



Latest insights on iodine

Dr Sarah Bath
Lecturer in Public Health Nutrition
University of Surrey

s.bath@surrey.ac.uk

@drsarahbath

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the National Dairy Council
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Dublin



**World Health
Organization**

“Iodine deficiency is the world’s most prevalent, yet
easily preventable, cause of brain damage”

Iodine intake recommendations



	Recommended iodine intake ($\mu\text{g}/\text{day}$)				
	UK: Reference Nutrient Intake (RNI) ¹	EFSA: Adequate intake ²	US IOM: Recommended Dietary Allowance ³	Australia & New Zealand: Recommended Dietary Intake ⁴	WHO : Recommended Nutrient Intake ⁵
Children 7-10 years	110	90	90 (7-8 y) 120 (9-10y)	90 (7-8 y) 120 (9-10y)	120
Adulthood	140	150	150	150	150
Pregnancy	140	200	220	220	250
Lactation	140	200	290	290	250

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1. Department of Health 1991; 2. EFSA 2014; 3. IOM 2001; 4. FSANZ; 5 WHO et al. 2007

Pre-pregnancy



- Iodine can be stored in the thyroid (up to 20 mg)
- Women of reproductive age should optimise stores¹
- Long-standing pre-pregnancy iodine intake linked to:
 - better thyroid function than abrupt increase via supplements in pregnancy^{2,3}



Public-health message must focus on women of reproductive age

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1. Glinoe 2004 Best Pract Res Clin Endocrinol Metab; 2. Moleti et al., 2008 J Clin Endocrinol Metab 3. Moleti et al. 2011 Clin Endocrinol (Oxf)

Iodine Deficiency Disorders



Severe
deficiency



Development of goitre;

Develops at very low iodine intake

Some evidence in UK pregnant women

What are the implications
of mild-to-moderate iodine
deficiency in pregnancy on
brain development?



Effect of inadequate iodine status in UK pregnant women on cognitive outcomes in their children: results from the Avon Longitudinal Study of Parents and Children (ALSPAC)

Sarah C Bath, Colin B Seaton, Jason Selinger, Louise T Franch, Margaret P Rayman

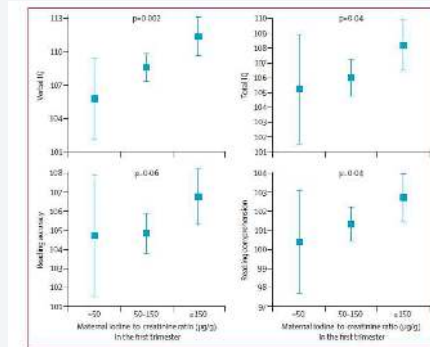


Figure: Means (95% CI) for child cognitive outcomes according to maternal iodine status in the first trimester. Values are adjusted for the effect of confounders (model three). Child verbal and total IQ were assessed at age 8 years and reading accuracy and comprehension at age 10 years. IQ=Intelligence quotient.

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Bath et al (2013) Lancet

Iodine is important in early pregnancy

The Journal of Clinical Endocrinology & Metabolism, Copyright 2019 DOI: 10.1210/clinem.aa00116

Maternal iodine status and child IQ

Association of maternal iodine status with child IQ: a meta-analysis of individual-participant data

Positive association between iodine status and verbal IQ

↓

Effects only significant up to 14 weeks' gestation

ORIGINAL ARTICLE

Maternal iodine status in a multi-ethnic UK birth cohort: Associations with child cognitive and educational development

Iodine measured in third trimester

↓

No association with school-measures of cognition

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1. Levie et al. 2019; 2. Threapleton et al. (2020)

