approach

Micronutrient	Factorial approach	Dose–
Folate	For all <i>population groups</i> , there are very limited data. <i>Bioavailability</i> : Interactions of other B-vitamins (B12, B6, riboflavin) and choline and bioavailability of folate.	<i>Intake</i> : Accurate data on folate intake (supplements, fortified foods). <i>Intake-health</i> : Standardization of intake and cognition would facilitate comparisons. <i>Status-health</i> : Data needed on folate status in infants, children, adolescents. <i>Health outcomes</i> : Adverse effects of low folate intake, for example, in populations at risk of deficiency (fortified population, supplemented population).
Vitamin B12	<i>Population groups</i> : There are no factorial data for children, adolescents, pregnant or lactating women. Reference values, where present, are currently based on scaling from adults and elderly.	<i>Intake-health</i> : Standardized intake data needed, particularly for children. <i>Status-health</i> : Data needed on B12 status (MMA and holoTC); relationship between B12 biomarkers and liver stores is not clear.
Iodine	<i>Population groups</i> : There are no factorial data for children, adolescents, pregnant or lactating women and elderly. <i>Bioavailability</i> : There was limited data of iodine absorption from whole diet.	<i>Intake</i> : Very limited data on iodine intake assessment. <i>Intake-health</i> : RCTs across all population groups and life stages with measuring relevant long-term health outcomes are needed to generate robust data. <i>Health outcomes</i> : Standardized measure of assessing cognitive function and reference ranges for thyroid function tests are needed.
Iron	<i>Population groups</i> : Effect of gender and menopausal status on obligatory losses and needs for lactation and in elderly are controversial. <i>Bioavailability</i> : Host-related factors that affect bioavailability and requirements are insufficiently studied, especially from whole diets.	<i>Intake-status</i> : Very few trials in the low-dose range. <i>Status markers</i> : Biomarkers of iron status need to be assessed in combination; the part of their variation due to infection/inflammation must be accounted for by measuring proper inflammatory markers. <i>Health outcomes</i> : Scarcely studied, little data on requirements for iron.

Critical Reviews in Food Science and Nutrition

Publication details, including instructions for authors and subscription information:
<http://www.tandfonline.com/loi/bfsn20>

EURRECA—Principles and Future for Deriving Micronutrient Recommendations

Mandy Claessens^a, Laura Contor^a, Rosalie Dhonukshe-Rutten^b, Lisette Cpgm De Groot^b, Susan J. Fairweather-Tait^c, Mirjana Gurinovic^d, Berthold Koletzko^e, Ben Van Ommen^f, Monique M. Raats^g & Pieter Van't Veer^b

^a ILSI Europe a.i.s.b.l., Brussels, Belgium

^b Division of Human Nutrition, Wageningen University, Wageningen, The Netherlands

^c Department of Nutrition, Norwich Medical School, University of East Anglia, Norwich, UK

^d Department of Nutrition and Metabolism, Institute for Medical Research, University of Belgrade, Belgrade, Serbia

^e Division of Metabolic Diseases and Nutritional Medicine, Ludwig-Maximilians-University of Munich, Munich, Germany

^f Microbiology and Systems Biology Research Group, TNO, Zeist, The Netherlands

^g Food, Consumer Behaviour and Health Research Centre, Department of Psychology, University of Surrey, Norwich, UK

Accepted author version posted online: 05 Aug 2013. Published online: 16 Aug 2013.

multilateral initiatives leading to the better use and development of research infrastructures, at EU and international level) and the Horizon2020 programme (<http://ec.europa.eu/research/horizon2020>) (the EU's new programme for research and innovation, running from 2014 to 2020 with an €80 billion budget).

Role of Iodine, Selenium and Other Micronutrients in Thyroid Function and Disorders

Vincenzo Triggiani^{1,*}, Emilio Tafaro¹, Vito Angelo Giagulli², Carlo Sabbà³, Francesco Resta⁴, Brunella Licchelli¹ and Edoardo Guastamacchia¹

¹Endocrinology and Metabolic Diseases, University of Bari, Bari, Italy; ²Department of Internal Medicine, Metabolic Diseases and Diabetes, Conversano-Monopoli, Italy; ³Internal Medicine, Department of Internal Medicine and Public Medicine (DI.MI.M.P.) University of Bari, Bari, Italy; ⁴Geriatrics and Gerontology, Department of Internal Medicine, Immunology and Infectious Disease (M.I.D.I.M.) University of Bari, Bari, Italy

Micronutrients, mostly iodine and selenium, are required for thyroid hormone synthesis and function. Iodine is an essential component of thyroid hormones and its deficiency is considered as the most common cause of preventable brain damage in the world.

Three different selenium-dependent iodothyronine deiodinases (types I, II, and III) can both activate and inactivate thyroid hormones, making selenium an essential micronutrient for normal development, growth, and metabolism. Furthermore, selenium is found as selenocysteine in the catalytic center of enzymes protecting the thyroid from free radicals damage.

Selenium deficiency can exacerbate the effects of iodine deficiency and the same is true for vitamin A or iron deficiency.