IODINE globalnetwork

An update on iodine in the diet in the UK and Ireland: the role of milk and dairy

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QUEEN'S UNIVERSITY BELFAST

HSC Belfast Health and Social Care Trust

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FoodBio Systems DTP

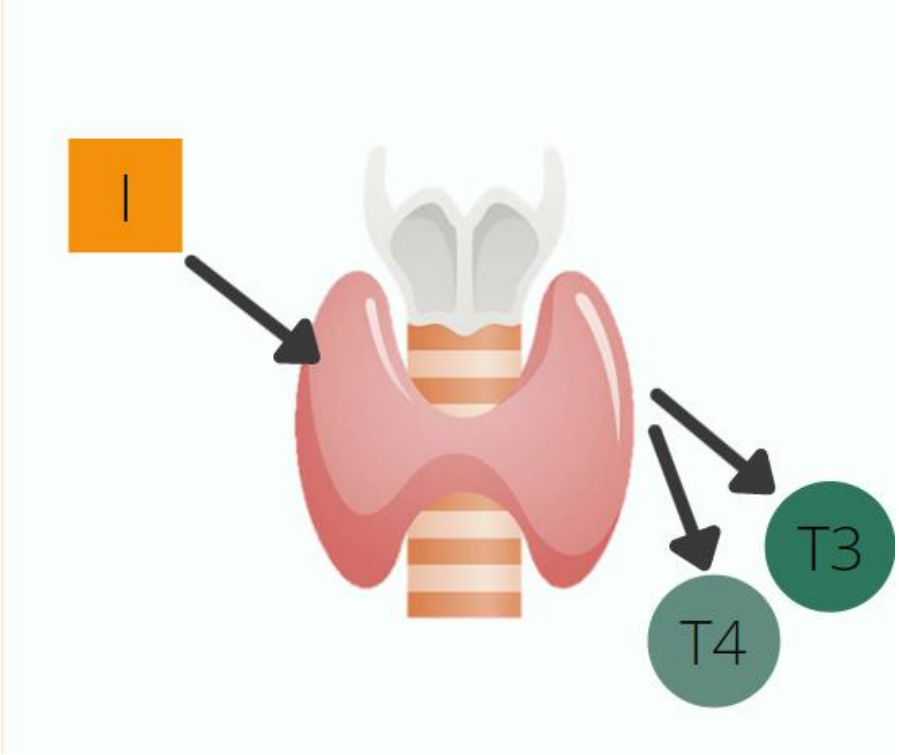
Iodine

Iodine is essential for the production of thyroid hormones T3 and T4

Iodine deficiency reduces the ability of the thyroid gland to produce thyroid hormones

Thyroid hormones are responsible for:

- Growth
- Cell repair
- Metabolism
- Brain development

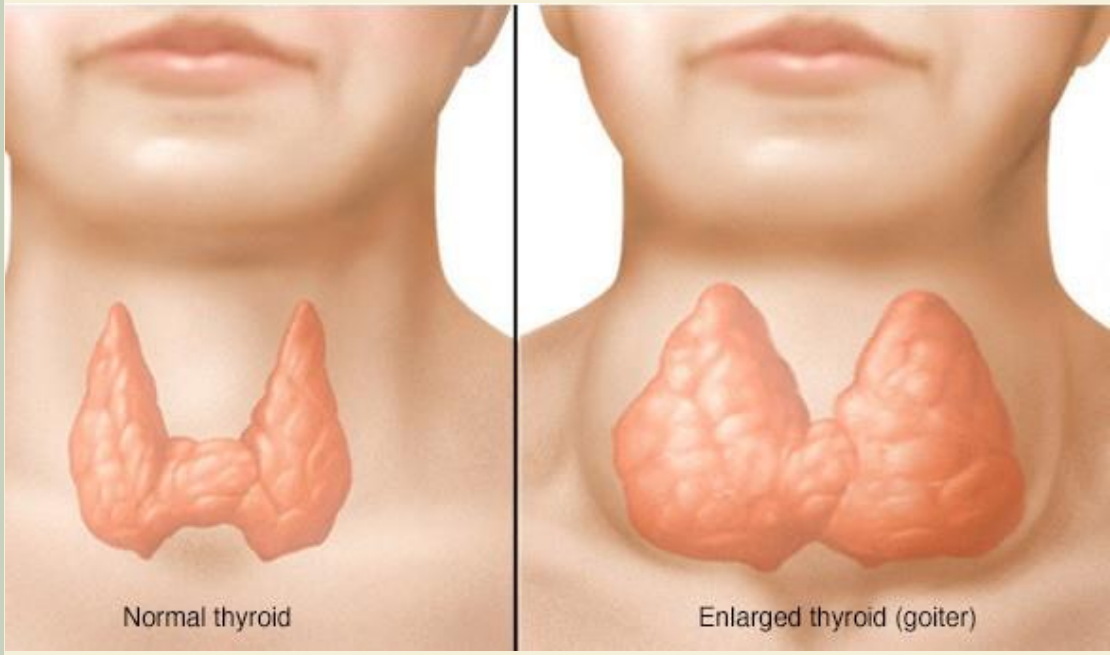


IODINE DEFICIENCY DISORDERS

- Goitre
- Cretinism
- Hypothyroidism
- Cognitive impairment

WHO Recommended intakes

Adults: 150µg/day
Pregnancy: 250µg/day



WHO - median UIC for iodine sufficiency

Adults: >100 µg/l
Pregnancy: >150 µg/l

Mild to moderate iodine deficiency

- Mild iodine deficiency associated with poorer cognitive outcomes in offspring (UK)
- Preconception maternal iodine status positively associated with IQ but not measures of executive function in childhood (UK); further data needed to establish public health importance of low preconception iodine status
- Little known about requirements when planning pregnancy and impact on status during pregnancy

