

**Plant-based diets in pediatrics:
The importance of iodized salt to
prevent iodine deficiency**

Dr. sc. Maria Andersson

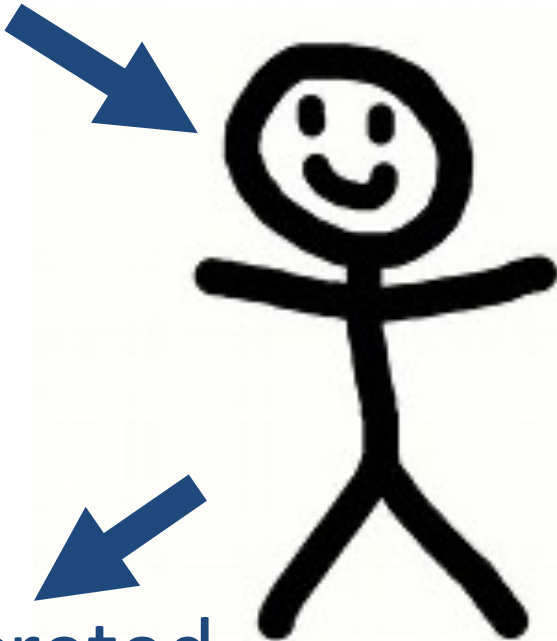
Nutrition Research Unit

University Children's Hospital Zurich

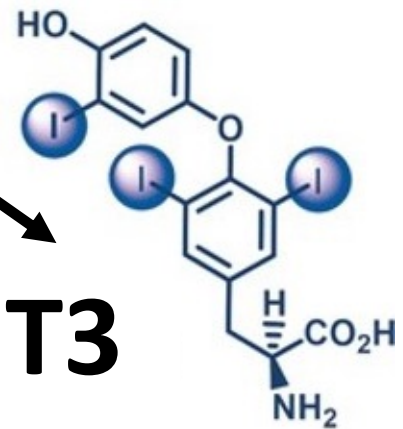
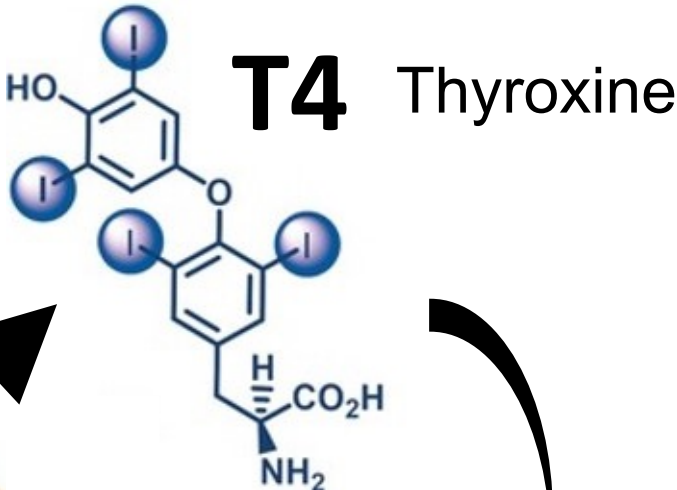
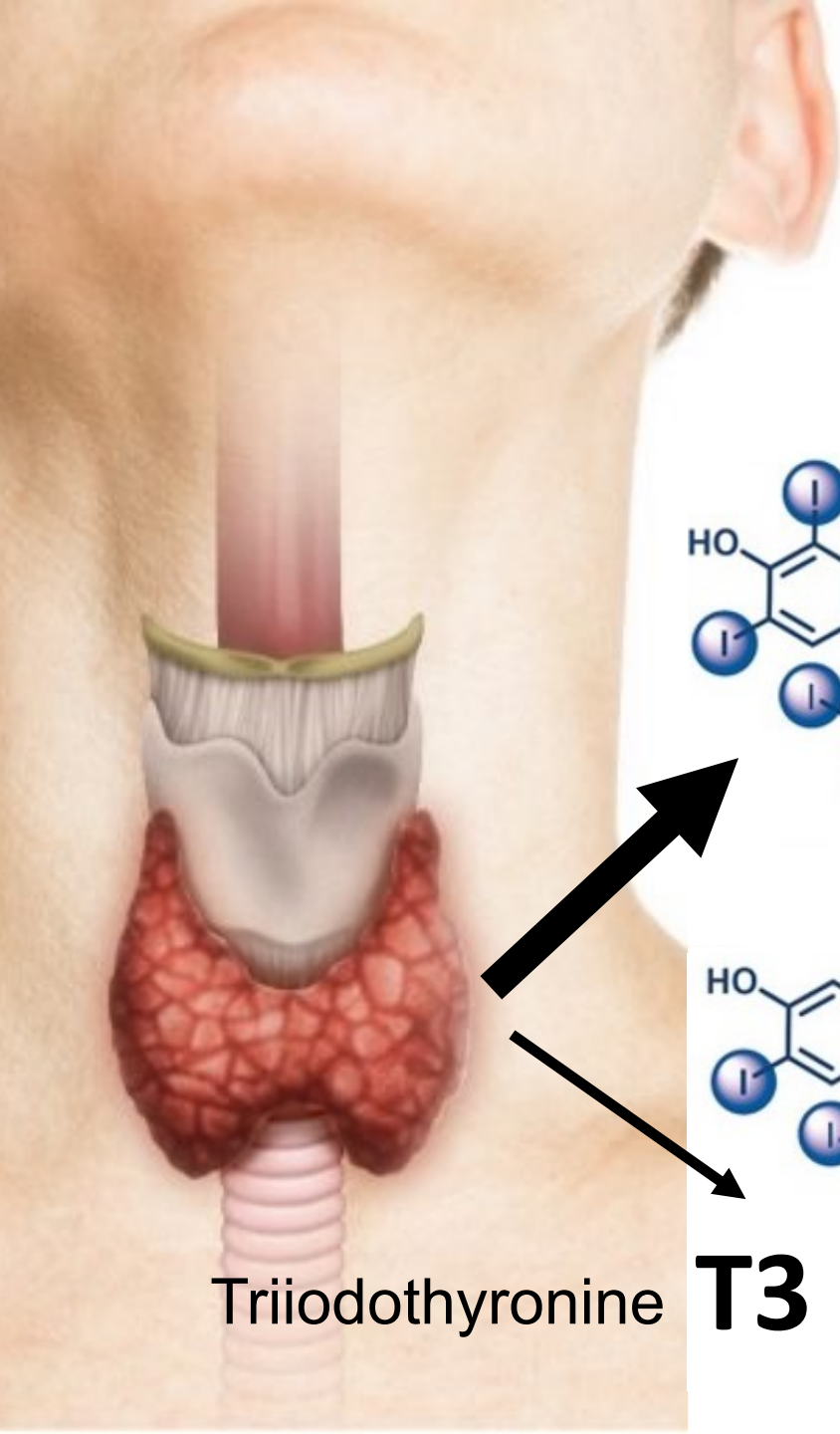


