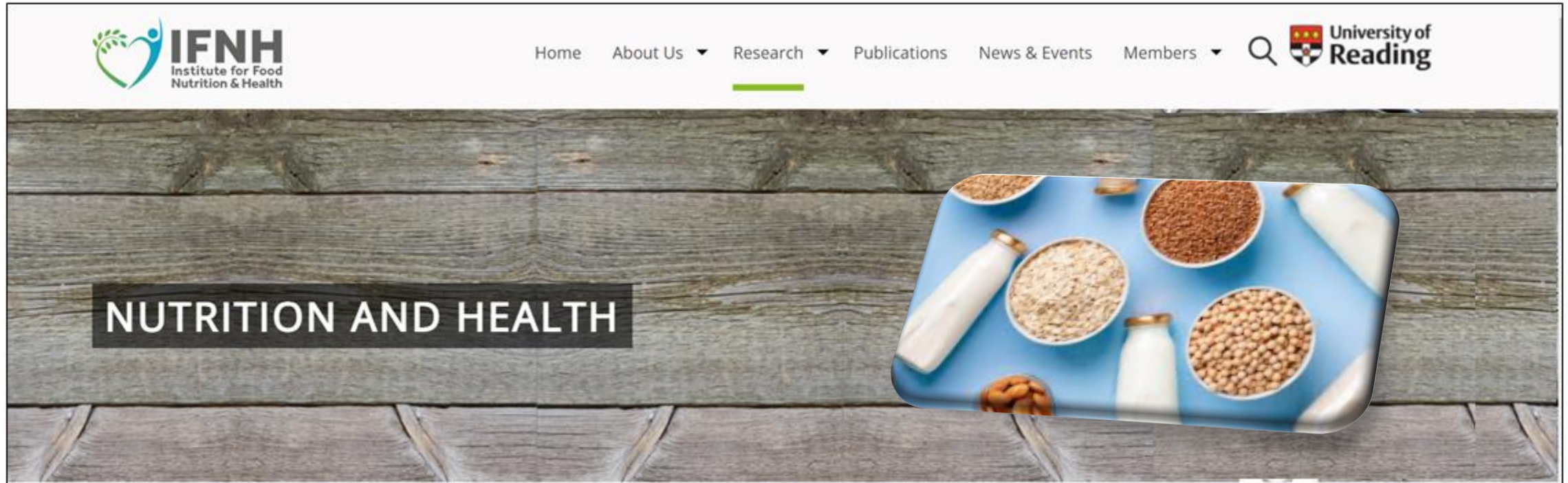


Dairy matrix effects: the case of protein transition and micronutrient bioavailability



Professor Ian Givens

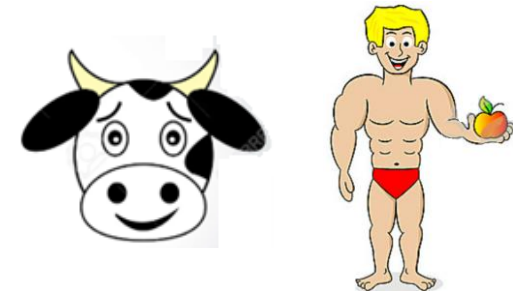
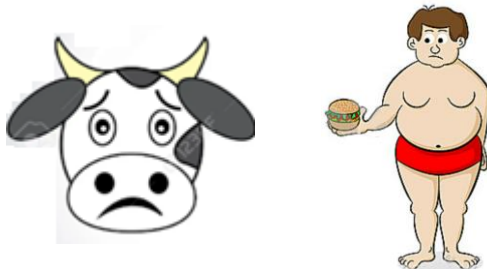
Institute for Food, Nutrition and Health,
University of Reading