Insufficient data to reach any meaningful conclusions on the benefits and harms of routine iodine supplementation in women before, during or after pregnancy

Cochrane Library

Cochrane Database of Systematic Reviews

Systematic review and meta-analysis of the effects of iodine supplementation on thyroid function and child neurodevelopment in mildly-to-moderately iodine-deficient pregnant women

Mariana Dineva,[1] Harry Fishpool,[1] Margaret P Rayman,[1] Jeewaka Mendis,[2] and Sarah C Bath[1]

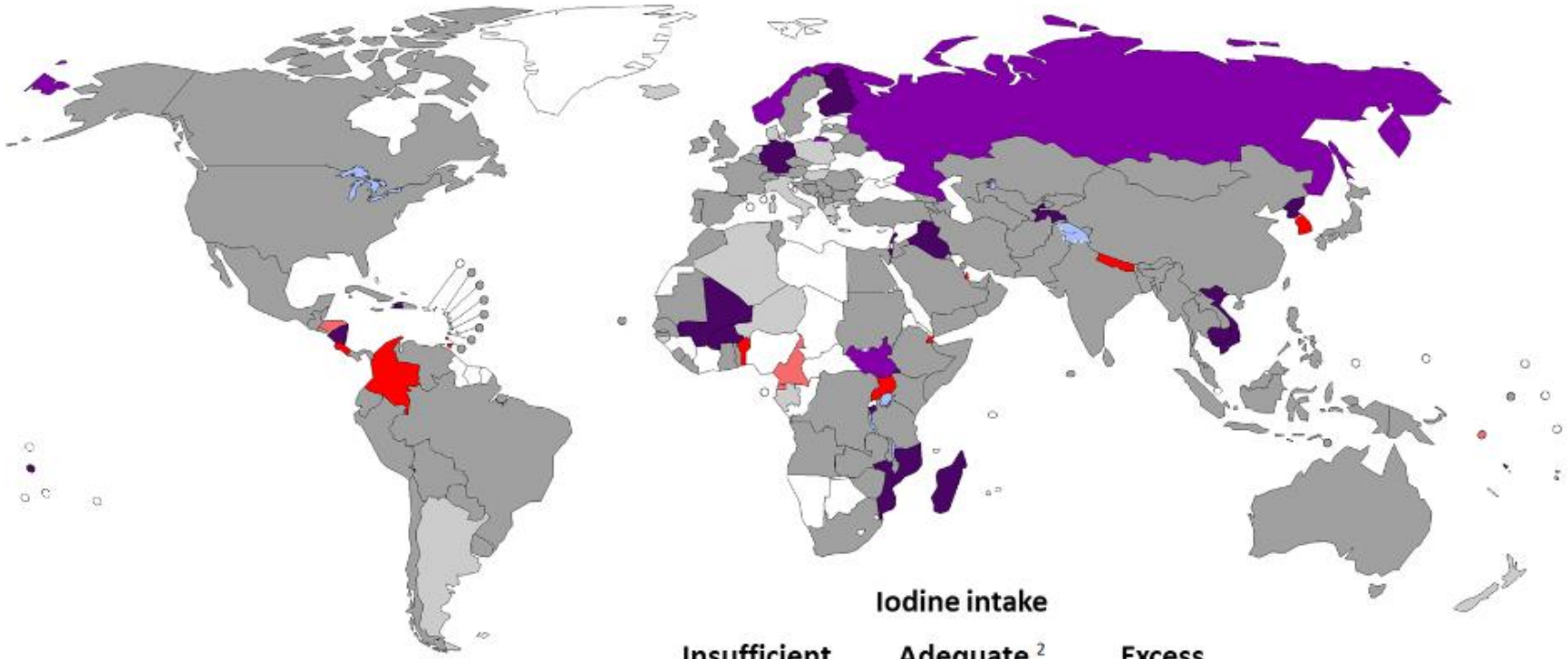
Insufficient good-quality evidence to support current recommendations for iodine supplementation in pregnancy in areas of mild-to-moderate deficiency
Well-designed RCTs, with child cognitive outcomes, are needed in pregnant women who are moderately deficient

sacn

Bath et al., 2013; Robinson et al., 2018; Harding et al., 2017; Dineva et al., 2020

Global scorecard of iodine nutrition in 2021

Iodine intake in the general population assessed by median urinary iodine concentration (mUIC) in school-age children (SAC)[1]
Studies conducted in 2005-2020



Iodine intake

	Insufficient mUIC <100 µg/L	**Adequate** [2] mUIC 100-299 µg/L	**Excess** mUIC ≥300 µg/L
National data	18	105	9
Sub-national data	3	13	4
No recent data	42		