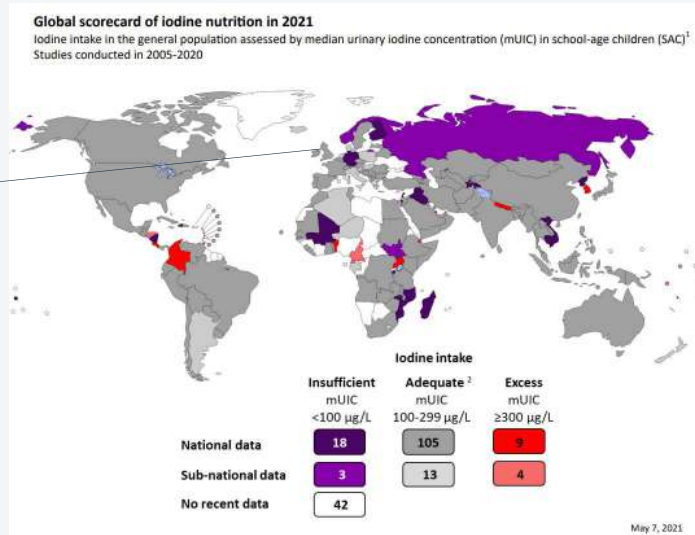


- Research gap:
- Randomised controlled trials in mild-to-moderate deficiency

Iodine status
in UK and
Ireland



Global iodine status in 2021



UK:
median UIC: 166 µg/L
Children 4-10 years
2015-16

Ireland:
median UIC: 111 µg/L
Teenage girls 14-15 yrs
2014-15

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UK: iodine status in NDNS



- Spot-urine samples used for iodine assessment in NDNS since 2013 (Year 6 of rolling programme)
- Results show:
 - Sufficiency in children (4-10 years)
 - Overall sufficiency in teenagers and adults
- Most recent results (Years 9-11) show
 - Women of childbearing age are now classified as iodine deficient according to WHO criteria

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NDNS Years 9-11 Report

Teenagers on the island of Ireland



European Journal of Nutrition
<https://doi.org/10.1007/s00394-019-02037-x>

ORIGINAL CONTRIBUTION



Iodine status of teenage girls on the island of Ireland

Karen Mullan¹ · Lesley Hamill² · Katy Doolan² · Ian Young² · Peter Smyth³ · Albert Flynn⁴ · Janette Walton⁴ · Andrew A. Meharg² · Manus Carey² · Claire McKernan² · Marcia Bell⁵ · Neil Black⁶ · Una Graham¹ · David McCance¹ · Cathy McHugh⁷ · Paul McMullan¹ · Siobhan McQuaid⁸ · Aonghus O'Loughlin⁹ · Antoinette Tuthill¹⁰ · Sarah C. Bath¹¹ · Margaret Rayman¹¹ · Jayne V. Woodside²

Teenage girls (14-15 yrs)

N= 903

Overall sufficient: median 111 µg/L

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Adults in Ireland



- National Adult Nutrition Survey (2008-2010;n=1106)
- 26% had intake below the EAR
 - 11% (15% in females) <LRNI
- Milk contributed 45% of intake
- Median UIC 107 µg/L = sufficient
 - Females = 101 µg/L

British Journal of Nutrition (2017), 117, 422–431
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doi:10.1017/S0007114516004347

Iodine intakes and status in Irish adults: is there cause for concern?

Breige A. McNulty^{1*}, Anne P. Nugent¹, Janette Walton², Albert Flynn², Christina Tlustos³ and Michael J. Gibney¹

¹UCD Institute of Food and Health, University College Dublin, Belfield, Dublin 4, Republic of Ireland

²School of Food and Nutritional Sciences, University College Cork, Cork, Republic of Ireland

³Food Safety Authority of Ireland, Abbey Court, Lower Abbey Street, Dublin 1, Republic of Ireland

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Abstract

I is an important mineral for health, required for the production of key thyroid hormones, which are essential for cellular metabolism, growth and physical development. Hence, adequate I is crucial at all stages of life, but imperative during pregnancy for fetal brain development and during a child's early life for neurodevelopment. Within Ireland, limited information exists on population I intakes and status. Therefore, the purposes of the present analysis were to estimate dietary I intakes and to analyse urinary iodine (UI) status using the cross-sectional National Adult Nutrition Survey 2008–2010 and the most recent Irish Total Diet Study. Median I intakes in the total population (n 1106) were adequate with only 26% of the population being classified as below the estimated average requirement (EAR). Milk consumption was the major source of I in the diet, contributing 45% to total intake. Likewise, median UI concentrations (107 µg/l) indicated 'optimal' I nutrition according to the WHO cut-off points. In our cohort, 77% of women of childbearing age (18–50 years) did not meet the EAR recommendation set for pregnant women. Although I is deemed to be sufficient in the majority of adult populations resident in Ireland, any changes to the current dairy practices could significantly impact intake and status. Continued monitoring should be of priority to ensure that all subgroups of the population are I sufficient.

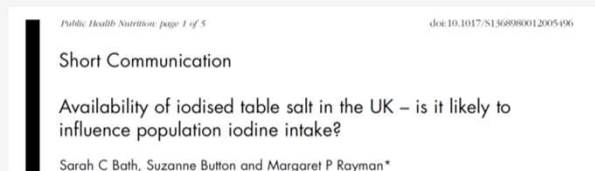
Key words: Iodine; Dietary intakes; Status; Urinary iodine

Journals of Nutrition

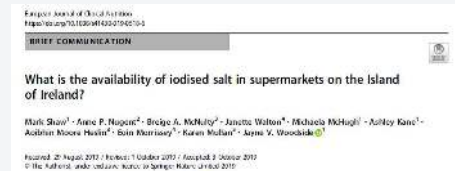
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Iodised salt