Dietary iodine requirement

150 $\mu\text{g}/\text{day}$



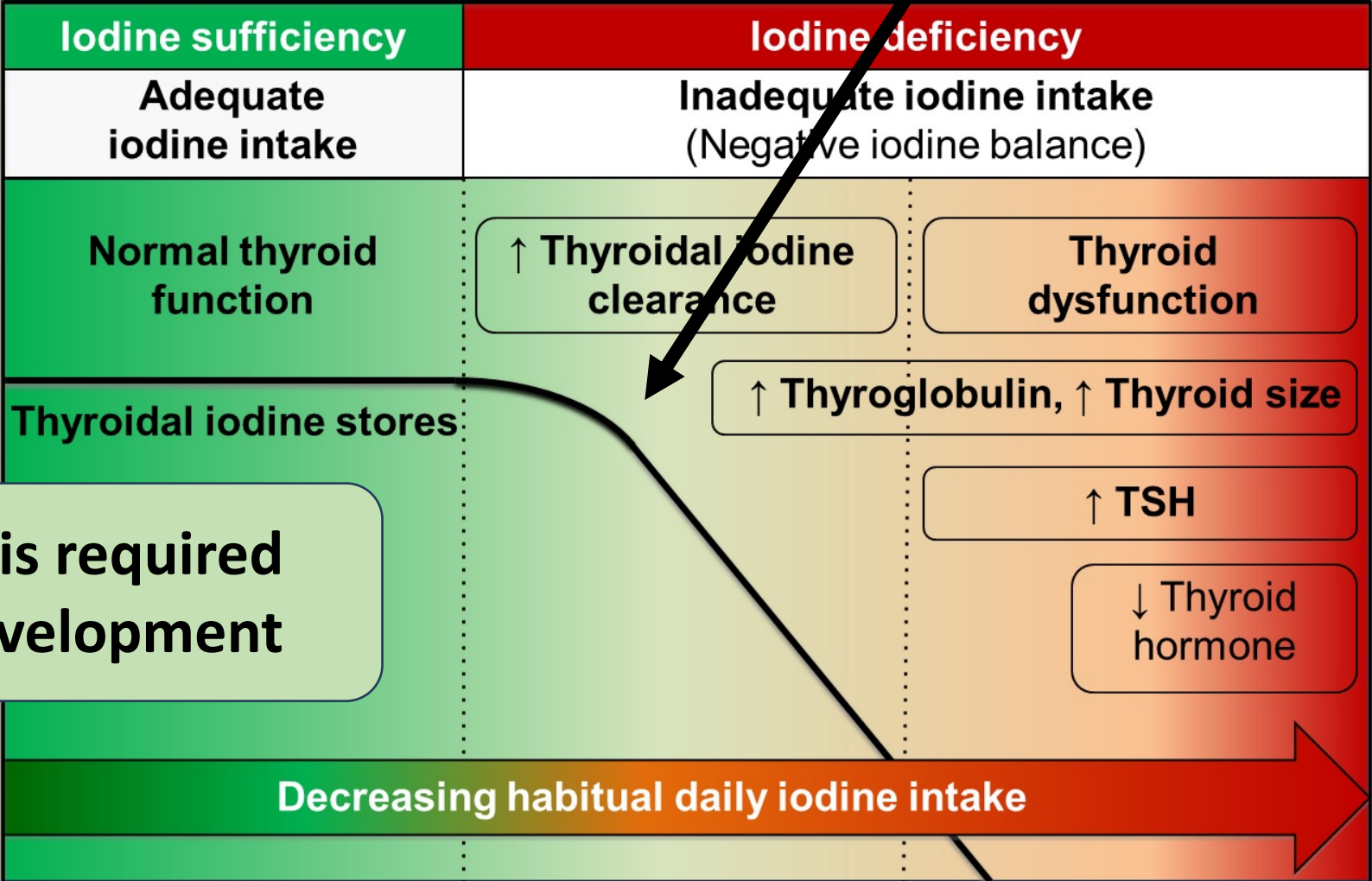
>90% excreted



1921

Adequate iodine intake is required for growth and brain development

Toxic nodular goitre and hyperthyroidism in adults and elderly



Bürgi et al. Acta Endo. 1990

Zimmermann J Nutr. 2008

Frau mit Kropf in Frienisberg, 1921.

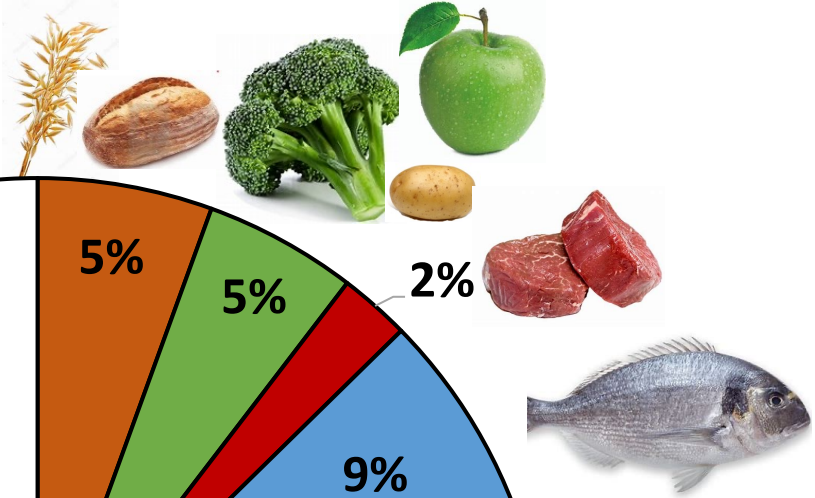
Bilder: Institut für Medizingeschichte der Uni Bern, Archiv (Slg. Lenggenhager, BDR 165)

