Balancing the plate: nutritional adequacy in sustainable diets

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European Milk Forum, EFAD
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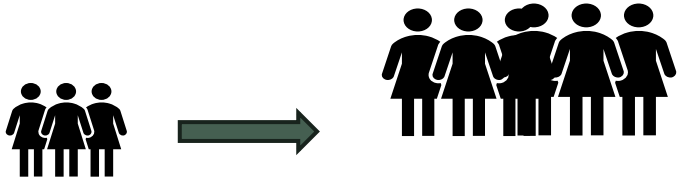
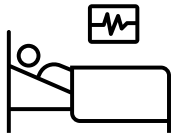
SuHeGuide 2019R546

Protein I 2021R546

UKRI doctoral training grant no: BB/T008776/1

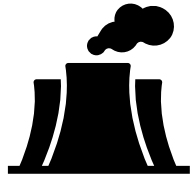
Why change?





Impact of poor dietary choices on health

2017: 11m deaths due to poor dietary choices, 255m years of ill health (DALY) [1]



Environmental Impact of food production

27% of global emissions (52.3bn tonnes of Carbon dioxide equivalents) come from food

THE LANCET

THE UNIVERSITY OF AUCKLAND Te Whare Wānanga o Tāmaki Makaurau NEW ZEALAND

WORLD OBESITY

Milken Institute School of Public Health THE GEORGE WASHINGTON UNIVERSITY

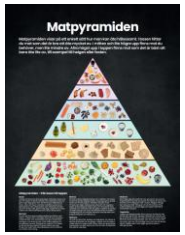
The Global Syndemic of Obesity, Undernutrition, and Climate Change: *The Lancet* Commission report

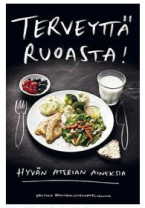
Boyd A Swinburn, Vivica I Kraak, Steven Allender, Vincent J Atkins, Phillip I Baker, Jessica R Bogard, Hannah Brinsden, Alejandro Calvillo, Olivier De Schutter, Raji Devarajan, Majid Ezzati, Sharon Friel, Shifalika Goenka, Ross A Hammond, Gerard Hastings, Corinna Hawkes,

[1](GBD Study, 2017) doi: 10.1016/S0140-6736(19)30041-8

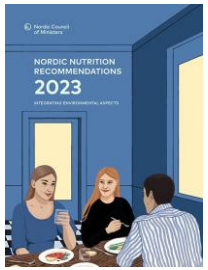
[2]Ritchie et al. (2022) - "Environmental Impacts of Food Production" Published online at OurWorldinData.org. Retrieved from: 'https://ourworldindata.org/environmental-impacts-of-food'

Healthy & sustainable diets





The Finnish food plate

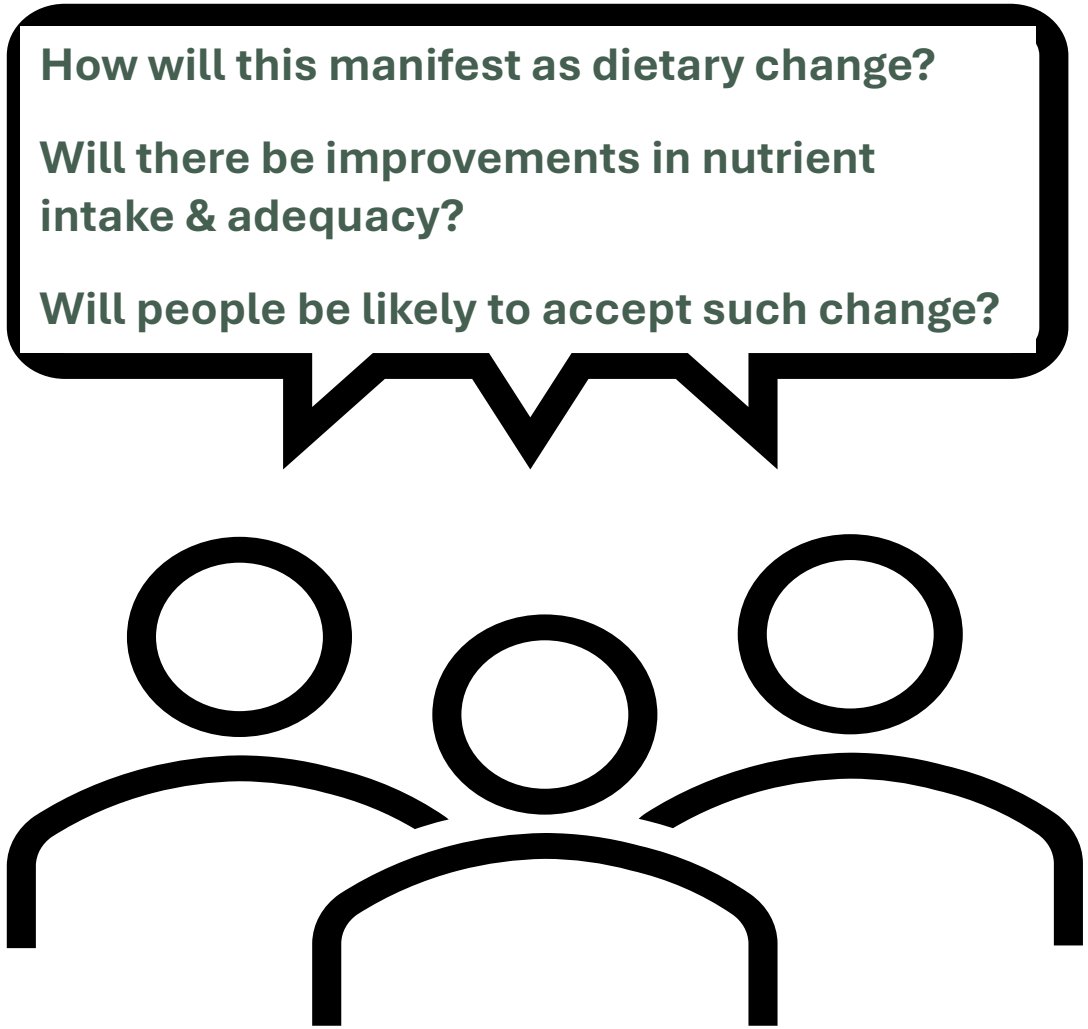


Willett et al. (2019). The Lancet Commissions Food in the Anthropocene : the EAT – Lancet Commission on healthy diets from sustainable food systems. Lancet, 393(10170):447–492

Image source: https://www.fao.org/nutrition/nutrition-education/food-dietary-guidelines/en/

FAO. (2012). Sustainable diets and biodiversity: directions and solutions for policy, research and action

Nutritional adequacy in sustainable diets?



1. The whole population approach

Sustainable diets for our population

The GOAL Mile in Louth last Christmas

Hannah Griffin
QUEEN'S UNIVERSITY BELFAST

Sustainable diets for our population

National food consumption data for island of Ireland (current dietary patterns)

Protein-i
Sustainable Healthy Nutrition

Used mathematical modelling to create a diet that is nutritionally adequate and environmentally friendly with minimal change from the usual (baseline) diet to ensure acceptability.

Griffin H, McNulty B, Wright D, Brennan L, Colombo, PE, Nugent AP, (2025) Creating healthy diets whilst minimising change from current diets: a linear programming approach. ISBPNA , New Zealand.
Griffin H, McNulty B, Wright D, Brennan L, Colombo, PE, Nugent AP, (2025) Creating healthy and sustainable diets whilst minimising change from current diets: a linear programming approach. Journal of Nutritional Science. IUNS, Paris

What did we do?