4 July 2024
Belfast



Protein transition

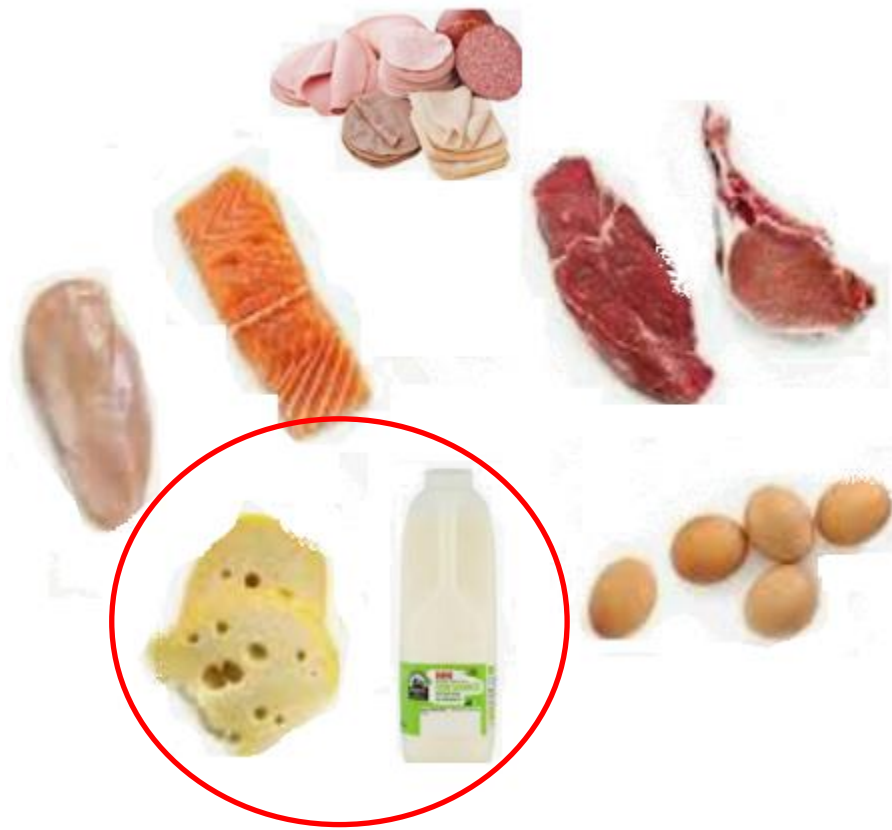




Food transition



Simplistic protein replacement is too simple

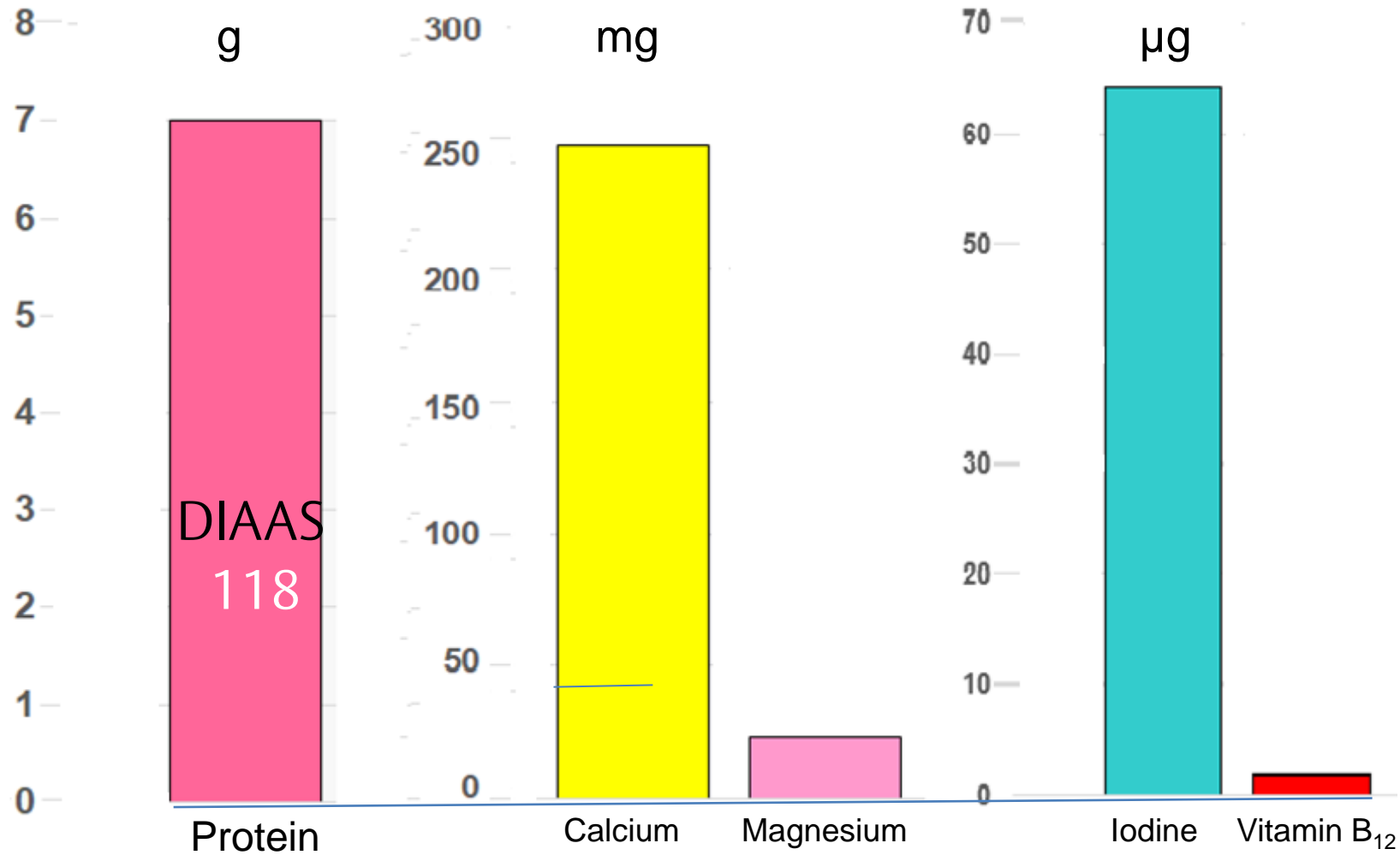


Protein quality matters