Zimmermann & Andersson, Nutr. Rev 2012

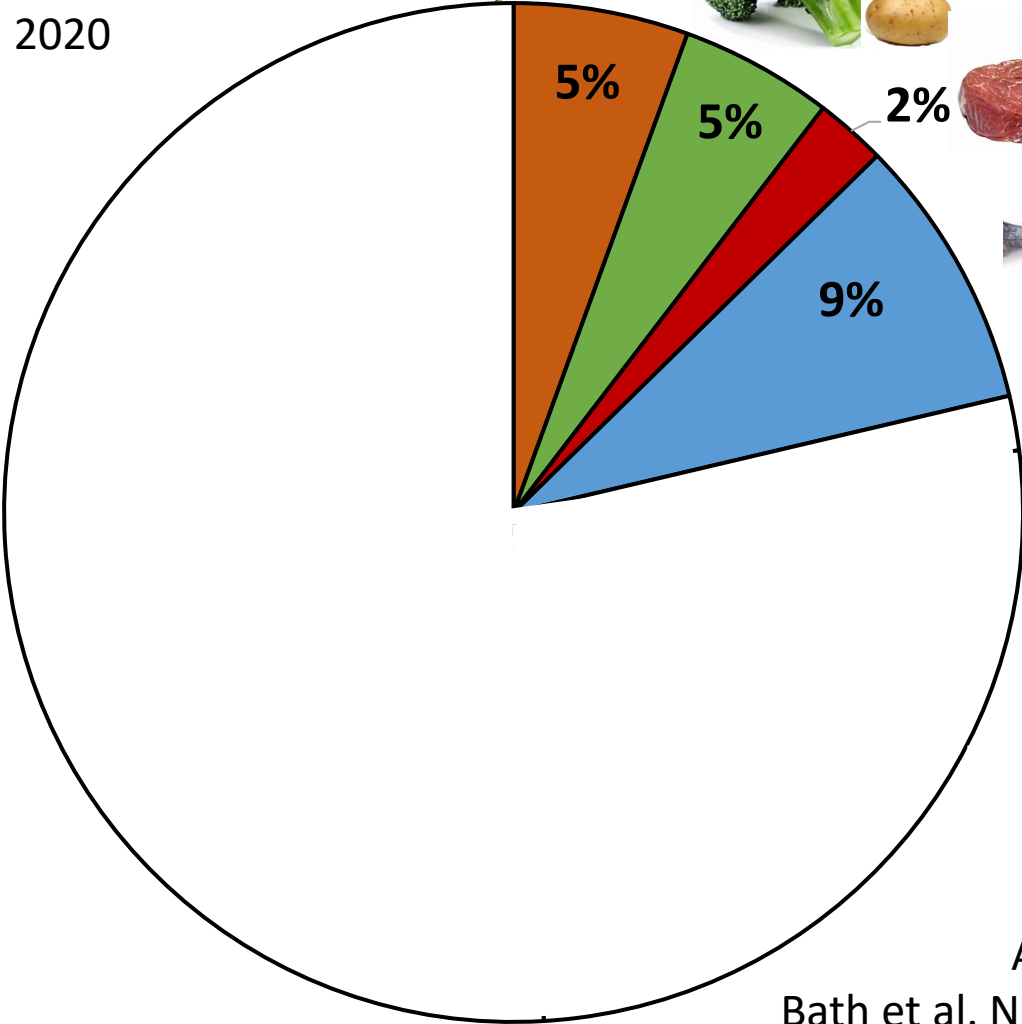
Zimmermann & Boelaert, Lancet Diabetes Endocrinol. 2015

Iodine deficiency: Why does it occur?

Adapted from:
Haldimann et al. Public Health Nutr. 2015,
Esche et al. Eur J Nutr. 2020