Baseline diet (National Diet and Nutrition Survey, National Adult Nutrition Survey)

Scenario 1 

Scenario 2 

Key:

Nutrient recommendations

Irish food based dietary guidelines

Environmental constraints (GHGe Chaudhary and Krishna 2019, https://pubs.acs.org/doi/10.1021/acs.est.8b06923

Linear Programming in R studio

Results

Baseline diet
N=1484

48%

52%

GHGe: 5.8 kgC02e/day
BWU: 1215.0 l/day

Diet made up of 23 food groups (including 'whole milk', 'cheese' and 'yoghurt, cream, dairy desserts and ice cream').

Scenario 1 Healthy Diet
Nutrients & IFBDG's

Created for 1038 people (72%)

46%

54%

GHGe: 5.4 kgC02e/day
BWU: 899.0 l/day

Diet made up of 9 food groups (including 3 animal- based food groups, including 'whole milk').

(female, older, non-smoker, higher social class)

Scenario 2 Sustainable Healthy Diet
Nutrients, IFBDG's & environmental

Created for 626 people (42%)

34%

66%

GHGe: 3.1 kgC02e/day
BWU: 90.7 l/day

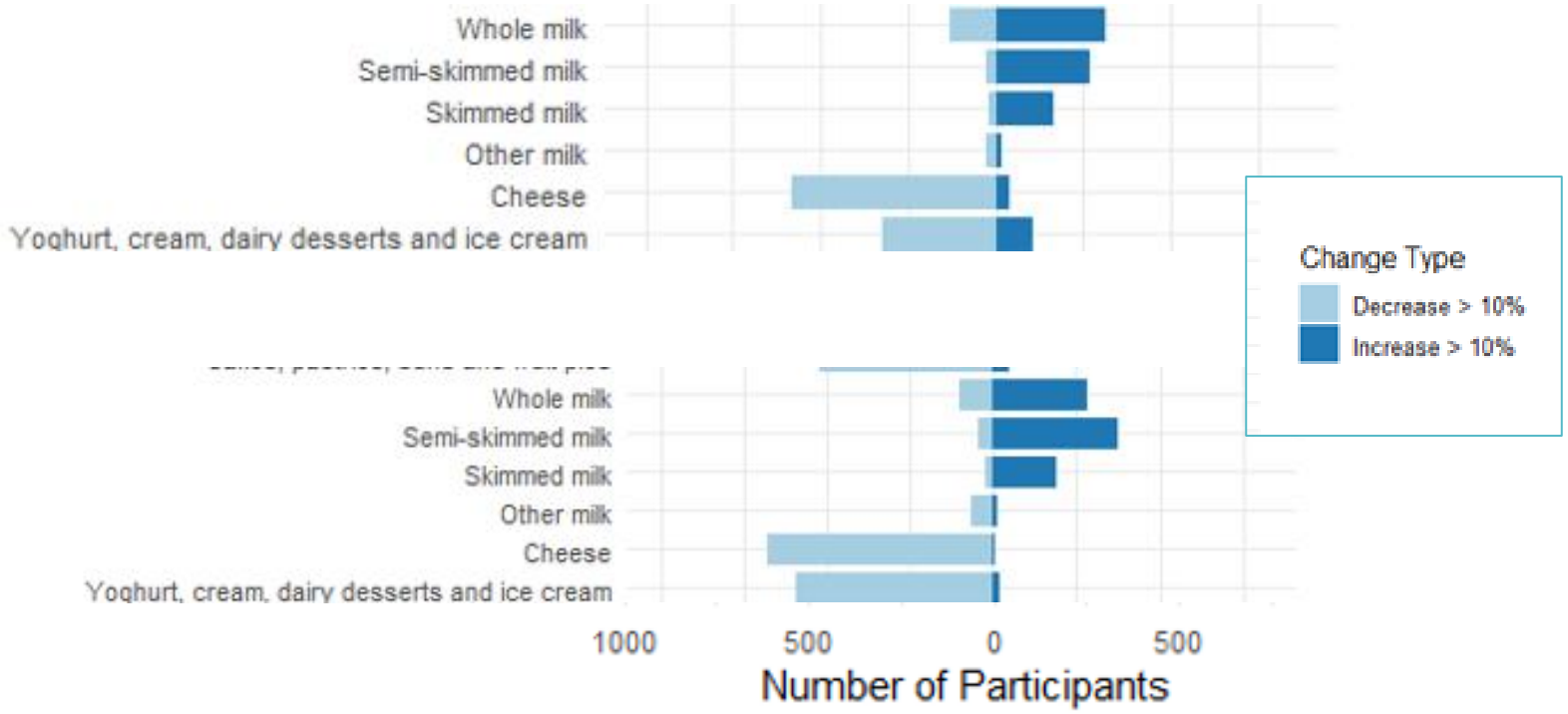
Diet made up of 10 food groups (including semi-skimmed and whole milk)

(female, older, non-smoker, higher social class)

By how much would we have to change our food intake: a focus on dairy?

Scenario 1

Scenario 2



Key take home 1

- It is possible to generate diets which would be acceptable, sustainable and healthy
- Changes in intake of many food groups, including dairy types
- Such diets would not be acceptable to many

Option 2: The single food approach?

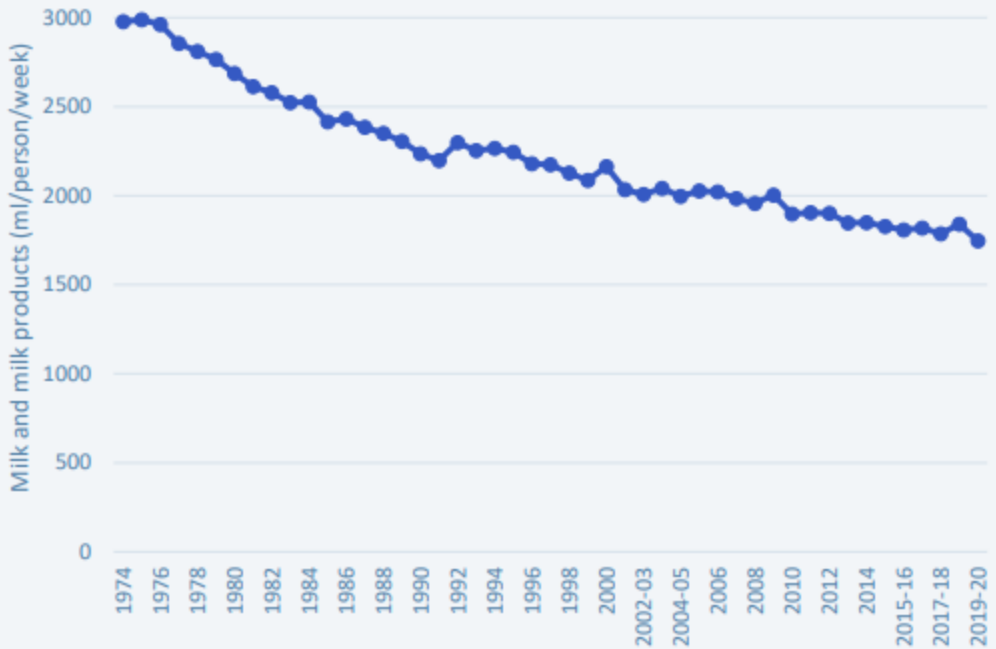
Would it be ‘easier’ to make single dietary swaps?