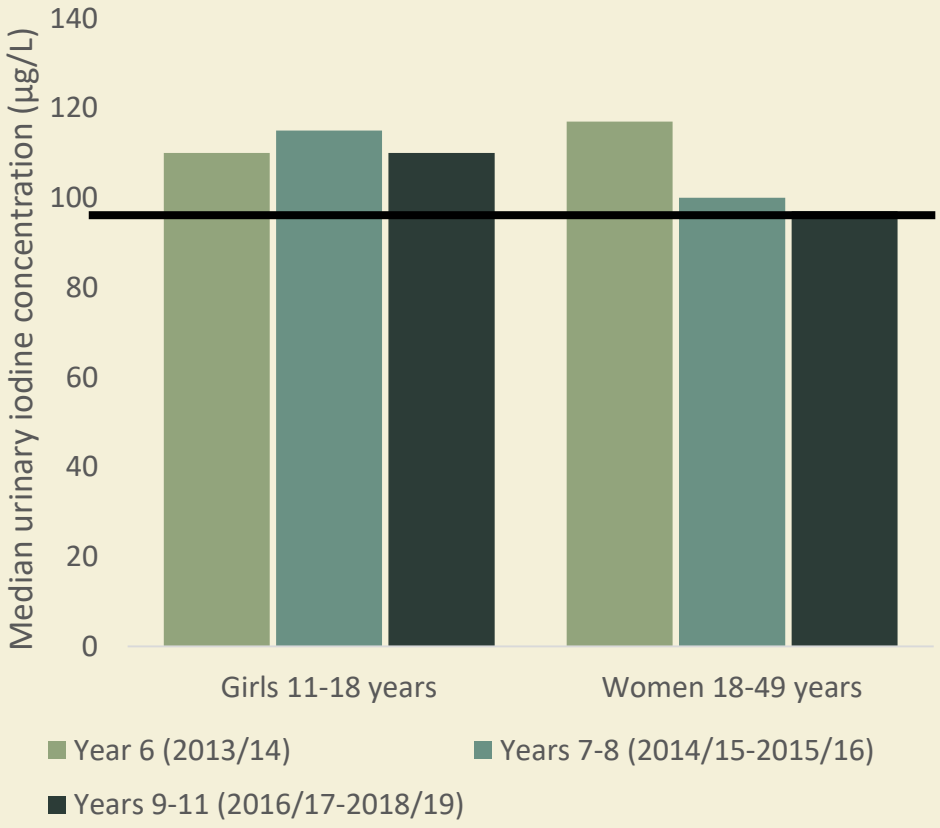
May 7, 2021

IODINE global**network**

Note: The boundaries, colours, denominations, and other information shown on this map do not imply any judgment on the part of the Iodine Global Network concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

IODINE STATUS IN UK

Reported re-emergence of iodine deficiency among schoolgirls; median UIC in 14-15 y was 80.1 µg/l



- Results from National Diet and Nutrition Survey (NDNS)
- WHO cut off for urinary iodine concentration is 100 µg/L
- Women of childbearing age (16-49 years) are now below the WHO threshold for sufficiency

Vanderpump et al., 2011; NDNS, 2020

Iodine status in Ireland

- 2008-2010 National Adult Nutrition Survey (NANS; ROI; n=1106) - borderline UIC in women aged 18-90 y (median 101 µg/l) with sufficiency in men (median 116 µg/l)
- Dietary data shows median intake as adequate with only 26% of the population being below EAR
- Continued monitoring should be of priority

McNulty et al., 2017

Urinary iodine concentration (UIC), I:Cr in Irish schoolgirls, with accompanying tap water and milk collections

Location	n	Median UIC (25^{th},75^{th} percentile) (µg/L)	Median I:Cr ratio (25^{th},75^{th} percentile) (µg/g)	Median iodine content tap water (25^{th},75^{th} percentile) (µg/l)	Geometric mean milk iodine (µg/kg)
Belfast	294	125 (85,179)	89 (64,139)	2.95 (0.90,3.41)	282
Derry	131	120 (81,172)	84 (60,121)	0.80 (0.48,2.14)	339
Dublin	97	105 (64,178)	87 (55,157)	0.59 (0.36,0.59)	221
Cork	146	101 (70,168)	86 (57,129)	1.80 (0.35,1.90)	193
Sligo	109	101 (59,140)	77 (45,132)	2.56 (0.32,2.56)	215
Roscommon	52	105 (64,150)	89 (56,135)	1.91 (1.90,2.15)	148
Galway	72	98 (64,134)	77 (50,97)	0.50	146

EUthyroid

safefood

Median UIC 111 µg/l

Mullan et al., 2020

Iodine status - pregnancy

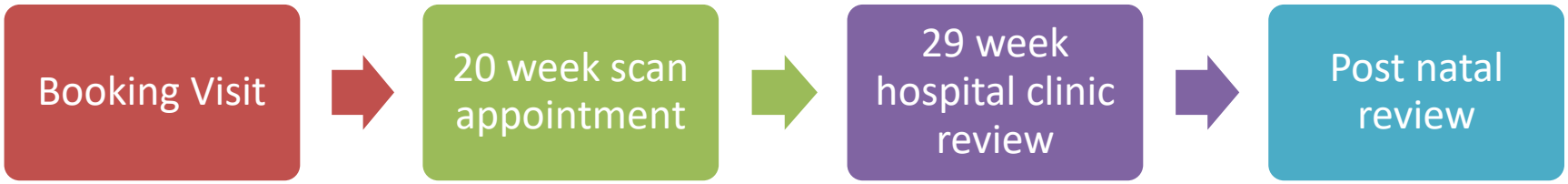


TABLE 2 Trimester specific and offspring median UIC and ICR

Trimester	Number of samples	Median UIC (IQR)	Median ICR (IQR)
First (<14 wk)	217	73 (37-122)	116.4 (71-216)
Second (18-22 wk)	134	94 (53-174)	147.2 (94-252.)
Third (28-32 wk)	153	117 (63-195)	149.9 (94-237)
Postpartum	88	90 (52-152)	60.2 (33-92)
Baby breastfed (at least partially)	49	149 (102-191)	
Baby formula fed	31	145 (114-252)	