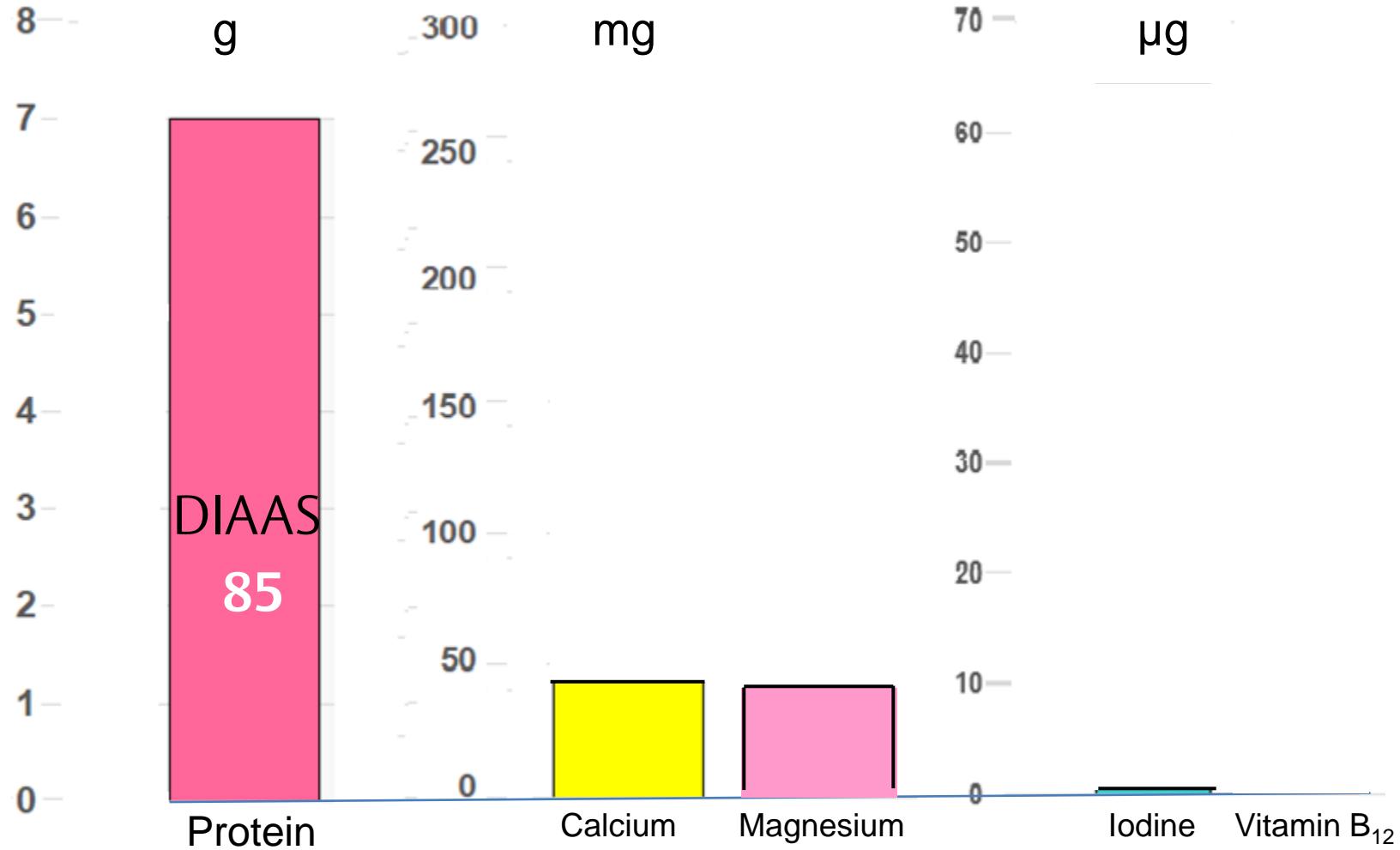
Animal derived foods are highly variable

- They have different nutrient profiles
- They have different functionalities
- They have different impacts on health