Why? Single food substitutions don’t require other changes in behaviour

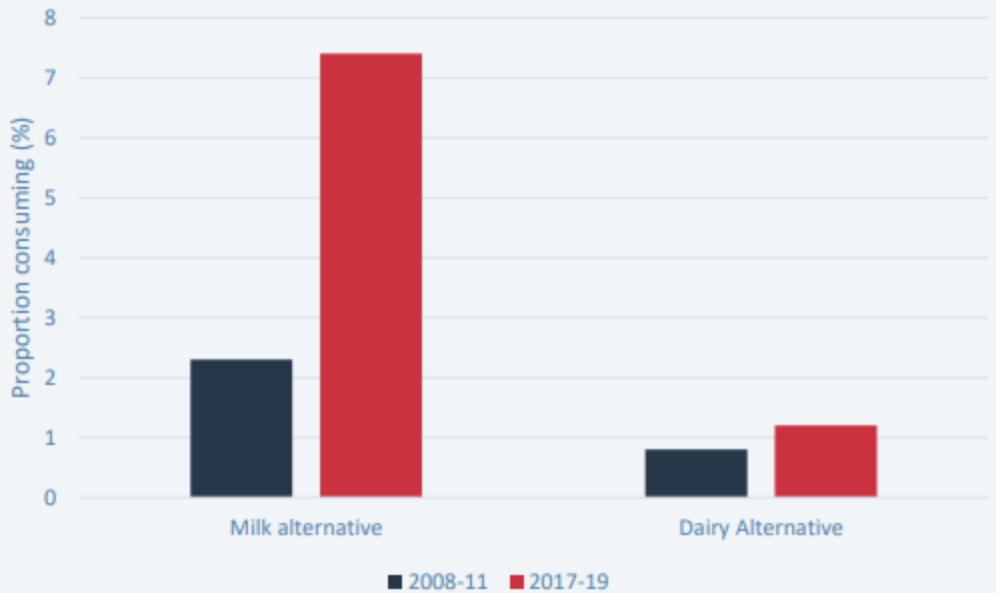
But is there an impact on dietary intake and nutritional status?

Changes in milk consumption

Milk consumption trend since 1970s in the UK

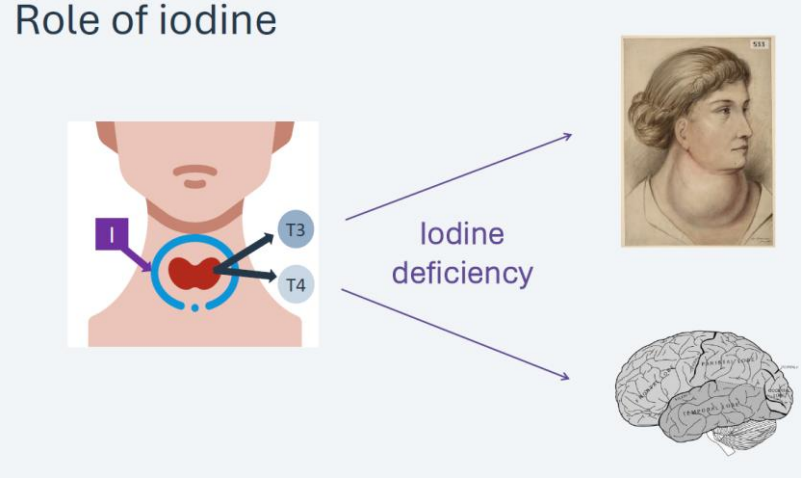


Plant-based alternatives trend since 2008 in the UK



1. National Food Survey (1942-2000) & Family Food Survey from 2002; 2. Alae-Carew et al 2022

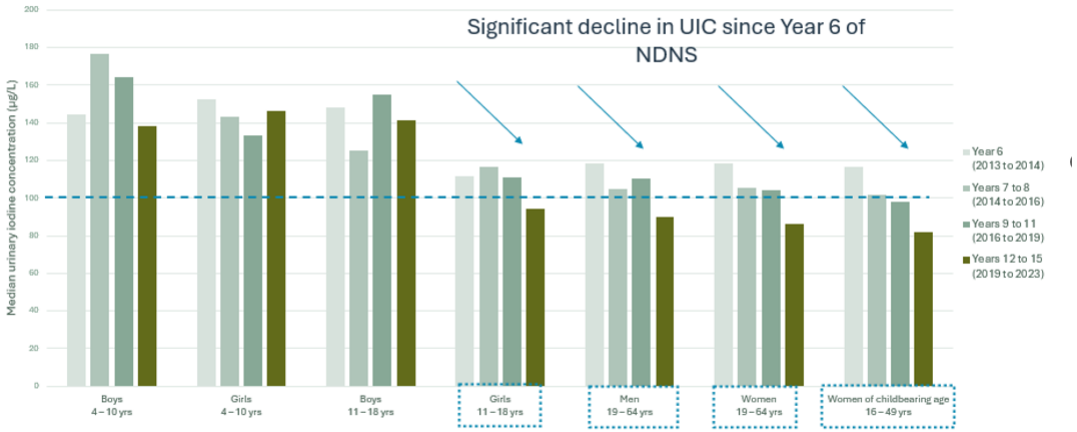
Why iodine?



World Health Organization

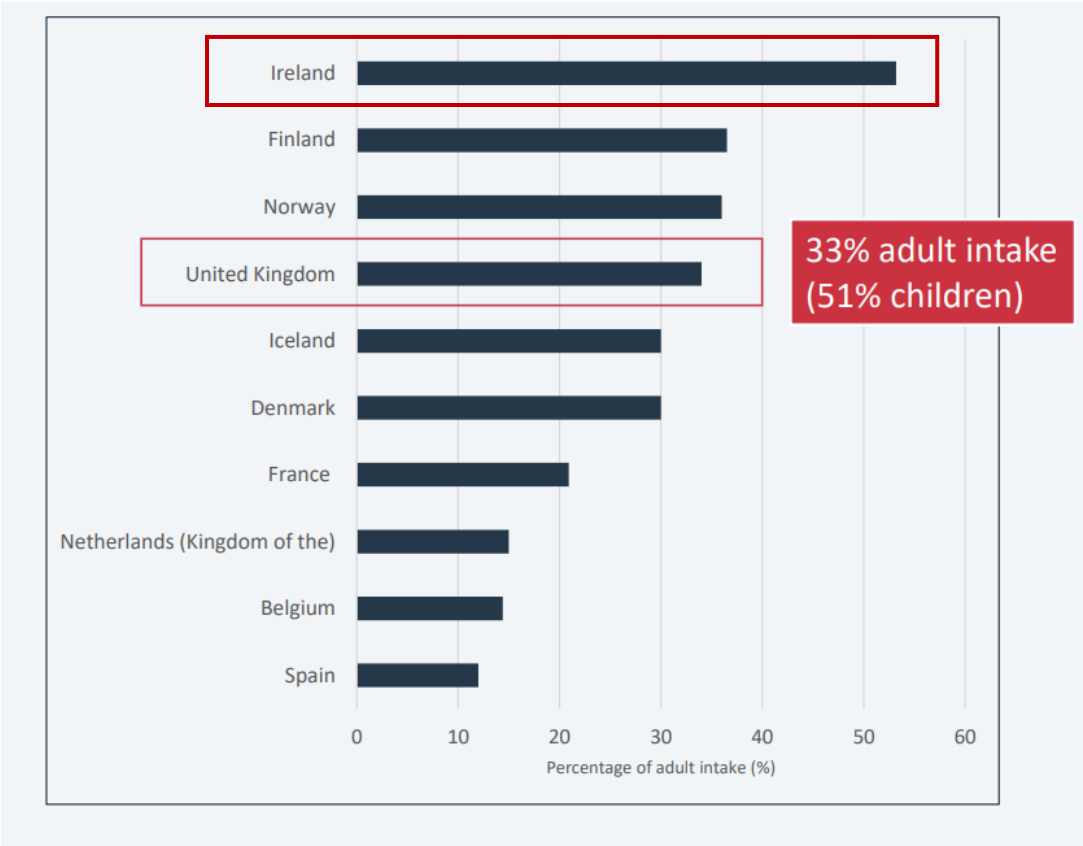
"Iodine deficiency is the world's most prevalent, yet easily preventable, cause of brain damage"