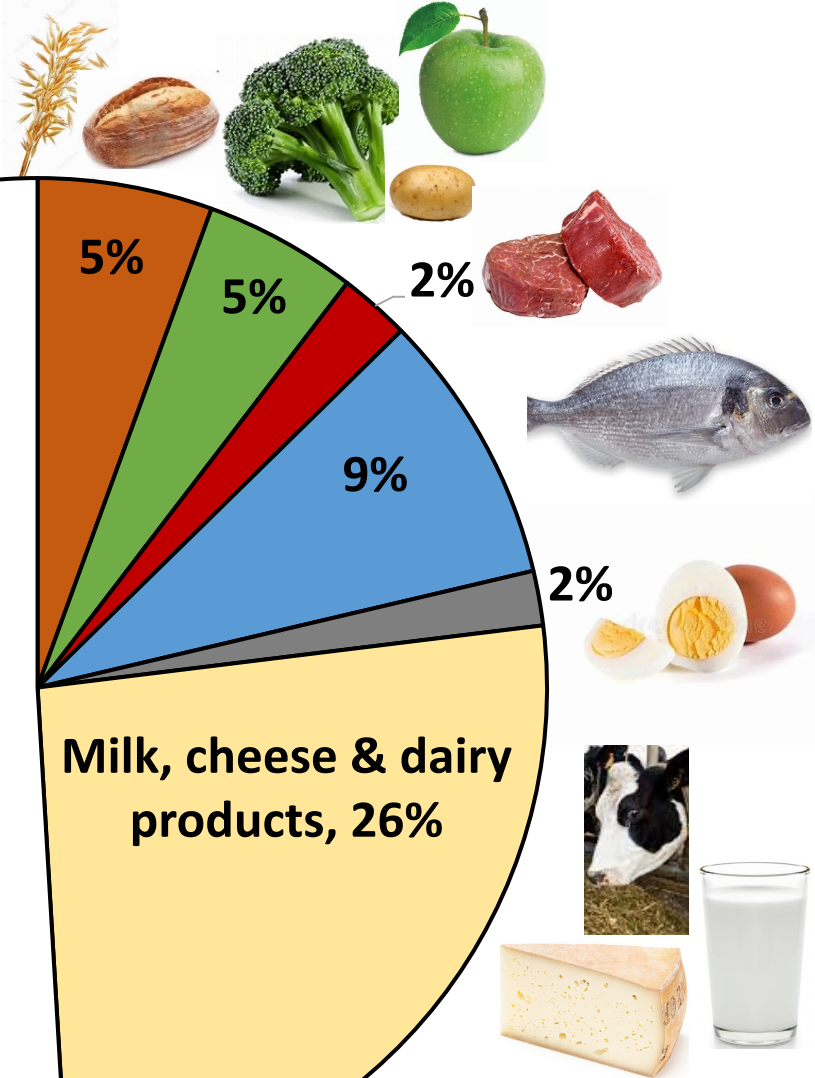


**Diet alone does not
meet the need of
150 µg/day**

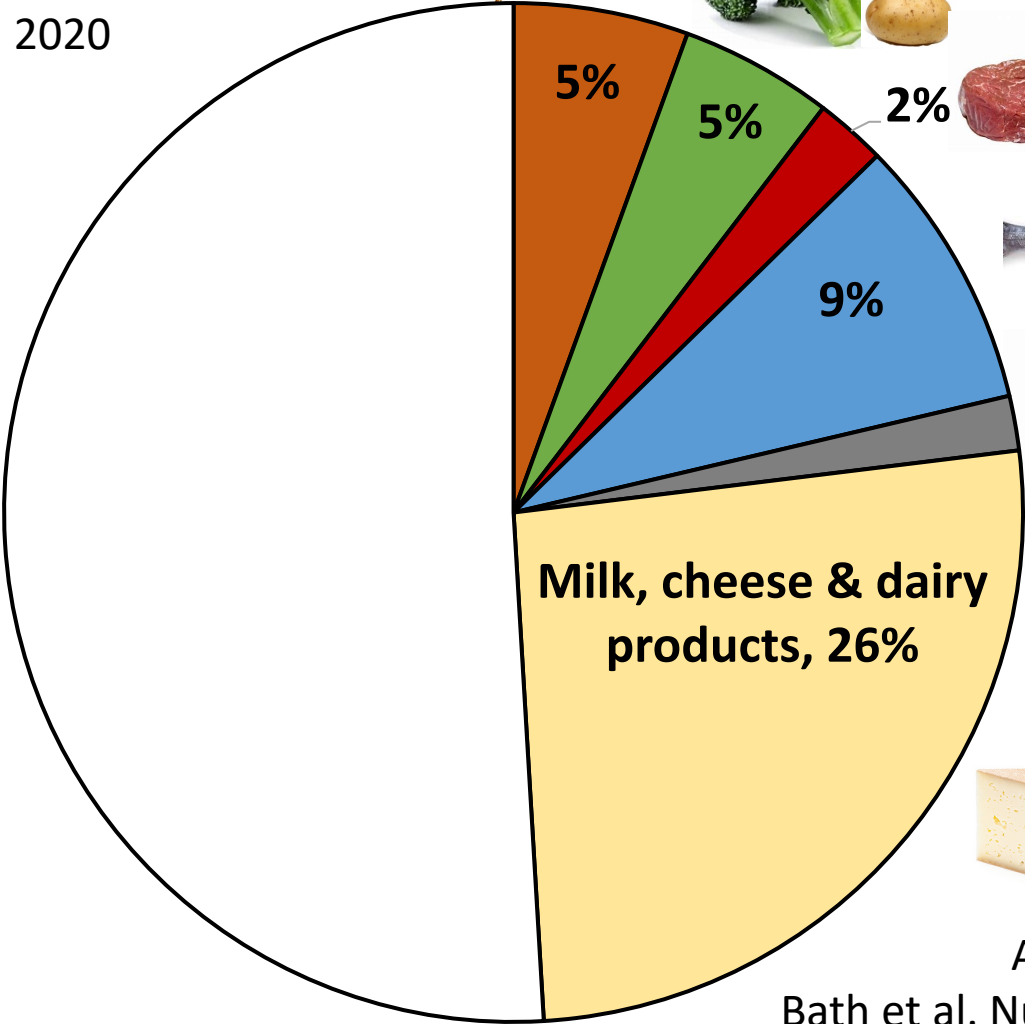


Adapted from:
Bath et al. Nutr. Rev. 2022,
Carlsen et al. Nutrients 2018

Adapted from:
Haldimann et al. Public Health Nutr. 2015,
Esche et al. Eur J Nutr. 2020