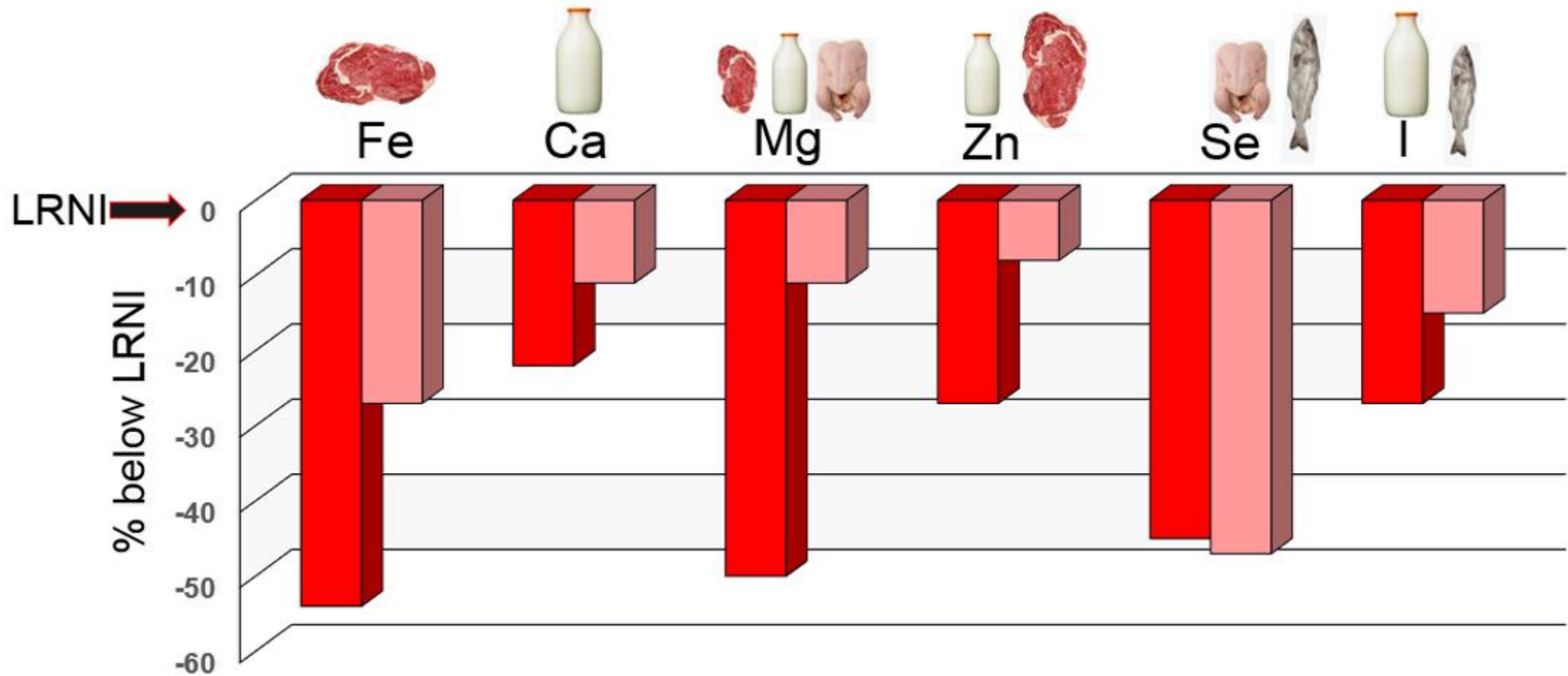
Replacing 7g protein in milk by soya beans