Iodine status in the UK (NDNS data)

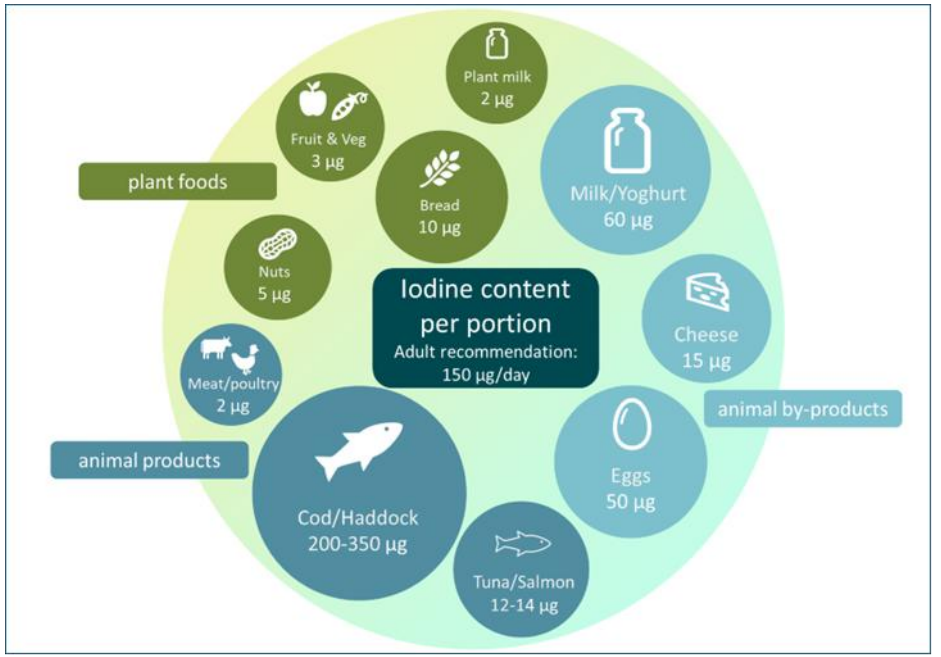


IGN Scorecard 2021: NDNS Years 6 - 15

Milk, plant-based milk alternatives and iodine



Percentage of adult iodine intake from milk and dairy products



Graphical Abstract from Nicol et al. Br J Nutr 2023 Vol. 131 Issue 2 Pages 265-275


Short Communication

Availability of iodised table salt in the UK – is it likely to influence population iodine intake?

Sarah C Bath, Suzanne Button and Margaret P Rayman*

BRIEF COMMUNICATION

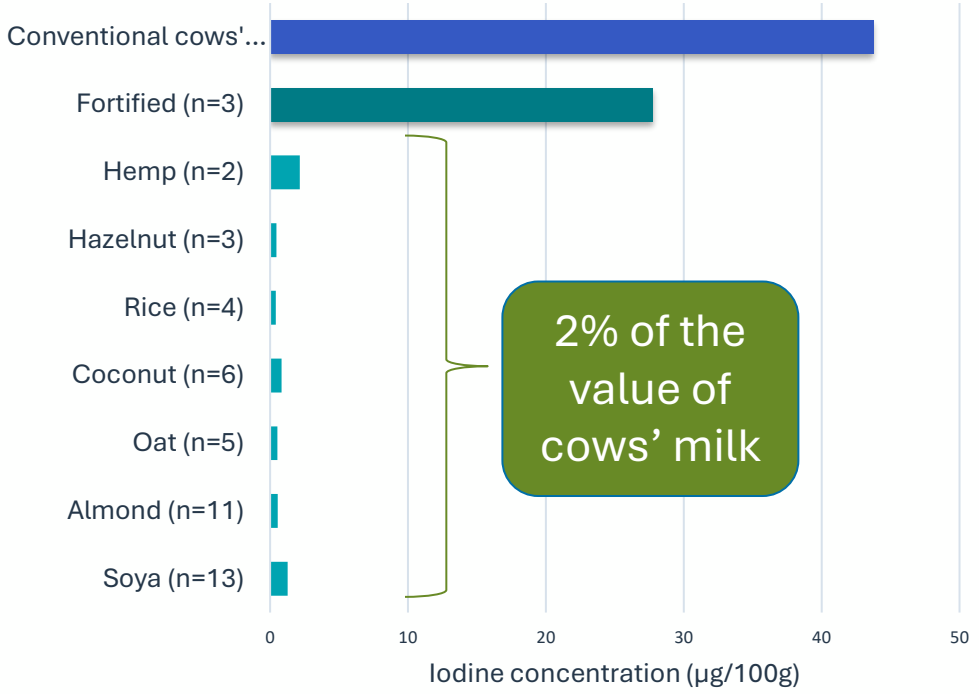
What is the availability of iodised salt in supermarkets on the Island of Ireland?