- cohort of pregnant women living in Northern Ireland is iodine deficient across **pregnancy** and into the **postpartum period**
- offspring are iodine sufficient when feeding is established
- Confirmed by analysis of thyroglobulin

EUthyroid

McMullan et al., 2019; Mullan et al., 2022

Accompanied by low knowledge of iodine

RESEARCH ARTICLE Open Access

Knowledge about iodine requirements during pregnancy and breastfeeding among pregnant women living in Northern Ireland

Paul McMullan[1], Alyson Hunter[3], David McCance[1], Jayne V. Woodside[2*] and Karen Mullan[1]

Results: Only 20% of women were aware of the potentially increased iodine requirements during pregnancy and breast feeding; 45% were unable to identify any foods they thought would be iodine rich. The three main sources of dietary iodine in the UK are fish, dairy and eggs and 30, 9 and 15% correctly identified these as good sources respectively. When asked about whether they felt they had been given sufficient advice about folic acid and iodine in pregnancy, 90% felt this was so for folic acid, but only 5% for iodine.

Conclusions: This study suggests that iodine knowledge among pregnant women living in NI is poor. In the absence of any iodine fortification programme, women in the UK may be vulnerable to iodine deficiency in pregnancy. At present they are poorly equipped to make positive dietary changes to meet their increasing iodine requirements during pregnancy and breastfeeding. Public health strategies should be considered to target this population group.

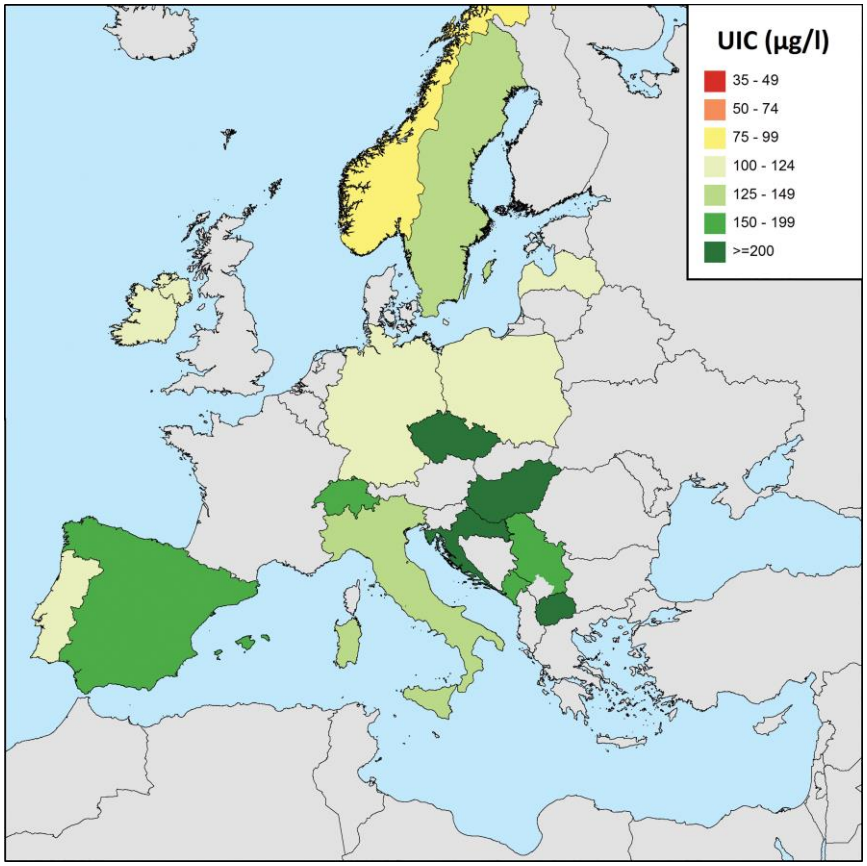
A review of current knowledge about the importance of iodine among women of child-bearing age and healthcare professionals

Lucy Kayes[1,2*], Karen R. Mullan[2] and Jayne V. Woodside[1]