Diet alone does not meet the need of 150 µg/day



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Universal salt iodization

Per capita salt intake
10 g/day → 5 g/day



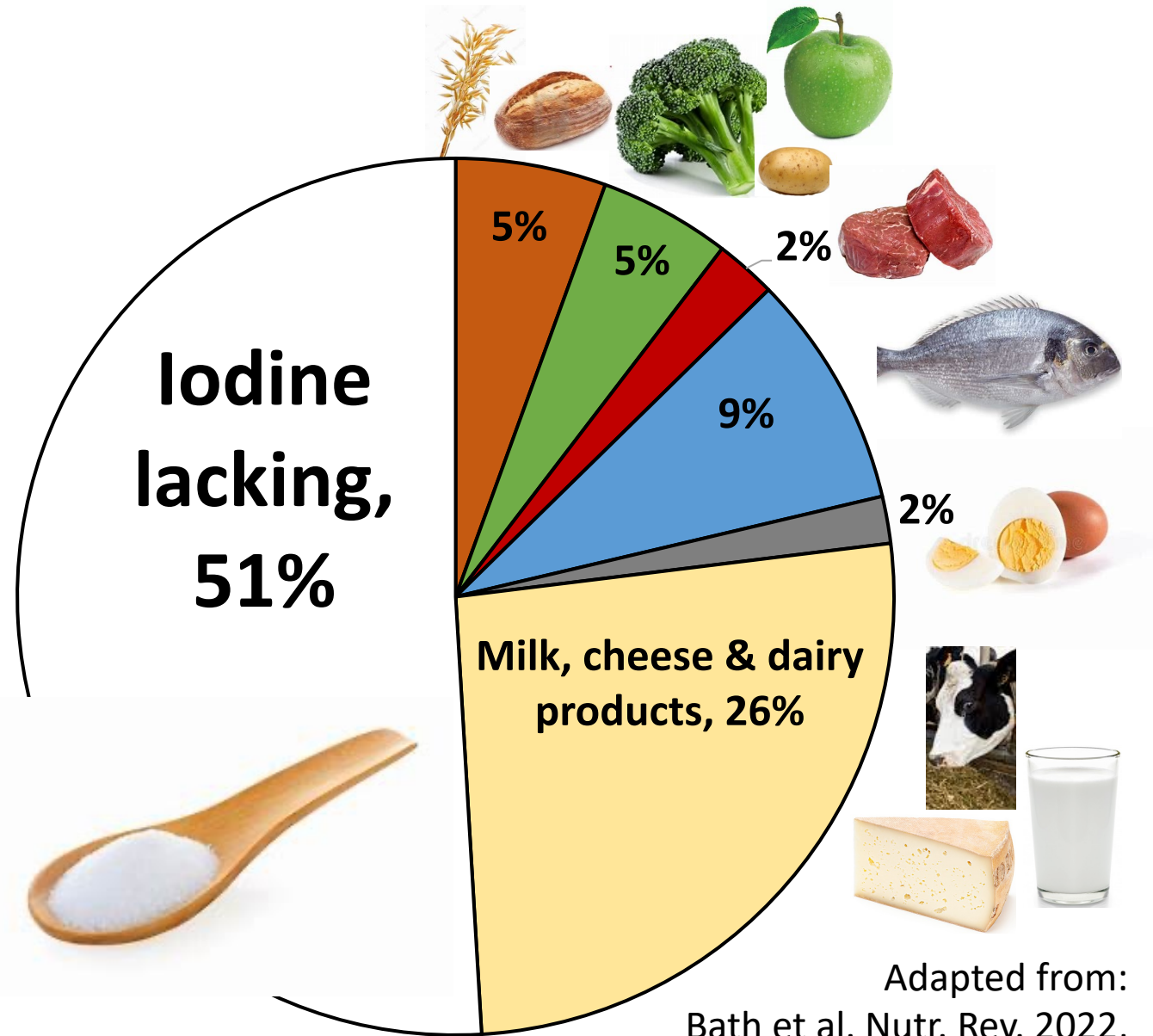
15-40 µg iodine/g salt



30% losses from
production to
consumption

Dietary iodine
150 µg/day

WHO 2007, UNICEF 2018



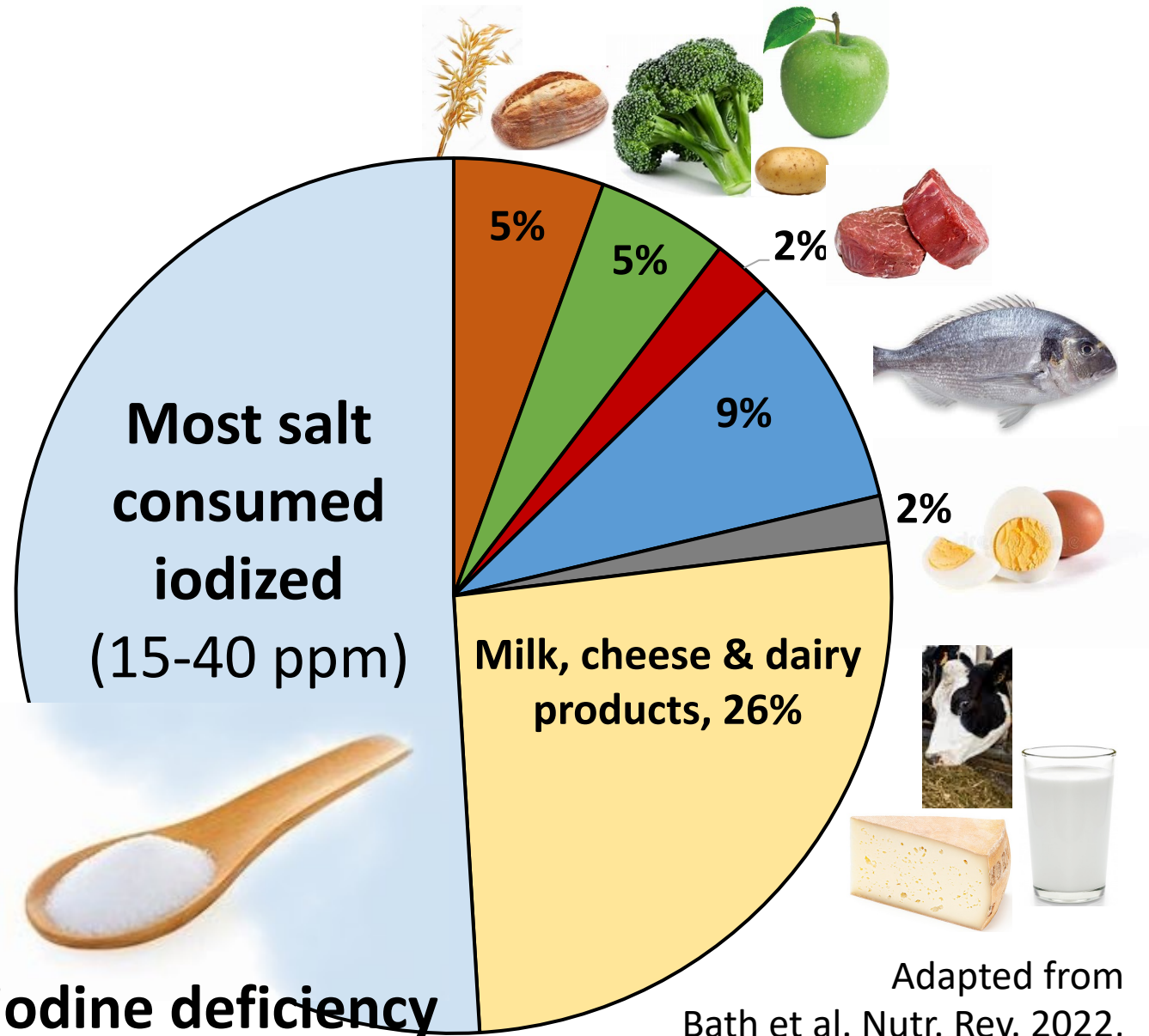
Adapted from:
Bath et al. Nutr. Rev. 2022,
Carlsen et al. Nutrients 2018

Adequate iodine intake in all population groups

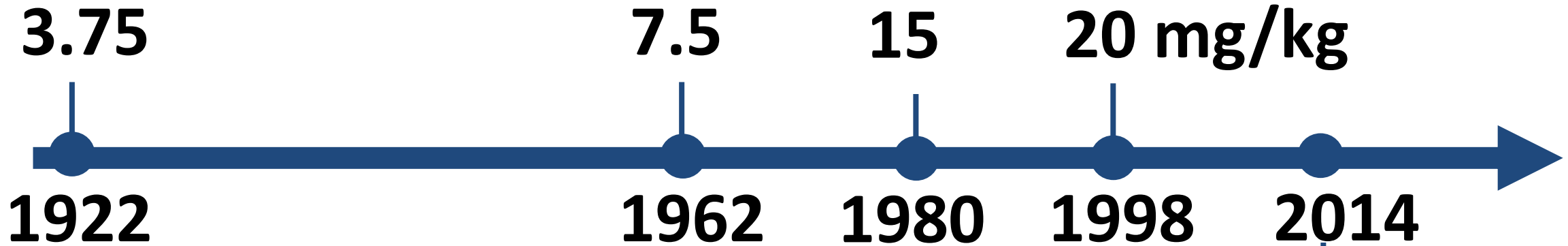


Low risk of iodine deficiency

WHO 2007,
Dold et al. J Nutr. 2018



Salt iodization in Switzerland



25 mg/kg
(20-40 mg/kg)
Voluntary legislation

Bürgi et al. Acta Endo. 1990
Verordnung des EDI 817.022.32 vom 16. Dezember 2016

Salt iodization in Switzerland

Total salt sales food-grade salt, Schweizer Salinen 2022:
59% iodized / 41% non-iodized



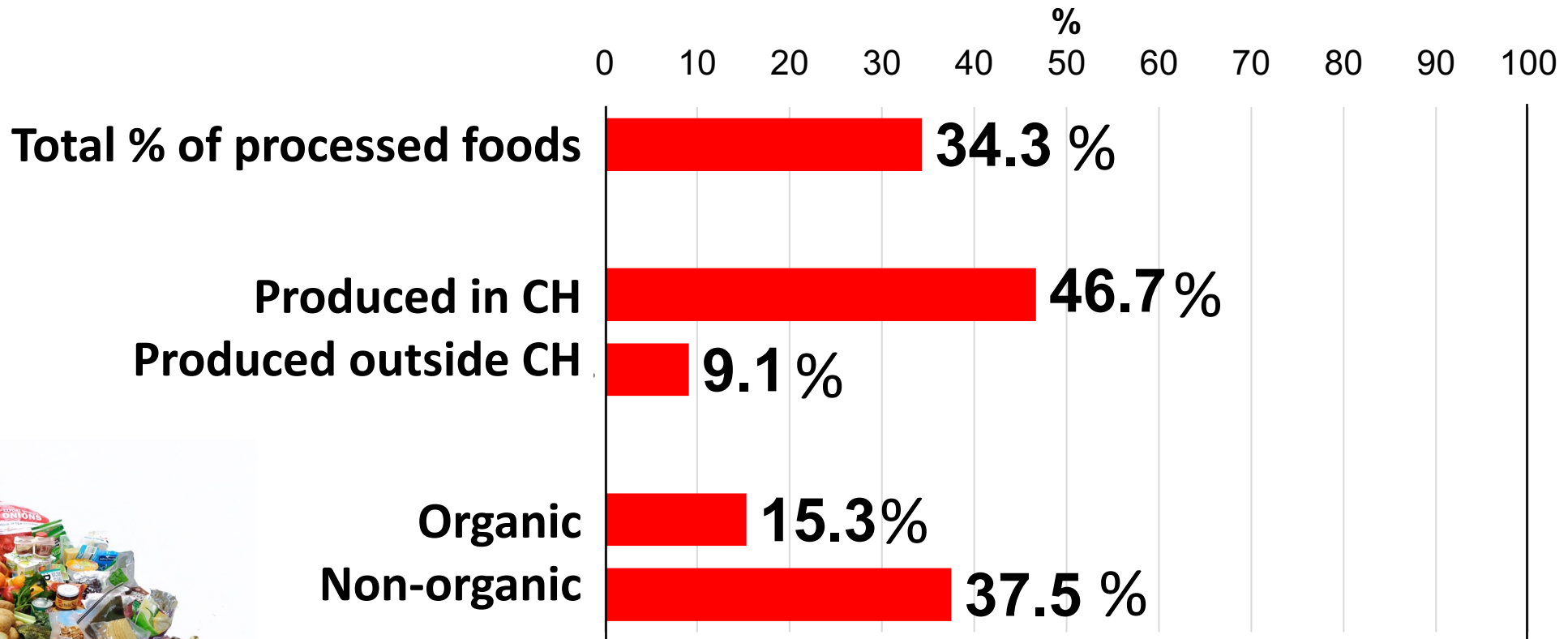
Swiss National Iodine Study 2020-21:
>80% are using iodized salt at home