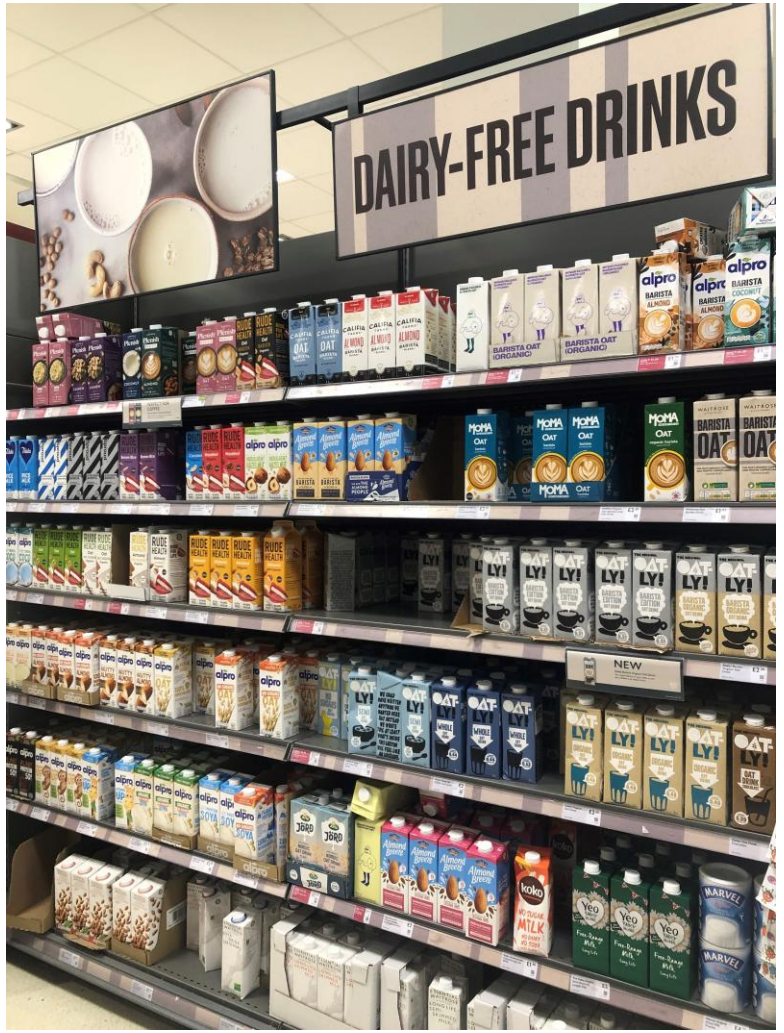
Iodine and milk alternatives

British Journal of Nutrition (2017), **118**, 525–532

Iodine concentration of milk-alternative drinks available in the UK in comparison with cows' milk

Sarah C. Bath[1], Sarah Hill[2], Heidi Goenaga Infante[2], Sarah Elghul[1], Carolina J. Nezianya[1] and Margaret P. Rayman[1]*



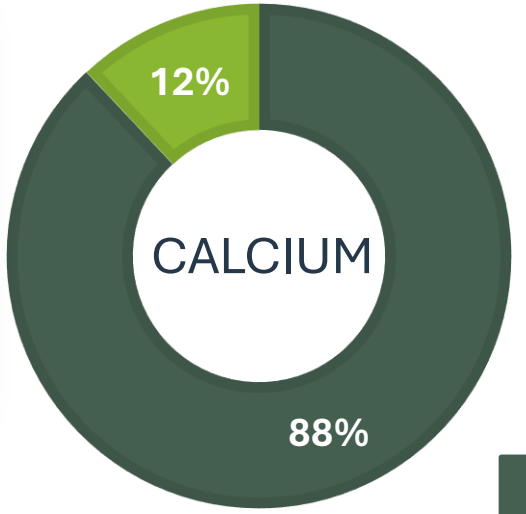


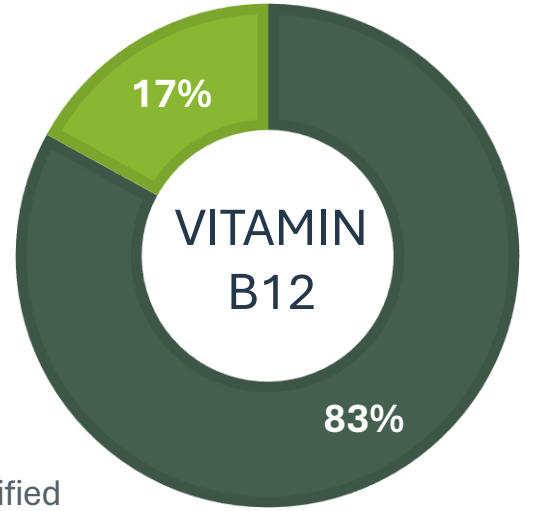
Fortification of milk alternatives

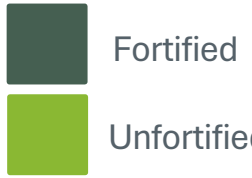
British Journal of Nutrition, page 1 of 11 doi:10.1017/S0007114522001052

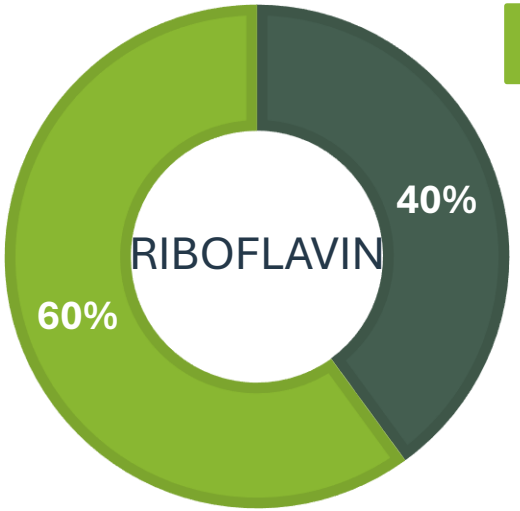
Iodine fortification of plant-based dairy and fish alternatives: the effect of substitution on iodine intake based on a market survey in the UK

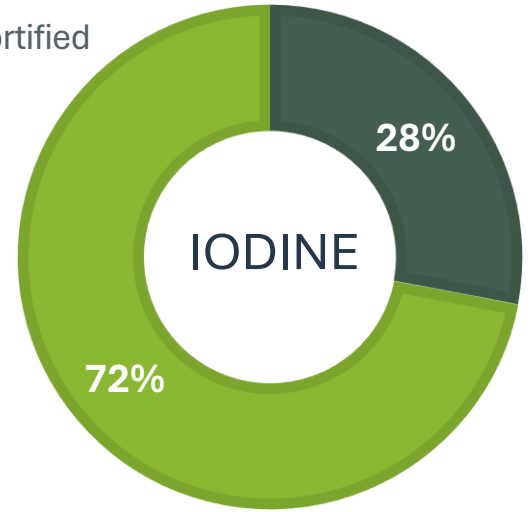
Katie Nicol[1], Eva-Leanne Thomas[1], Anne P. Nugent[2], Jayne V. Woodside[3], Kathryn H. Hart[1] and Sarah C. Bath[1]*



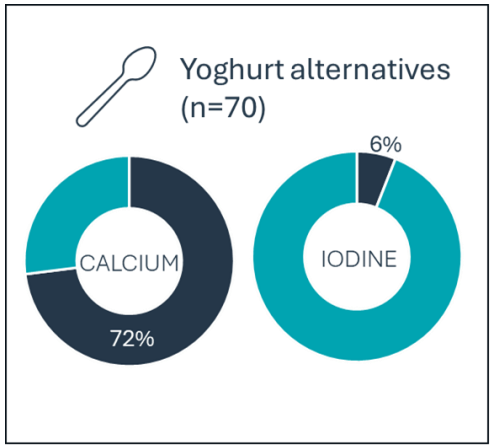


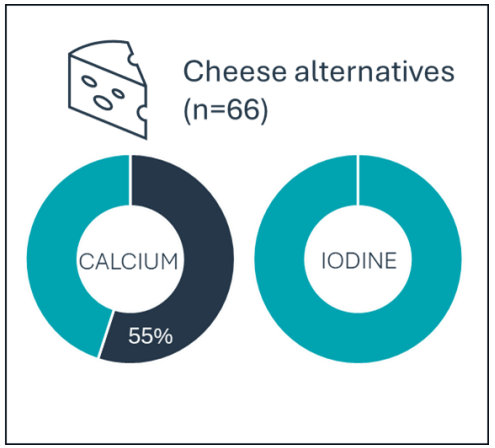






- Market survey December 2020; milk alternatives (n=146)





Provision of iodine


British Journal of Nutrition (2023), 129, 832–842 doi:10.1017/S0007114522001052

Iodine fortification of plant-based dairy and fish alternatives: the effect of substitution on iodine intake based on a market survey in the UK

Katie Nicol[1], Eva-Leanne Thomas[1], Anne P. Nugent[2], Jayne V. Woodside[3], Kathryn H. Hart[1] and Sarah C. Bath[1]*