Replacing 7g protein in milk by soya beans

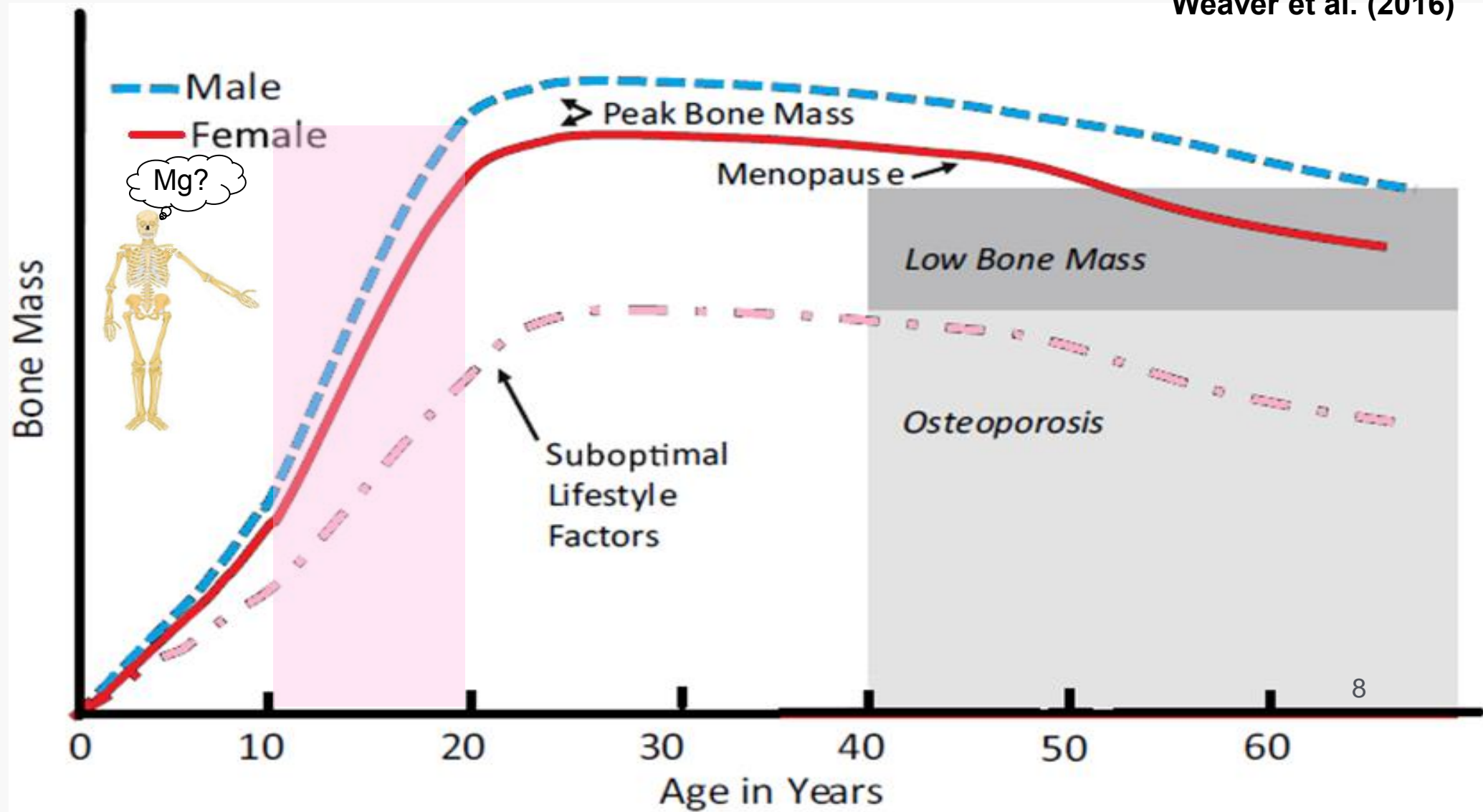


Sub-optimal micronutrient intake of UK female adolescents and adults

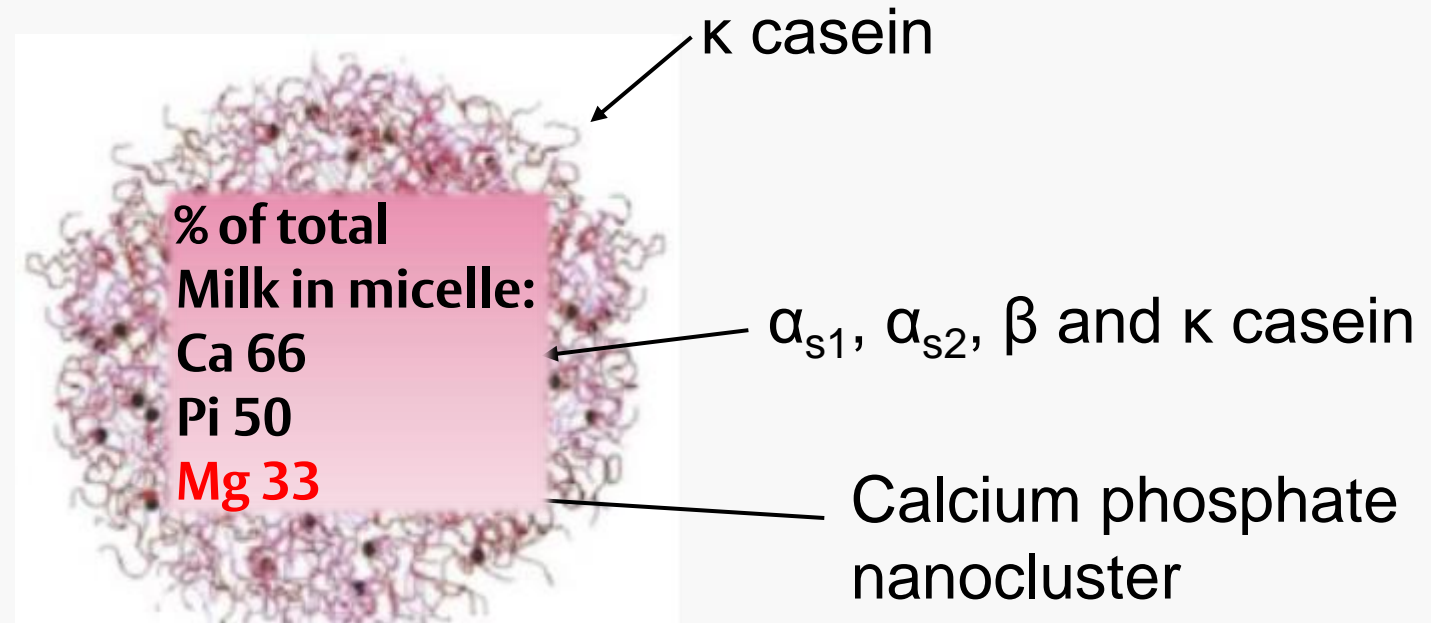
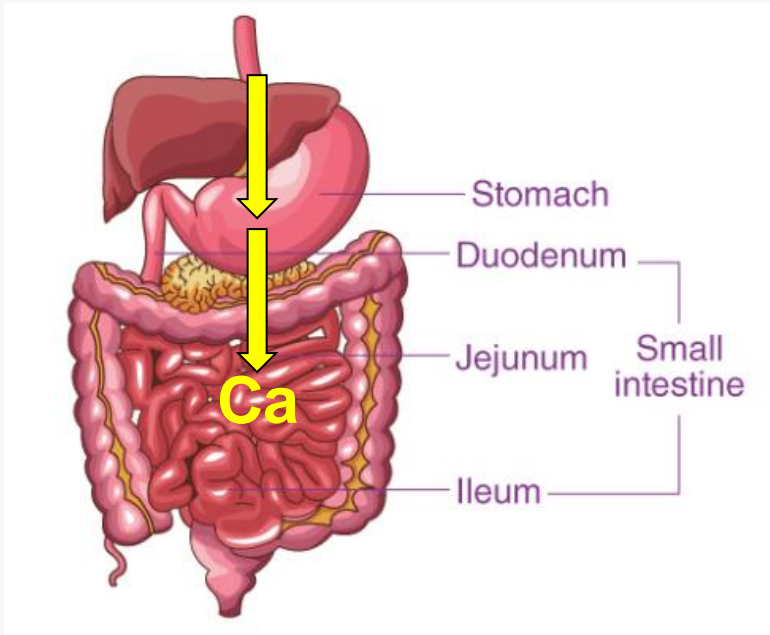