BLV study 2020:
87% of bakeries are using iodized salt



75-80% of all consumed salt from processed foods

Poor coverage of iodized salt in processed foods



BLV and ZHAW 2022

Iodine status

Population biomarker

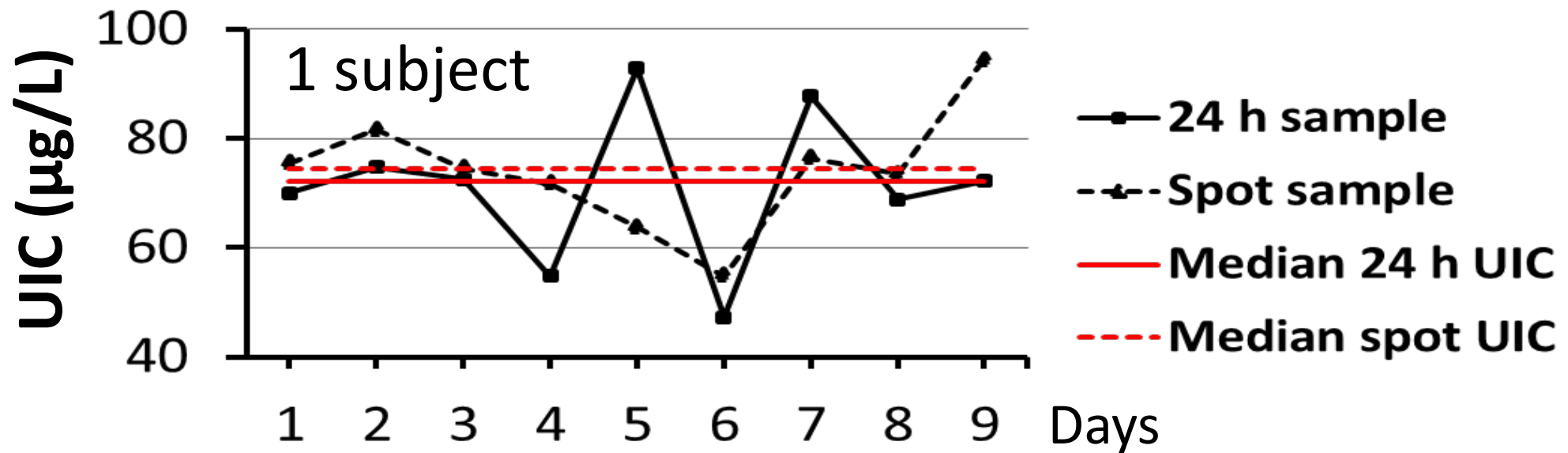
Urinary iodine concentration (UIC)



>90% of the dietary iodine
excreted within 24 h

Urinary iodine concentration

High intra-individual variability (~40%)



x 10

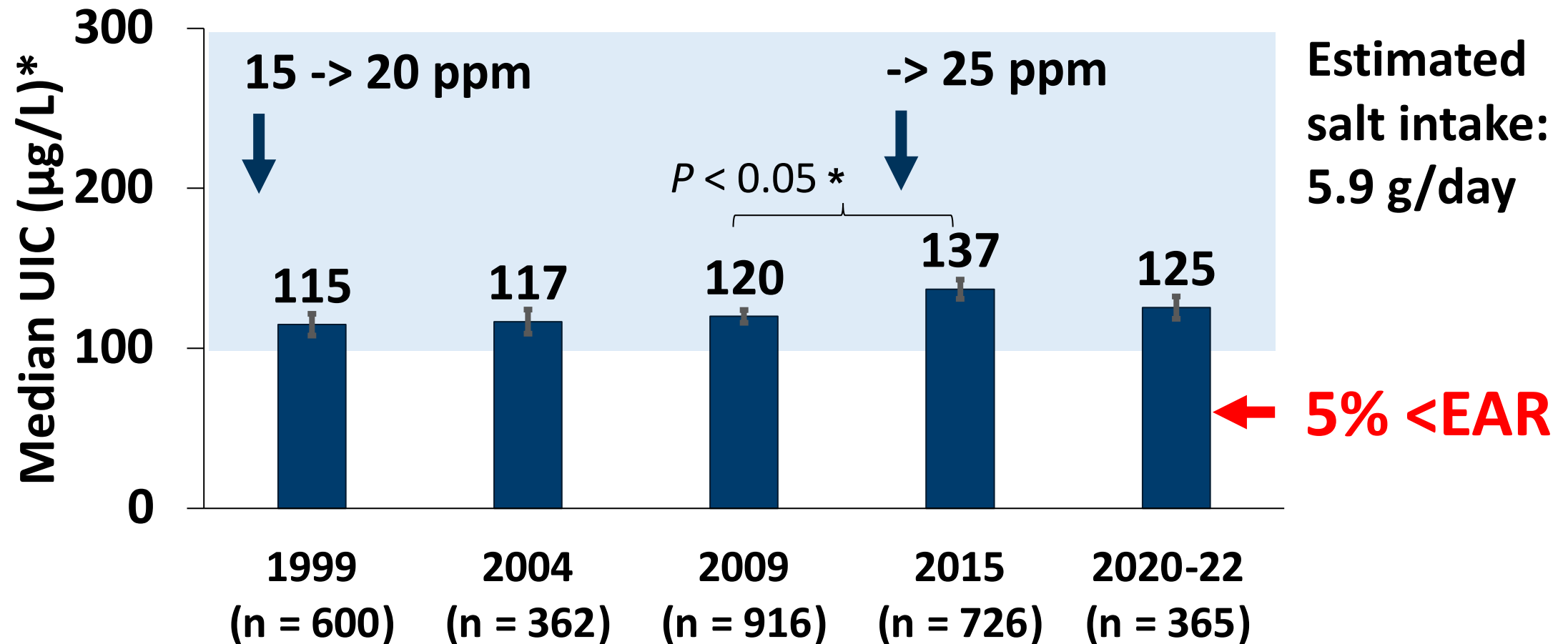
No individual biomarker

13

Iodine status in the Swiss population



Adequate iodine intake in 6-12 years old children



*Bootstrapped 95% CI

Fischer et al. Eur J Nutr. 2023 (accepted)