Cows' milk products

= 124 µg

Unfortified plant-based products

= 2.6 µg

97.8% reduction

Nicol et al 2022

Population impact of moving from cows milk to dairy alternatives: UK data

100% replacement of cow's milk in NDNS food diaries with milk alternative:

European Journal of Nutrition
https://doi.org/10.1007/s00394-023-03286-7

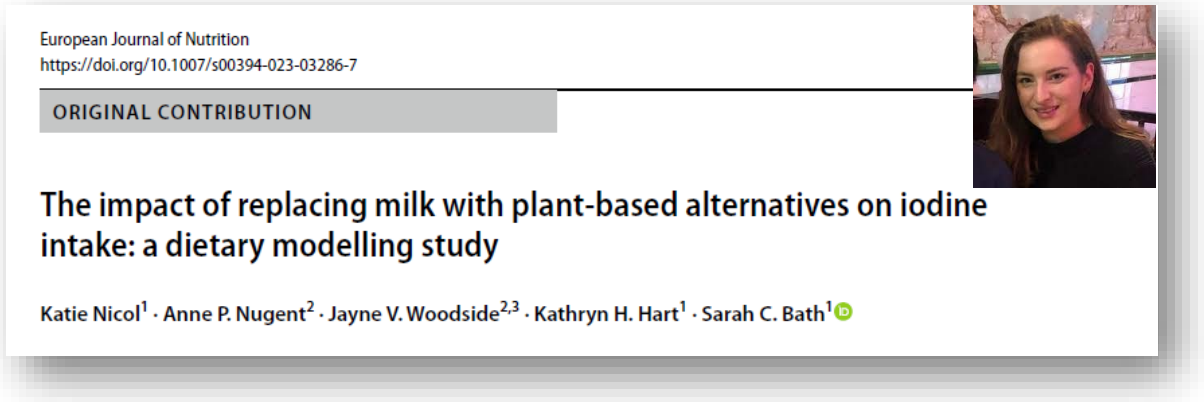
ORIGINAL CONTRIBUTION

The impact of replacing milk with plant-based alternatives on iodine intake: a dietary modelling study

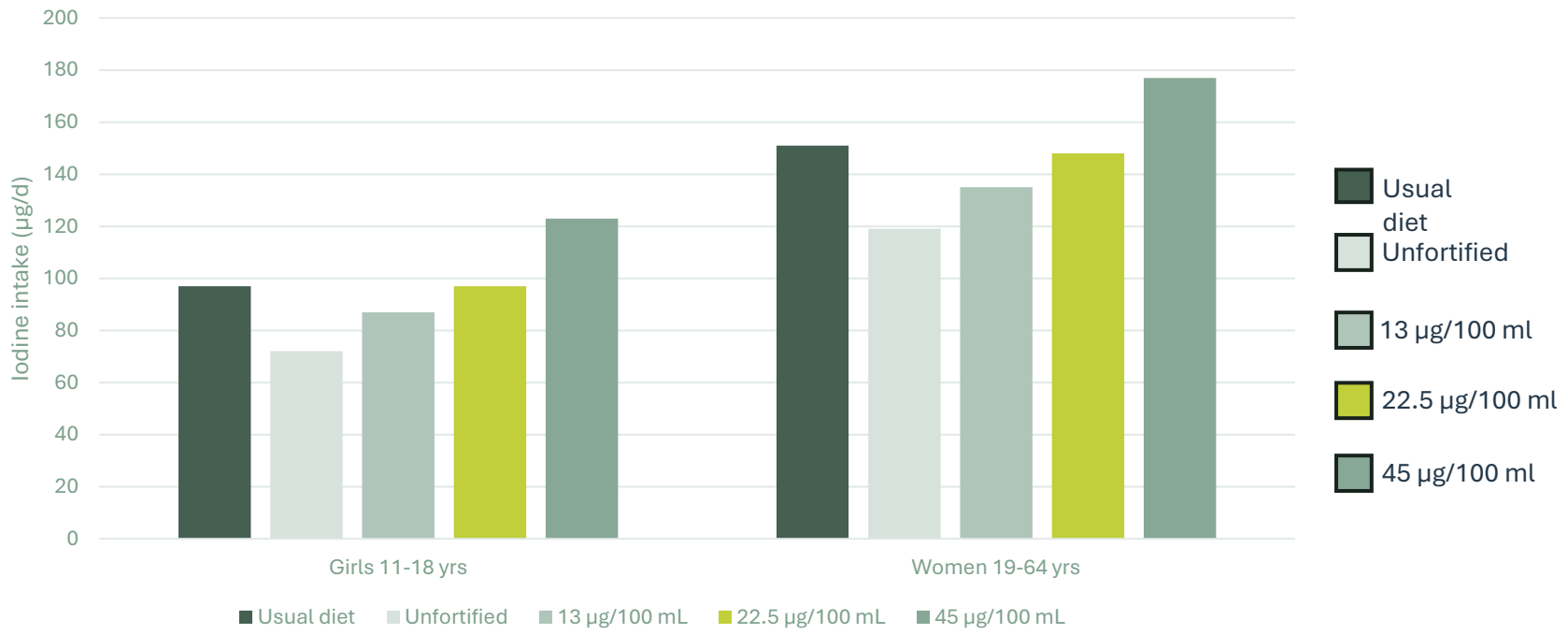
Katie Nicol[1] · Anne P. Nugent[2] · Jayne V. Woodside[2,3] · Kathryn H. Hart[1] · Sarah C. Bath[1]

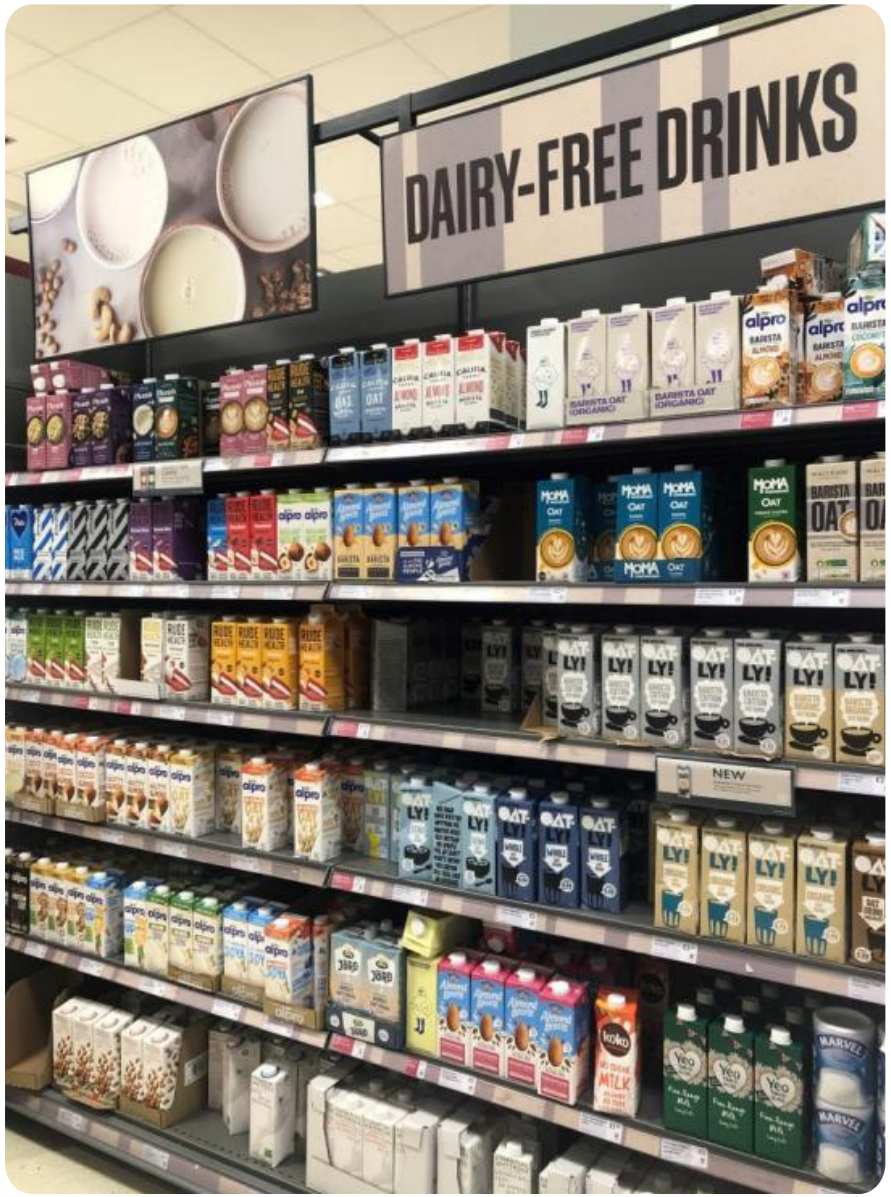
- Unfortified
- 13 µg/100ml
- 22.5 µg/100ml
- 27 µg/100ml
- 45 µg/100ml