Bone mass changes with age

Weaver et al. (2016)



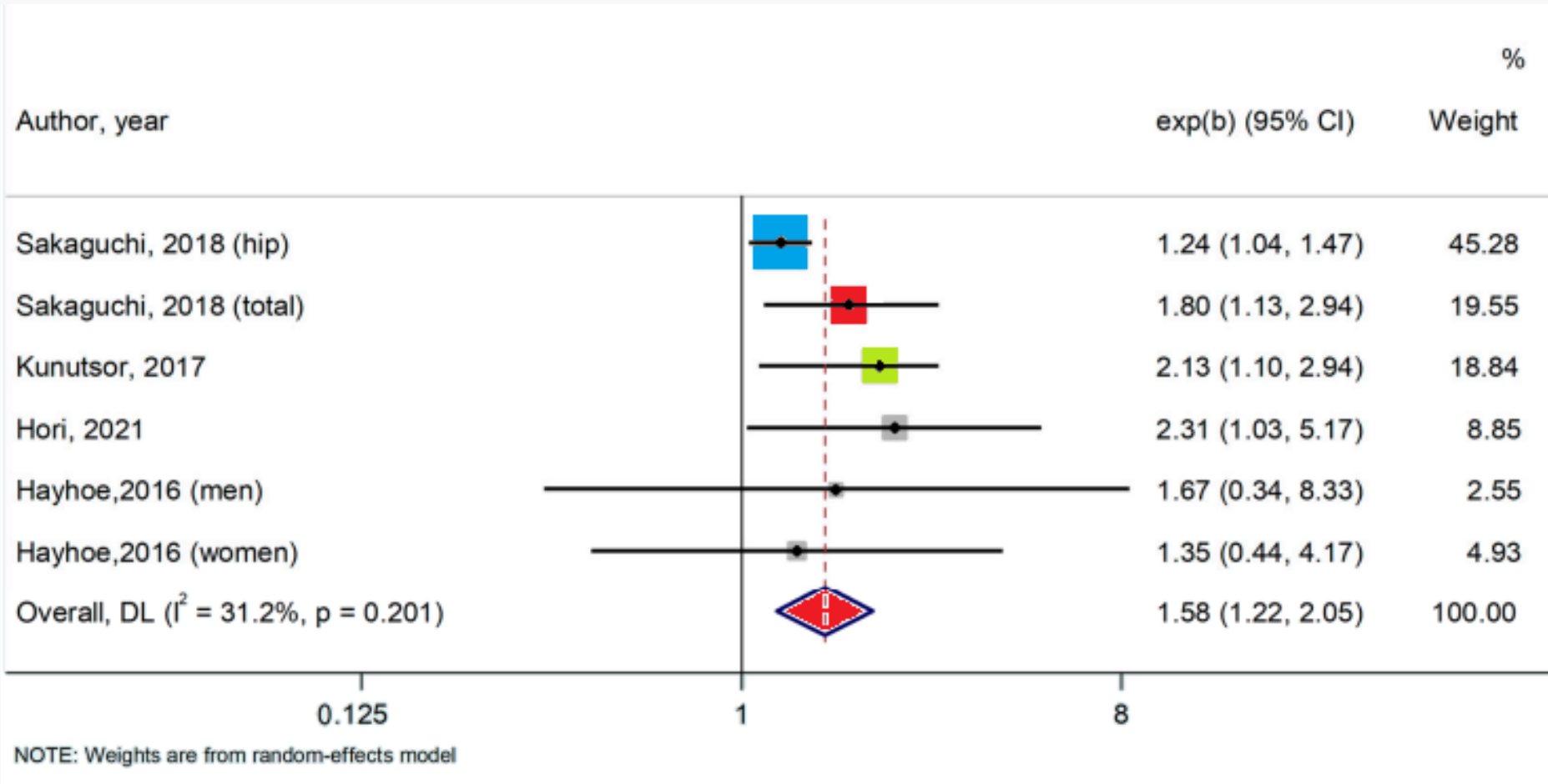
Caseins: a Ca and P carrier function: a matrix within a matrix