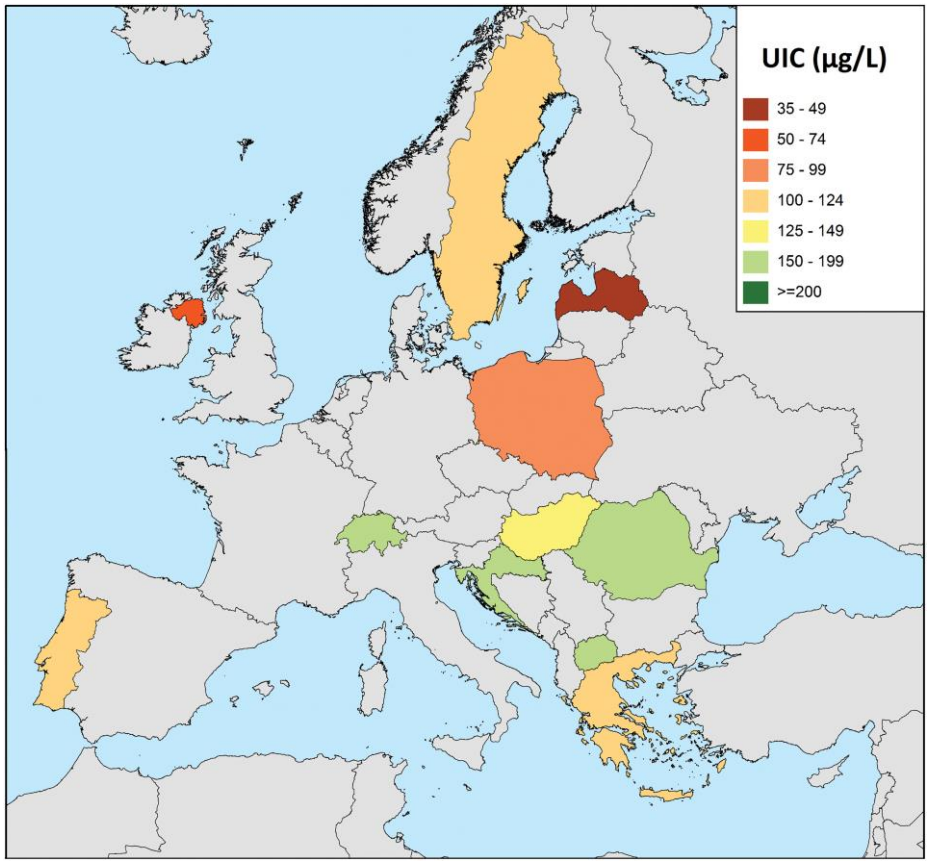
[1]*Centre for Public Health, Queen's University Belfast, Institute of Clinical Sciences Building A, 294 Grosvenor Road, Belfast BT12 6BJ, UK*
[2]*Regional Centre for Endocrinology and Diabetes, Royal Victoria Hospital, 294 Grosvenor Road, Belfast BT12 6BA, UK*

McMullan et al., 2019; Kayes et al., 2022

Schoolgirls



Pregnancy



- standardized urinary iodine concentration (UIC) data; gold-standard laboratory in Helsinki
- iodine deficiency is still present in Europe
- need to harmonise iodine-related studies/measurements to improve the validity and comparability of results

EUthyroid

https://www.iodinedeclaration.eu/

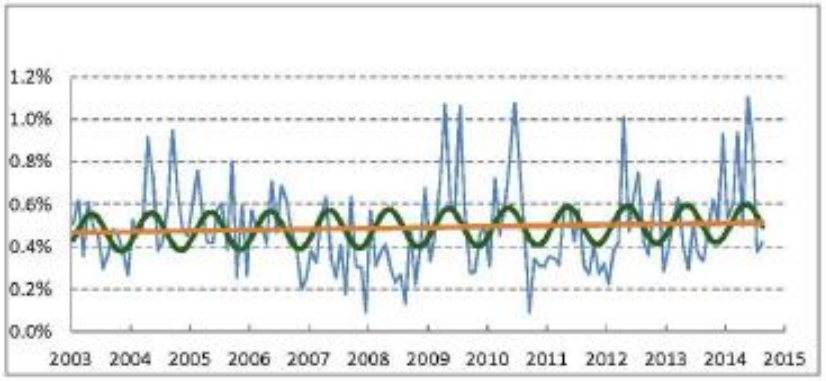
Ittermann et al., 2020

ORIGINAL ARTICLE

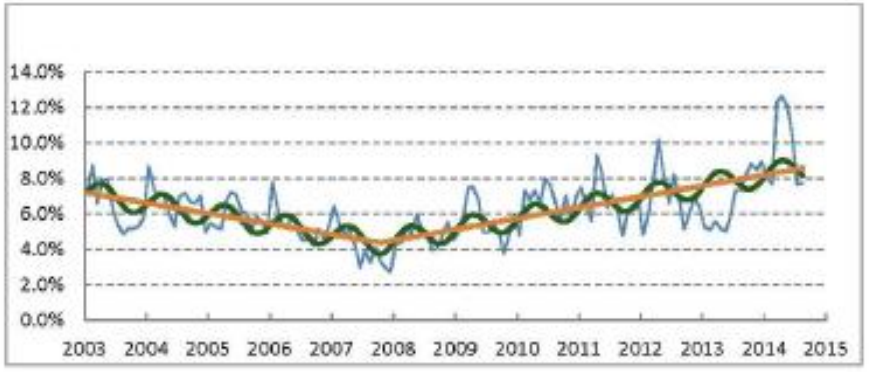
WILEY

Neonatal TSH levels in Northern Ireland from 2003 to 2014 as a measure of population iodine status

- Analysed nTSH heel prick test results from NI national screening database between 2003 and 2014 (n=288,491)
- WHO propose definition of population iodine sufficiency at <3% nTSH >5 mIU/l
- Overall population prevalence of 0.49% nTSH >5 mIU/l; no year attaining prevalence >3%
- Rising frequency of results >2 mIU/l of concern?