Fortification of milk alternatives



Fortification at ≥ 22.5 and < 45 µg iodine/100 mL required to minimize the impact on iodine intake





Key take home 2

- Iodine is an overlooked but vital nutrient
- UK and Ireland do not have salt iodisation policies
- Most milk alternatives are not iodine-fortified; iodine needs to be considered within plant-based diets

Option 3: An intervention trial: MyPlanetDiet RCT:

Can an environmentally protective diet reduce Green house gas emissions (GHGe), meet nutritional requirements and promote health, without adverse effects?

SuHeGuide

MyPlanetDiet: randomised controlled trial

UCD DUBLIN

UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh

QUEEN'S UNIVERSITY BELFAST

Participants: Healthy adults (18-64Y) with moderate/high greenhouse gas emitting diets (n=360 [3x 120])

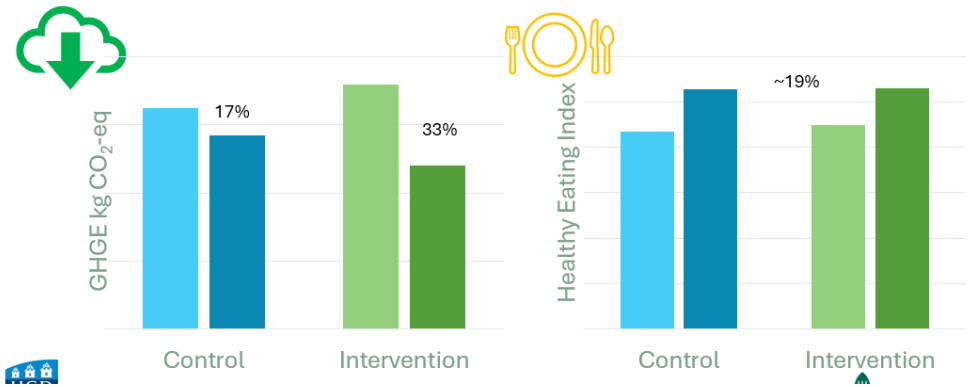
Intervention group:

Personalised advice based on proposed sustainable healthy guidelines

Control group:

Personalised advice based on existing Healthy Eating Guidelines

MyPlanetDiet Environment and Diet



Did the diet influence the proportion of males and females likely to have poor dietary intakes?*

Compared to control group at study end

- riboflavin, vitamin B_6, vitamin B_{12}, calcium, zinc & vitamin C
- Vitamin E & Copper

- riboflavin, selenium, iodine

*Comparison of % of the population with usual intakes below the average requirement

The American Journal of Clinical Nutrition 122 (2025) 962–971

The American Journal of CLINICAL NUTRITION

journal homepage: https://ajcn.nutrition.org/

Original Research Article

Sustainable diets reduce diet-related greenhouse gas emissions and improve diet quality: results from the MyPlanetDiet randomized controlled trial

Katie P Davies [1], Eileen R Gibney [1], Ursula M Leonard [2], Leona Lindberg [3], Jayne V Woodside [3,4], Mairead E Kiely [2], Anne P Nugent [1,4], Elena Arranz [2,5], Marie C Conway [6], Sinead N McCarthy [6], Aifric M O'Sullivan [1,*]

[1] Institute of Food and Health, School of Agriculture and Food Science, University College Dublin, Dublin, Ireland; [2] Cork Centre for Vitamin D and Nutrition Research, School of Food and Nutritional Sciences, University College Cork, Cork, Ireland; [3] Centre for Public Health, School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast, Belfast, Northern Ireland, United Kingdom; [4] Institute for Global Food Security, School of Biological Sciences, Queen's University Belfast, Belfast, United Kingdom; [5] Instituto de Investigación en Ciencias de la Alimentación, CIAL (CSIC-UAM, CEI UAM+CSIC), Universidad Autónoma de Madrid, Madrid, Spain; [6] Department of Agrifood Business and Spatial Analysis, Teagasc Food Research Centre, Ashtown, Dublin, Ireland

The American Journal of Clinical Nutrition xxx (xxxx) xxx

The American Journal of CLINICAL NUTRITION

journal homepage: https://ajcn.nutrition.org/

Original Research Article

Impact of sustainable diets on micronutrient intakes and status: outcomes of the MyPlanetDiet randomized controlled trial

Ursula M Leonard [1], Katie P Davies [2], Leona Lindberg [3], Jayne V Woodside [3,4], Anne P Nugent [2,4], Aifric M O'Sullivan [2], Eileen R Gibney [2], Sinead N McCarthy [5], Elena Arranz [1,6], Mairead E Kiely [1,*]

[1] Cork Centre for Vitamin D and Nutrition Research, School of Food and Nutritional Sciences, University College Cork, Cork, Ireland; [2] Institute of Food and Health, School of Agriculture and Food Science, University College Dublin, Dublin, Ireland; [3] Centre for Public Health, School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast, Belfast, Northern Ireland, United Kingdom; [4] Institute for Global Food Security, School of Biological Sciences, Queen's University Belfast, Belfast, Northern Ireland, United Kingdom; [5] Department of Agrifood Business and Spatial Analysis, Teagasc Food Research Centre, Ashtown, Dublin, Ireland; [6] Instituto de Investigación en Ciencias de la Alimentación, Universidad Autónoma de Madrid, Madrid, Spain

Will people be likely to accept such change?