Casein micelle
Ca phosphate supersaturated
i.e. greatly > solubility

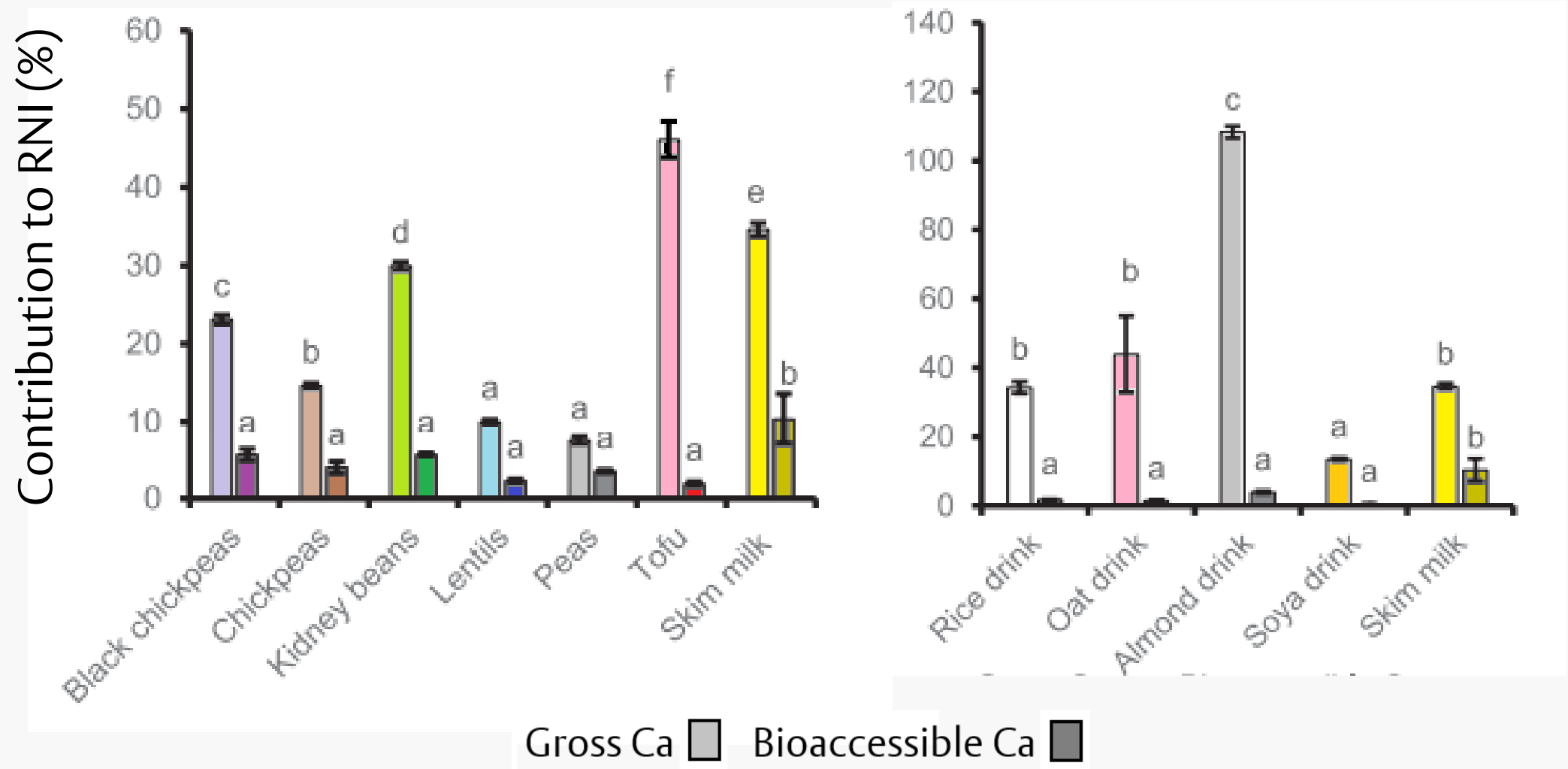
Association between low serum Mg and incident fractures