Not widely available in the UK and Ireland



20% availability
(with market share)



12% availability



Table salt in the UK = ~15% of total salt

Strong salt-reduction messages

Dietary sources of iodine across Europe

Systematic Review

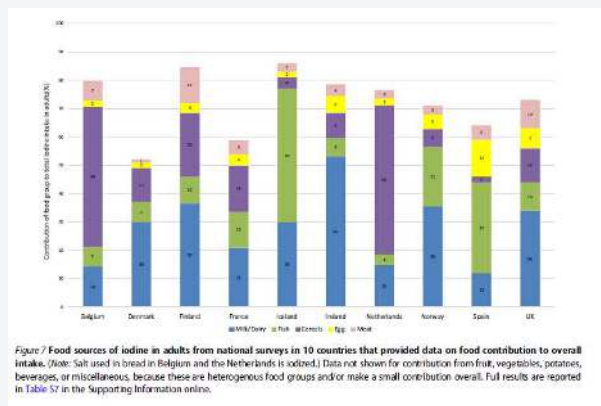
A systematic review of iodine intake in children, adults, and pregnant women in Europe—comparison against dietary recommendations and evaluation of dietary iodine sources

Sarah C. Bath , Janneke Verkaik-Kloosterman, Magalie Sabatier, Sovianne ter Borg, Ans Eilander, Katja Hora, Burcu Aksoy, Nevena Hristozova , Lilou van Lieshout, Halit Tanju Besler, and John H. Lazarus

Milk provides

- 53% in Ireland
- 34% in the UK

Of total adult iodine intake



Why are plant-based diets a concern for iodine?



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Plant-based recommendations: EAT LANCET and provision of iodine



	Intake (g/d) Total (range)	Iodine provision (µg/d)
Whole grains		
Rice, wheat, corn & other	232	0
Tubers/starchy vegetables		
Potatoes & cassava	50 (0 – 100)	0
Vegetables		
All vegetables	300 (200 – 600)	6
Fruits		
All fruits	200 (100 – 300)	5
Dairy foods		
Whole milk or equivalents	250 (0 – 500)	76
Protein sources		
Beef, lamb & pork	14 (0 – 28)	0
Chicken & poultry	29 (0 – 58)	1.5
Eggs	13 (0 – 25)	7
Fish	28 (0 – 100)	25
Legumes	75 (0 – 100)	1.5
Nuts	50 (0 – 75)	6
Added fats		
All oils	52 (0 – 80)	0
Added sugars		
All sugars	31 (0 – 31)	0
TOTAL IODINE		128

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Nicol et al. 2023 Br J Nutr

What is the iodine concentration of milk-alternative drinks?

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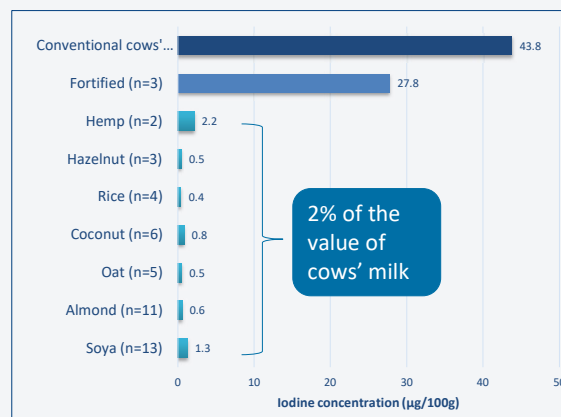
Iodine in unfortified milk alternatives

- In 2017: **6%** fortified with iodine
 - One brand
 - Not the market leader

British Journal of Nutrition, page 1 of 5
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Iodine concentration of milk-alternative drinks available in the UK in comparison with cows' milk

Sarah C. Bath¹, Sarah Hill¹, Heleci Goenaga Intante², Sarah Elghul¹, Carolina J. Nozières¹ and Margaret F. Rayman^{1,3}



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Bath et al. 2017 Br J Nutr

Does consumption plant-based milk alternative increase the risk of iodine deficiency?