Adherence & acceptability

Adherence was similar between groups

Control	Intervention
Associated with higher diet quality (HEI)	Associated with higher HEI & lower GHGE
Most adhered to group: red and processed meat	Most adhered to group: red meat (beef/lamb)
Least adhered to group: dairy	Least adhered to group: beans, peas and lentils
Treat foods most difficult to follow (self-reported)	Treat foods most difficult to follow (self-reported)

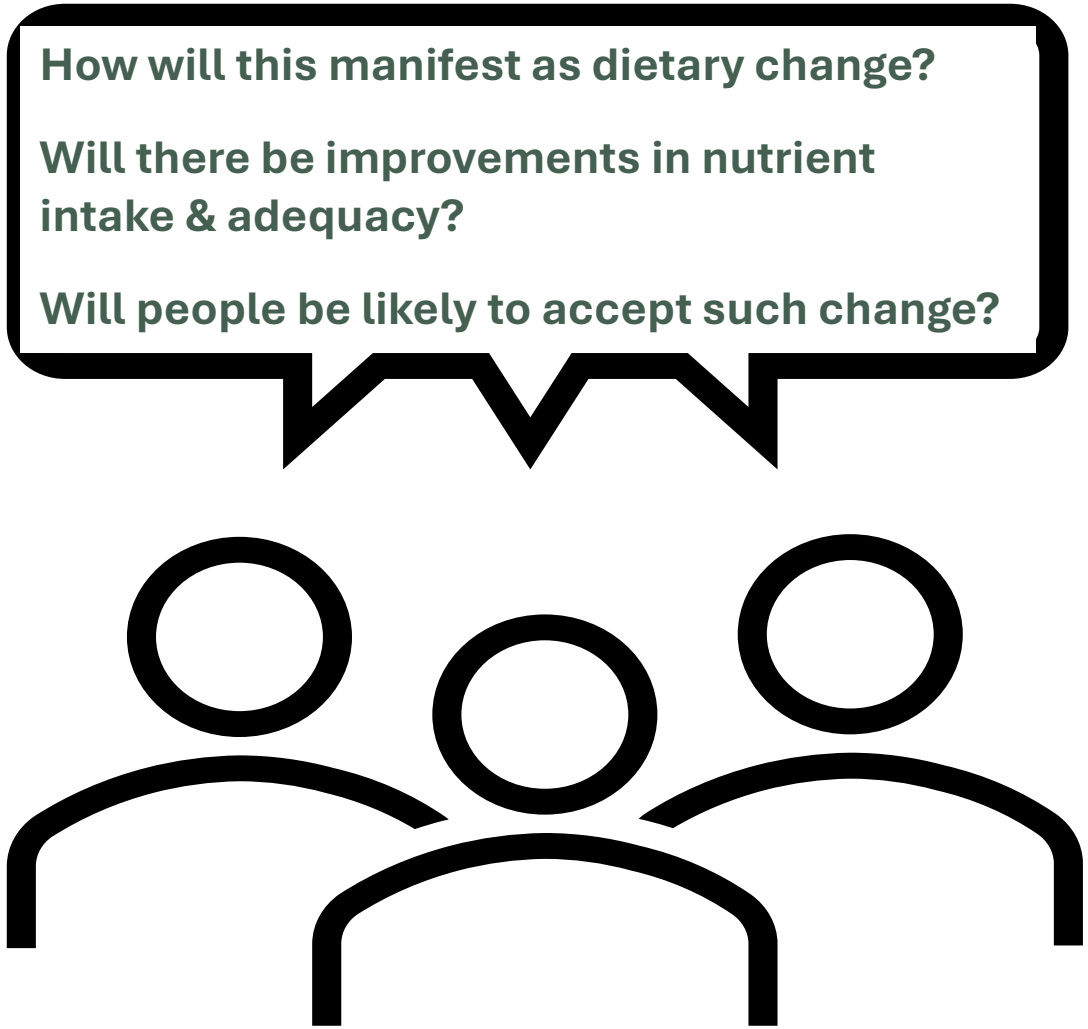
Lindberg L, Nugent AP, Davies KP, Leonard UM, O'Sullivan A, Gibney ER, Kiely ME, Arranz E, Conway MC, McCarthy S, Woodside JV (2025) Adherence and acceptability of the MyPlanet Diet study recommendations. IUNS, Paris

Key take home 3

- Compared to a diet based on healthy eating guidelines, a diet based on sustainable dietary principles reduced greenhouse gas emissions but resulted in a higher prevalence of inadequate intakes of several micronutrients, especially among women.

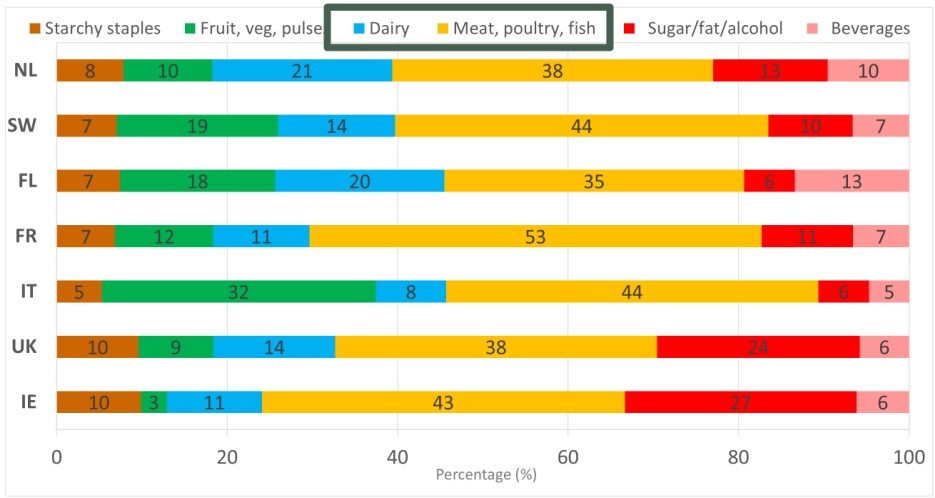
- **Certain aspects of the diet may be more acceptable than others**

Nutritional adequacy in sustainable diets?



Overall Conclusion

Contribution of food groups to total dietary GHGE



- The change is great: There remains a considerable gap between current eating patterns and dietary patterns which are both healthy and sustainable
- Need to consider nutrient content and fortify where required
- Must consider the entire scope of the WHO/FAO definition of Sustainable Diets
- A whole-diet approach may be required with adequate consideration of nutrient-dense but also discretionary foods
- Considerable proportions of the population may find it a challenge!

Thank you

Queen's University Belfast

Hannah Griffin

Sinan Dong

Alexandra-Irina Mavrochefalos

Eva-Leanne Thomas

Rachel Moore

Dr. Leona Lindberg

Dr. Tony Benson

Dr. Rufielyn Gravador

Dr. David Wright

Prof. Moira Dean

Prof. Michelle McKinley

Prof. Jayne Woodside

University College Dublin

Dr. Katie Davies

Dr. Aoife O'Gorman

Assoc. Prof. Breige McNulty

Assoc. Prof Aifric O'Sullivan

Prof. Eileen Gibney

Prof Lorraine Brennan

Surrey University

Dr. Katie Nicol

Dr. Sarah Bath

University College Cork

Dr. Ursula Leonard

Prof. Mairead Kiely

Karolinska Instituet

Dr Patricia Eustachio Colombo

Teagasc

Dr. Sinead McCarthy

Dr Marie Conway (now TUD)

Wider Protein-I and SuHe teams. MyPlanetDiet participants

a.nugent@qub.ac.uk

Protein-i Sustainable Healthy Nutrition

SuHeGuide

An Roinn Talmhaíochta, Bia agus Mara Department of Agriculture, Food and the Marine

Department of Agriculture, Environment and Rural Affairs

Sustainability at the heart of a living, working, active landscape valued by everyone