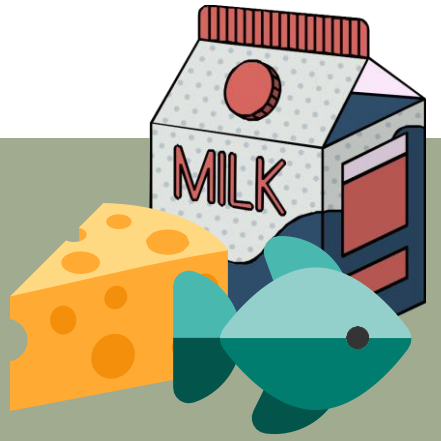
>5 mIU/l



>2 mIU/l

Mullan et al., 2018

Iodine and diet



Sources of iodine

Food	Portion	Iodine concentration (µg/portion)
Cow's milk	200ml	50-100
Organic cow's milk	200ml	30-60
Yoghurt	150g	50-100
Cheese	40g	15
Haddock	120g	390
Cod	120g	230
Plaice	130g	30
Salmon	100g	14
Scampi	170g	160
Eggs	1 egg (50g)	25

Data taken from Finglas P RM et al. (2015) *McCance and Widdowson's The Composition of Foods integrated dataset*

*iodine content of these foods can vary based on type, season, farming & processing practices.

Milk and dairy products account for 33% of iodine intake in UK adults and 51% in children

Example 150µg/day

GLASS OF MILK DAILY

+

PORTION OF DAIRY DAILY

+

X2 FISH PER WEEK

Urinary iodine concentration according to intake of dairy products

	Number of participants	Median UIC (µg/L)
Cows' Milk consumed per day (n=864)		
None	50 (6%)	90 (63-116)[a]
140ml	197 (23%)	92 (63-124)[a]
140-279ml	230 (27%)	115 (73-158)[b]
280-242ml	166 (19%)	120 (89-165)[b]
425-570ml	110 (13%)	139 (81-204)[b,c]
More than 570ml	111 (13%)	145 (103-243)[d]
Cream (n=885)		
Never/less than once a month	571(65%)	108 (69-162)[a,b]
Once in two weeks	229 (26%)	115 (81 -166)[b]
≥Once a week	85 (10%)	122 (93-196)[b,c]
Dairy desserts (n=891)		
Never/less than once a month	485(54%)	104 (68-152)[a]
Once in two weeks	235 (26%)	117 (75-172)[b]
≥Once a week	171 (19%)	128 (86-172)[b]

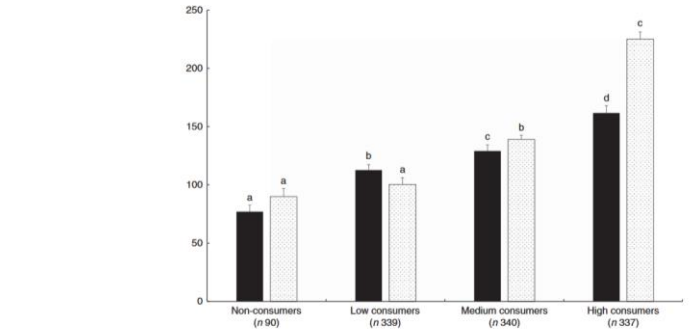
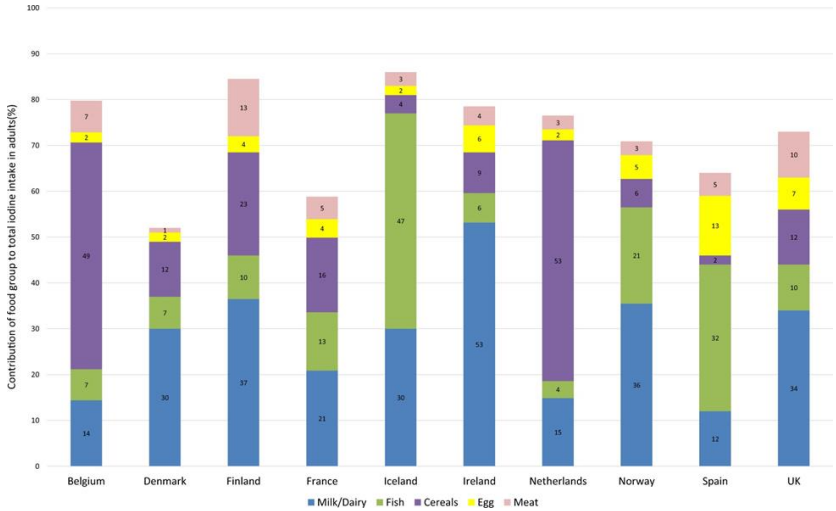


Fig. 1. The relationship between quartiles of milk consumption and dietary intakes of iodine (▒; µg/d) and urinary iodine (■; µg/l). Milk intakes used to calculate consumption groups refer to consumption of whole, semi-skimmed and skimmed milks; non-consumers recorded no consumption of milk (0 g/d), low consumers (61 g/d), medium consumers (174 g/d) and high consumers (418 g/d). In each graph, differences between consumption groups were assessed using ANOVA with Scheffé *post hoc* test. [a,b,c,d] Mean values with unlike letters were significantly different ($P < 0.001$).