- Classified data in NDNS (n=3976) as:
 - Exclusive cows' milk consumer (n=3399)
 - Exclusive milk-alternative consumer (n=88)
- Iodine intake was significantly lower in exclusive consumers of milk alternatives than cows' milk consumers (94 v. 129 $\mu\text{g}/\text{d}$; $P < 0.001$)
- Exclusive consumers of milk alternatives had an iodine status (based on spot-urine iodine concentration) that was classified as iodine deficient
 - Median UIC = 79 $\mu\text{g}/\text{L}$ (threshold = 100 $\mu\text{g}/\text{L}$ for adequacy)



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Dineva et al. 2021 Br J Nutr

Fortification of milk alternatives



Market survey completed in December 2020

Milk alternatives (n=146)

- 88% with calcium
- 28% with iodine

Yoghurt alternatives (n=76)

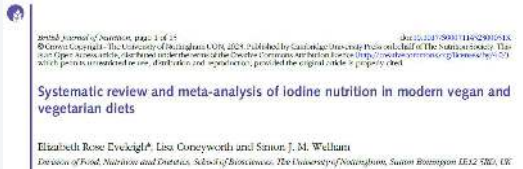
- 73% fortified with calcium
- 6% fortified with iodine

Cheese alternatives (n=67)

- 55% fortified with calcium
- None fortified with iodine

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Iodine deficiency in vegans



Vegans have low iodine intake and status¹



Case reports of goitre in UK vegan²⁻⁵:

- toddlers
- children
- women of childbearing age

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1. Eveleigh et al. 2020 Nutrients; 2. Eveleigh et al. 2023 Br J Nutr; 2. Yeliosof & Silverman (2018). J Pediatr Endocrinol Metab; 3. Brandt et al. (2018). Endocrine Abstracts; 4. Park et al. (2005) Endocrine Abstracts; 5. Shaikh et al. (2003). J Pediatr Endocrinol Metab;



Potential solutions for low
micronutrient supply with plant-
based diets

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Seaweed – not a reliable source



- Kelp and seaweed supplements are not recommended
- Kelp iodine concentration = 2164 µg/g (1443% of the adult RNI)
- Nori = 36 µg/g (24% of the adult RNI)
- All seaweed is highly variable in iodine content so not a reliable source

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1. Food Standards Agency 2008 2. Yeh et al 2014; 3. Teas et al 2004; 4. van Netten et al 2000; 5. Phaneuf et al 1999; 6. Romaris et al 2011; 7. Smith et al 2010; 8. Schiener et al 2015; 9. Maehre et al 2014; 10. Lee et al. 1994

Misconceptions of dietary sources



- Not rich sources of iodine:
 - Strawberries (1 µg/100g)
 - Potato skins (1 µg/100g)
 - Kidney beans (5 µg/100g)
 - Himalayan rock salt
 - Sea salt (< 0.001 µg/g)

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Public Health England (2019) McCance and Widdowson's composition of foods integrated dataset

Supplementation



- No official recommendation for iodine supplements (even in pregnancy)
- Those following plant-based diet, or with few dietary sources can consider iodine-containing multi-vitamin/mineral supplement
- Dose should be no more than the RNI (i.e. around 150 µg/day)
- Avoid kelp/seaweed supplements

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Increased fortification of plant-based foods



- Argument for greater fortification of plant-based alternatives
- More research needed on exact concentration required

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Other vehicles for iodine fortification?

- Bread is fortified with iodine in some countries
 - Netherlands
 - Belgium
 - New Zealand and Australia
- Bread in the Netherlands has a concentration of 50 µg/100g (20 µg/40g slice)
 - Bread in the UK is not fortified and has a concentration of 8 µg/100g (3 µg/ 40g slice)

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BDA Food Fact Sheet

- Available to download: <https://www.bda.uk.com/resource/iodine.html>

BDA
Food Fact Sheet: Iodine

The Food Fact Sheet is a resource for health professionals, it explains why iodine is important for your patients and how to help them achieve their recommended intake.

What is iodine and how does it help the body?

Iodine is essential for the production of thyroid hormones. It is important for the thyroid gland to produce thyroid hormones to help regulate the body's metabolism and to help the body to absorb calcium from the diet.

What happens if my intake of iodine is not enough?

A lack of iodine can lead to a condition called hypothyroidism. This can cause a range of symptoms including weight gain, fatigue, and depression. It can also lead to a condition called goitre, which is a swelling of the thyroid gland.

How much iodine is needed?

Age	Male Recommended per day (µg)*
Adult	100
Pregnant	200
Over 65 years old	200

*Based on UK Recommended Daily Allowance (RDA)

Before and during pregnancy and breastfeeding

It is important to ensure you are getting enough iodine before and during pregnancy and while breastfeeding. This is because iodine is essential for the development of the baby's brain and thyroid gland.

Where is iodine found in the diet?

Iodine is found in a variety of foods including seaweed, fish, and dairy products. It is also found in some fortified foods such as bread and salt.

What is iodine and how does it help the body?

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Top tips

- Use iodized salt when cooking
- Eat fish and seafood regularly
- Eat dairy products regularly
- Eat seaweed products
- Eat fortified foods such as bread and salt

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