M Andersson | 30 Nov 2023 | 15

Prevalence of inadequate iodine intake



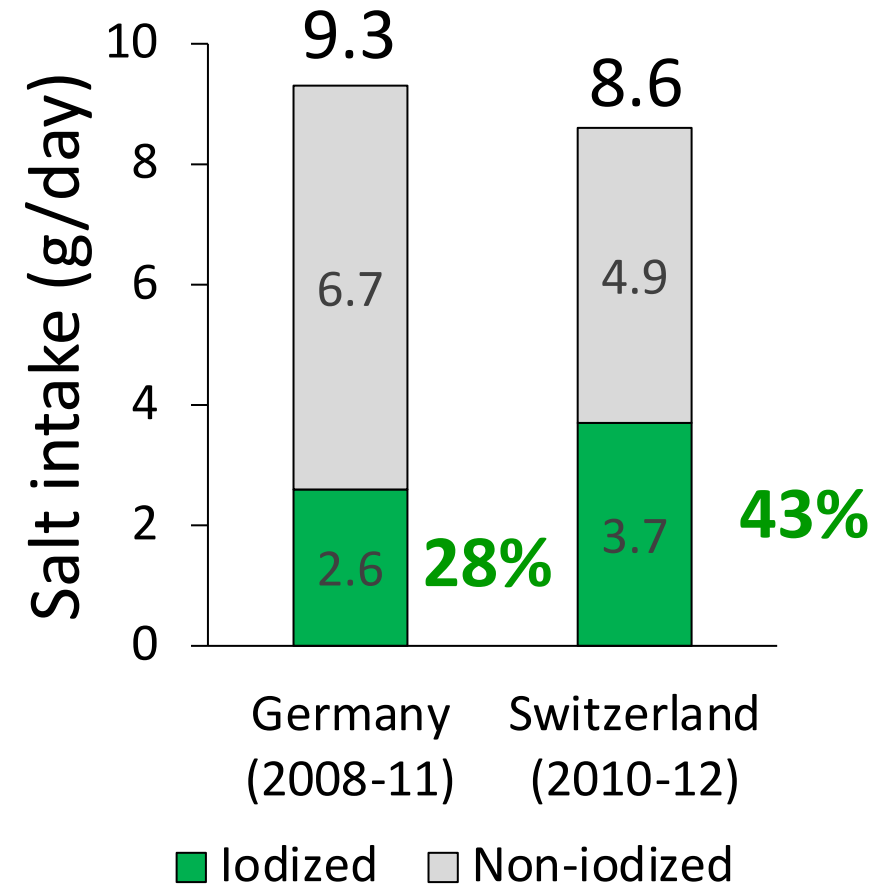
Haldimann et al. Public Health Nutr. 2015
Stalder et al. Swiss Med Wkly. 2019

Fischer et al. Eur J Nutr. 2023 (accepted)

Studies measuring urinary iodine and sodium (24 h urine) in demonstrate:



The proportion of iodized salt is **too low**



Haldimann et al. Public Health Nutr. 2015
Esche et al. Eur J Nutr. 2020



Recommended intake ($\mu\text{g}/\text{day}$)

250

0-5 years

90

6-12 years

120

≥ 13 years

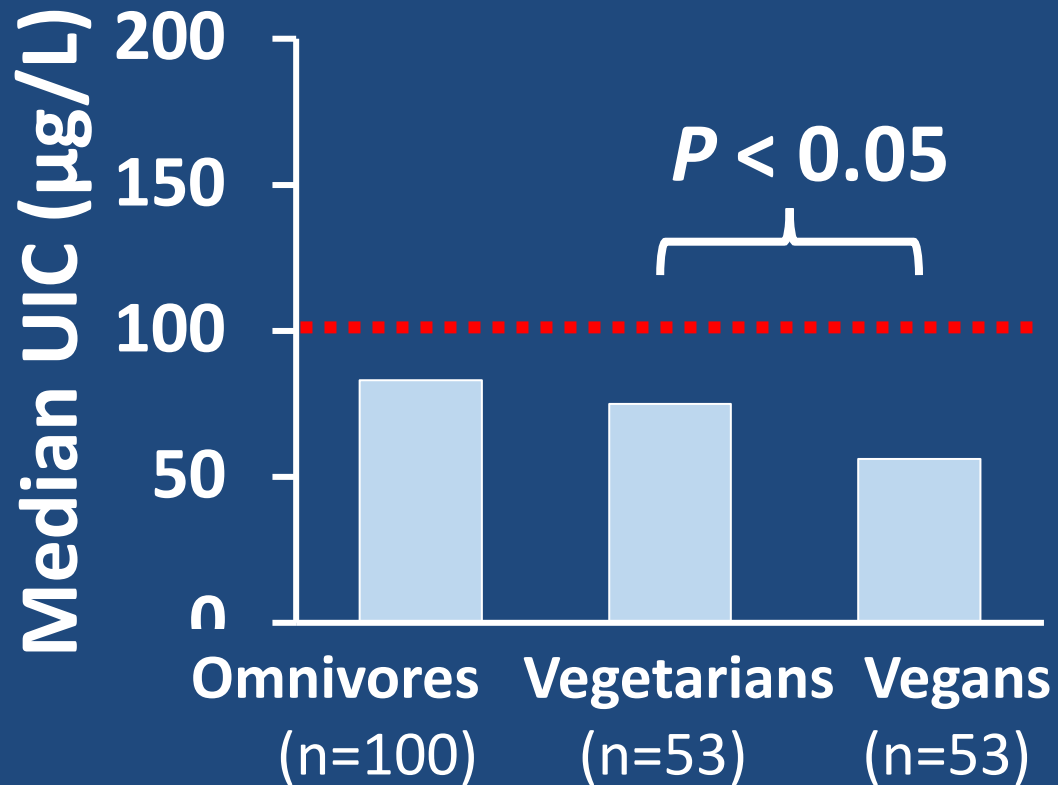
150

**Pregnant and lactating women
taking a dietary supplement should
choose a product containing iodine**

blv.admin.ch

Andersson et al. J Clin Endocrinol Metabol. 2010

Vegans at risk of iodine deficiency



Schüpbach et al. Eur J Nutr. 2017

Vegan products

(Fleisch- Käasersätze, Quorn®, Tofu etc)