Food sources of iodine in adults from national surveys in 10 countries that provided data on food contribution to overall intake

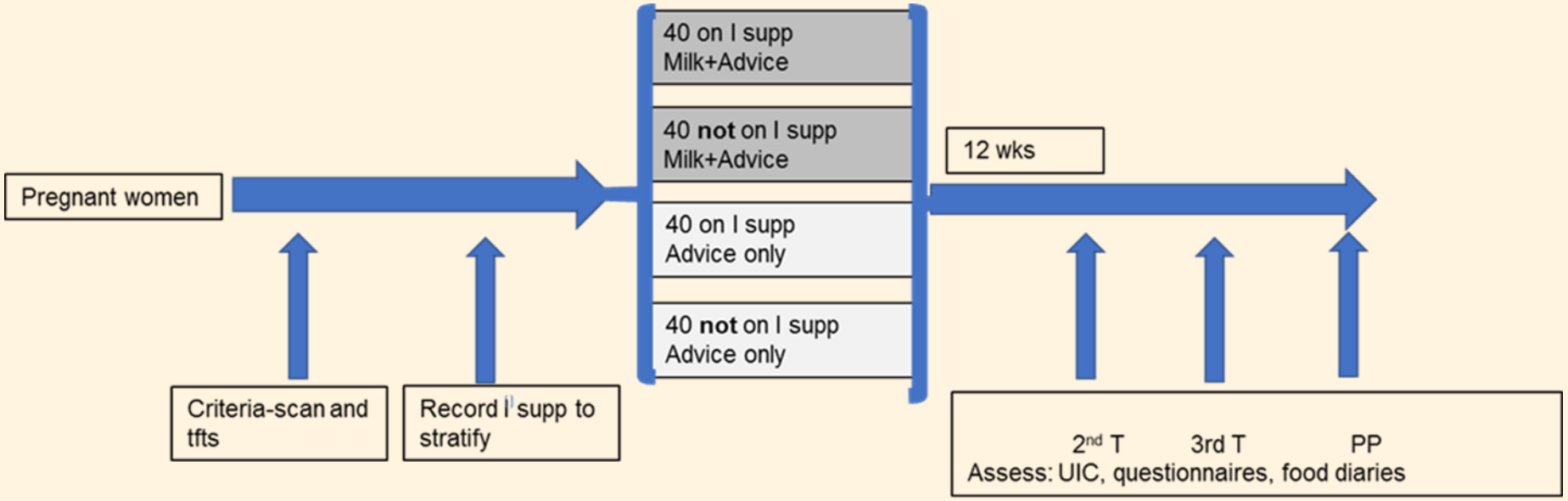
Mullan et al., 2020; McNulty et al., 2017; Bath et al., 2022

SALT IN UK AND IRELAND IS NOT IODISED

21.5% of UK and 12.4% of Irish supermarkets surveyed stocked iodised salt

Bath et al., 2014; Shaw et al., 2019

Milk intervention in early pregnancy



Milk consumption approximately 1 pint/day; effect on iodine status in mother and child

HSC Public Health Agency

DAIRY COUNCIL NORTHERN IRELAND

Rise in plant-based diets

- **21%** of UK consumers classify themselves as flexitarian
- Sales of plant-based milk **doubled** from 2019 to 2020
- In 2021 **one in three** British adults drink plant-based milk alternatives
- **44%** of adults aged 25-44 are plant-based milk users

3% of UK adults are vegan

Kantar Worldpanel (2021) Consumer Tracker
Mintel (2021) Dairy and Non-Dairy Drinks, Milk and Cream - UK - 2021.

An updated market survey of plant-based dairy and fish alternatives

Methods

WAITROSE & PARTNERS
ASDA
ocado
ALDI
LIDL
TESCO
Morrisons
Sainsbury's

Nicol et al., 2022

2020 MARKET SURVEY

	2015 Total products*	2020 Total products	% Change
Total milk products	90	146	62%
Almond	17	34	100%
Coconut	7	21	200%
Other nut	4	12	200%
Oat	8	32	300%
Pea	0	6	-
Rice	8	5	-38%
Soya	46	36	-22%

Products fortified with iodine:

20%

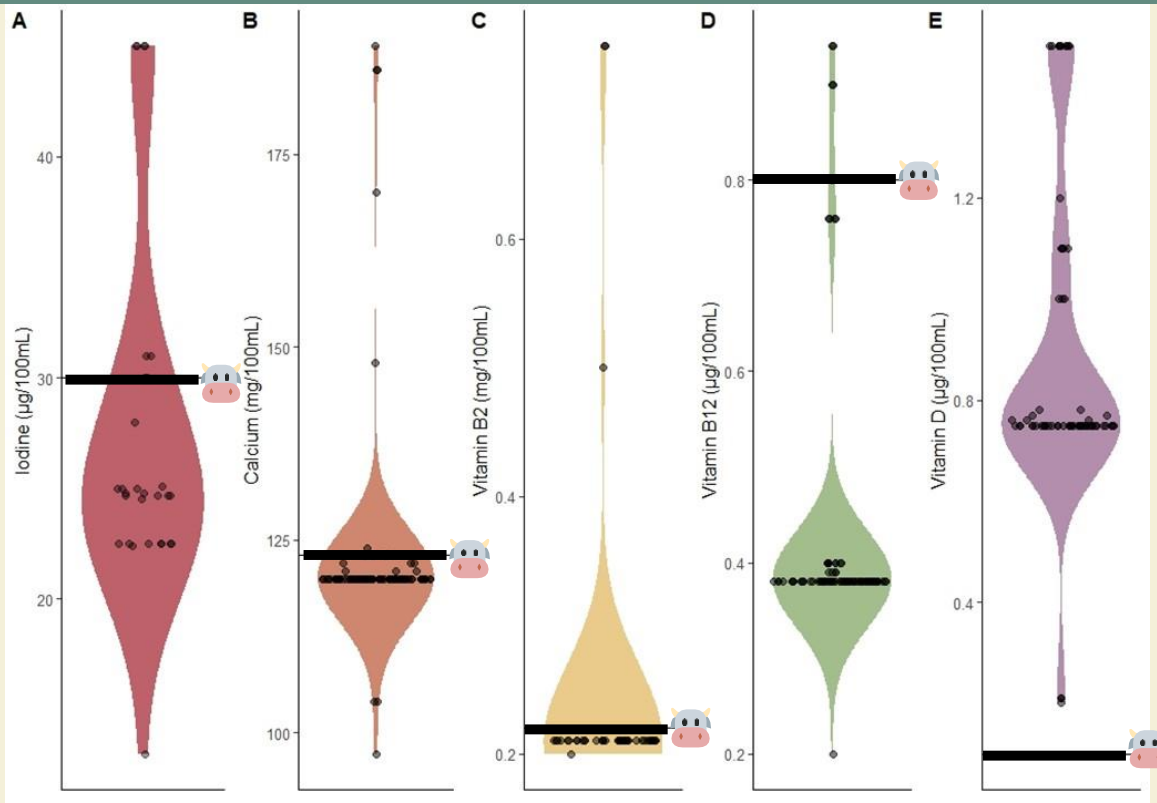
0%

5%

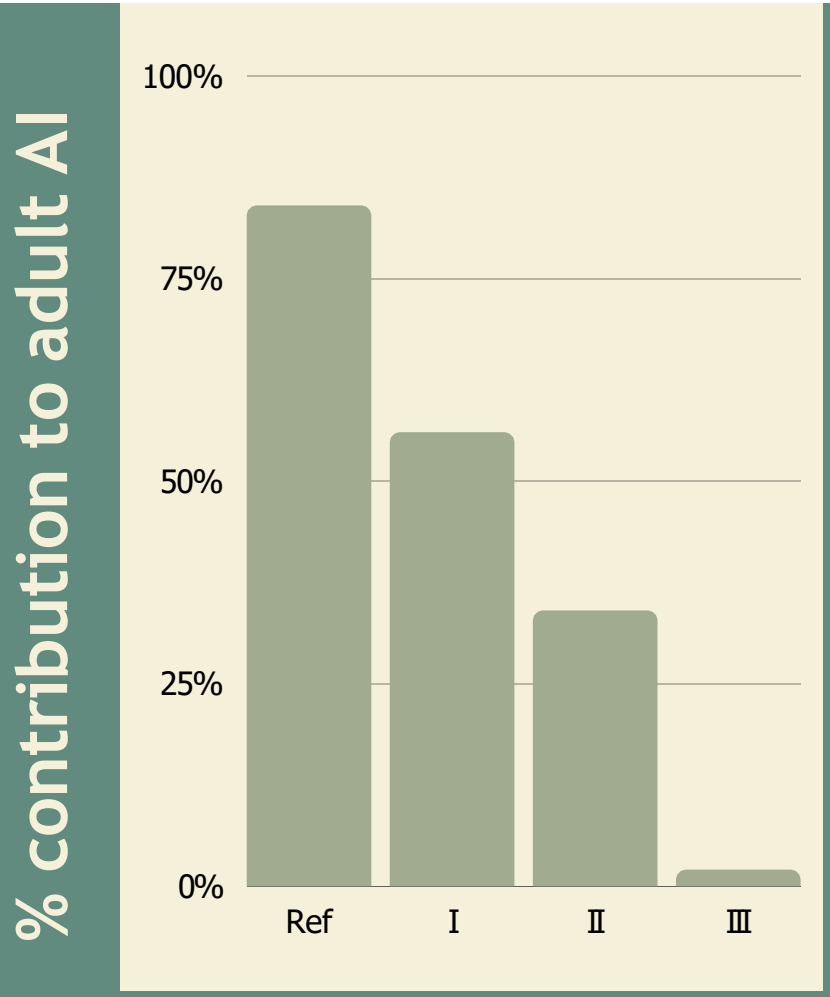
0%

Nicol et al., 2022

Results - Range of fortification



Nicol et al., 2022



RESULTS - PORTION BASED MODELLING

- The current recommendation is to consume 3 portions of dairy per day

Modelling scenarios	
Ref	3 portions of cow's milk/dairy products
I	2 portions of fortified & 1 unfortified plant-based alternatives
II	1 portion of fortified & 2 unfortified plant-based alternatives
III	3 portions unfortified plant-based alternatives

Nicol et al., 2022

Conclusion

- Iodine intake and status on IoI at low end of normal range
- Iodine status of pregnant women in NI low
- Very low levels of iodised salt availability throughout Ireland
- Milk and dairy an important source of iodine
- Unfortified plant-based alternatives will increase risk of insufficiency

Thanks to study teams and funders

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THANK YOU