Only 8.4% contain iodized salt

BLV and ZHAW 2022

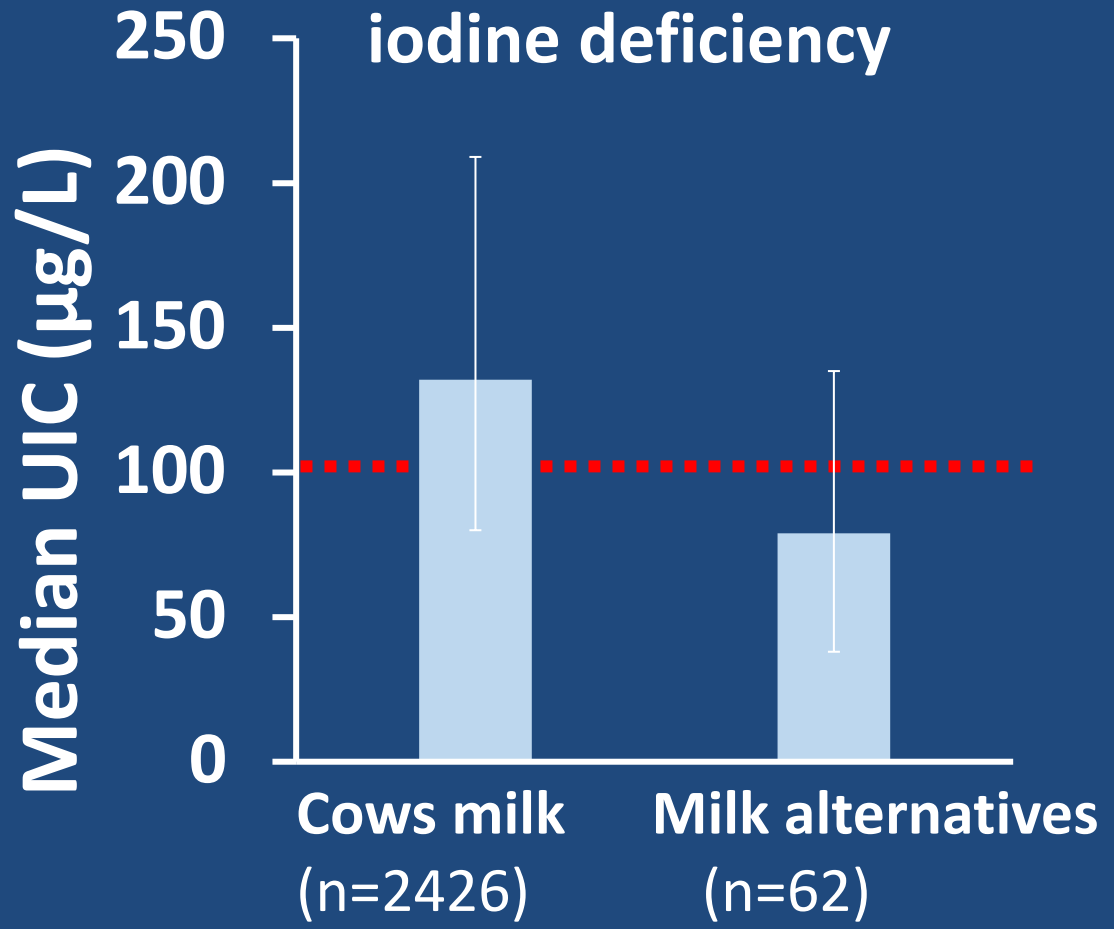
Plant-based alternatives

Few fortified with iodine



Nicole et al. Br J Nutr. 2023

Consumers of unfortified milk-alternative drinks are at risk of iodine deficiency



UK NDNS, children 7-9 yrs
 Median UIC, IQR
 Dineva et al. Br J Nutr. 2021

Vegan products

(Fleisch- Käasersätze, Quorn®, Tofu etc)

Only 8.4% contain iodized salt

BLV and ZHAW 2022

Plant-based alternatives

Few fortified with iodine



Walther et al. Front Nutr. 2022
 Nicole et al. Br J Nutr. 2023



Isolated cases

↓ **UIC**
↑ **Thyroid volume**
↑ **Thyroglobulin**
↑ **TSH, ↓ T4 (↓ T3)**

Veganism as a cause of iodine deficient goiter and hypothyroidism

Severe iodine deficiency

High soy consumption
in combination with iodine deficiency
may exacerbate the risk

Yeliosof & Silverman, J Pediatr Endocrinol Metab. 2018

Caprio et al. Front Endocrinol. 2022

Pillai et al. J Pediatr Endocrinol Metab. 2022 etc.

Iodine supplements

- Not recommended to healthy children
- No risks at doses corresponding to recommended dietary intake
- Product containing iodine alone not approved by Swiss Medic (multivitamin & mineral supplements)



Examples only

- Low iodized salt coverage: Pregnant & lactating women consuming a pre- or postnatal dietary supplement recommended to choose a product **containing iodine**



Not recommended

- High concentrations
- Variability in content

Classification and species	Iodine content, $\mu\text{g/g DW}$ (range)	g needed \rightarrow 150 $\mu\text{g/day}$
Green algae (Chlorophyta)	30-185	2.0-6.0
Red algae (Rhodophyta)	20-200	0.3-3.0
Brown algae (Phaeophyceae)	2'500-10'000	0.01-0.04

Smyth, Eur Thyroid J. 2021

Blikra et al. Compr Rev Food Sci Food Saf. 2022

Iodine excess

- **Generally well-tolerated by healthy individuals**
- **Risk of iodine-induced thyroid dysfunction in susceptible individuals**
(Hypo- or hyperthyroidism, goitre, thyroid autoimmunity)

Leung & Braverman, Nat. Rev. Endocrinol. 2014

Farebrother et al. Ann N Y Acad Sci. 2019

Conclusions

- Plant foods are poor sources of iodine
- **Salt iodization** effectively prevents iodine deficiency, but its use in food production is currently low – especially in vegan products
- Cow's milk, dairy products, and eggs are important dietary iodine sources, but many plant-based milk alternatives contain no iodine
- The iodine intake in vegetarians is comparable to omnivores, but individuals following a **vegan diet** may be at risk of iodine deficiency

Recommendations



What to do?

	Iodized salt		Iodine fortification
	Table & cooking	Food products	Plant-based milk & dairy alternatives
Consumer	X	X	X
Pediatrician	X	X	X
Food industry	-	X	X

Recommendations: Vegans

Pediatricians

- **Brief dietary assessment**
(iodized salt, plant-based milk & dairy alternatives and soy-based products)
- **Individual iodine status: Not possible** (urine)
- **TSH: Indicated *only* if no iodized salt is consumed**

What to do?

- **Dietary supplementation:**
Generally safe at doses corresponding to recommended dietary intake, but ***not recommended*** unless no iodized salt is consumed

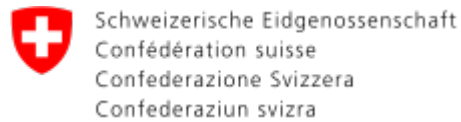
**Iodized salt necessary to
maintain adequate iodine
intake for the next 100 years**



**... as we move to a more
plant-based diet**



Acknowledgements



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