Dominguez et al., 2023
Nutrients 15, 1304



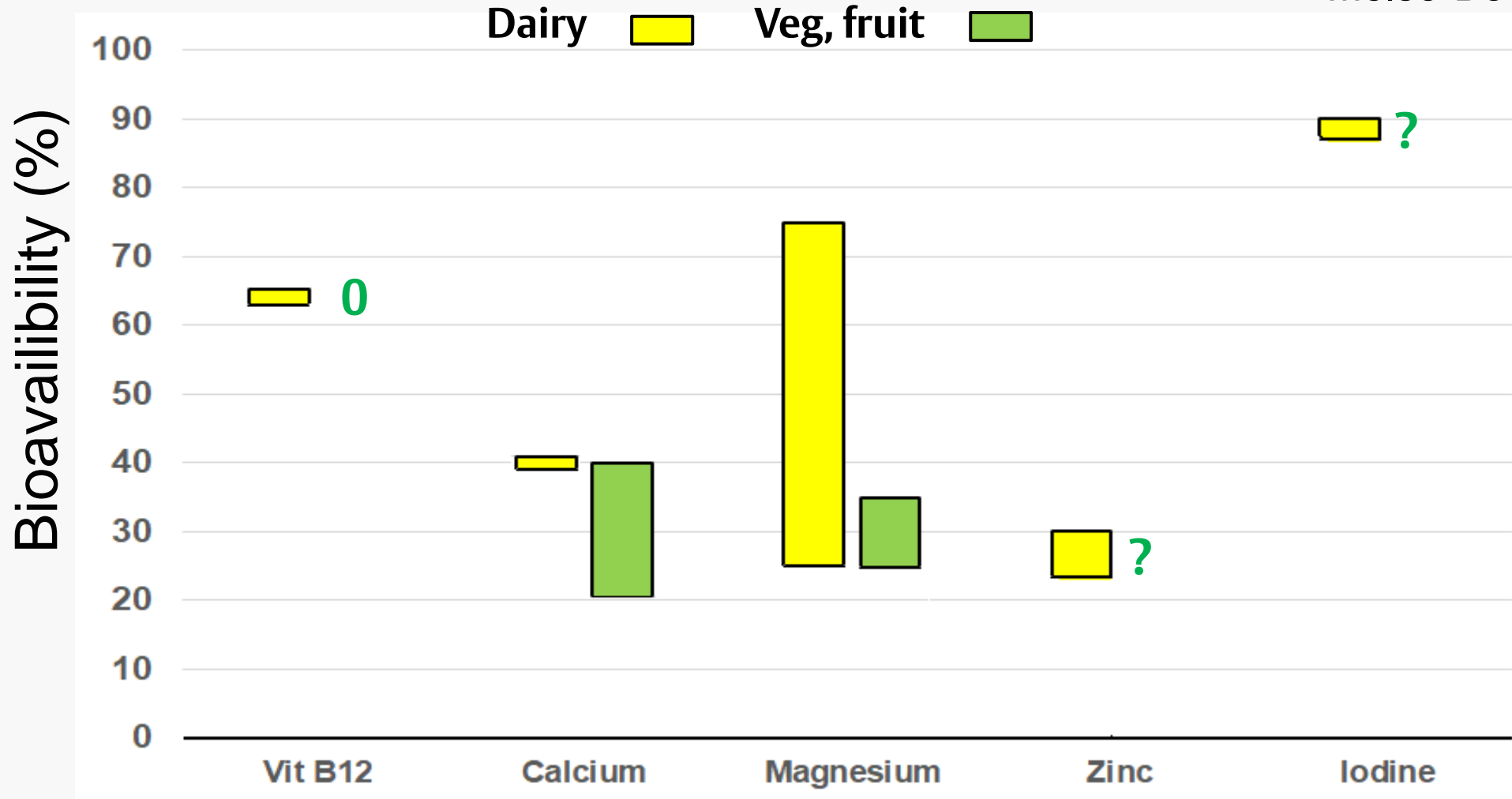
Gross Ca supply and bioaccessible Ca per serving from plant foods vs milk

Muleya et al., 2024



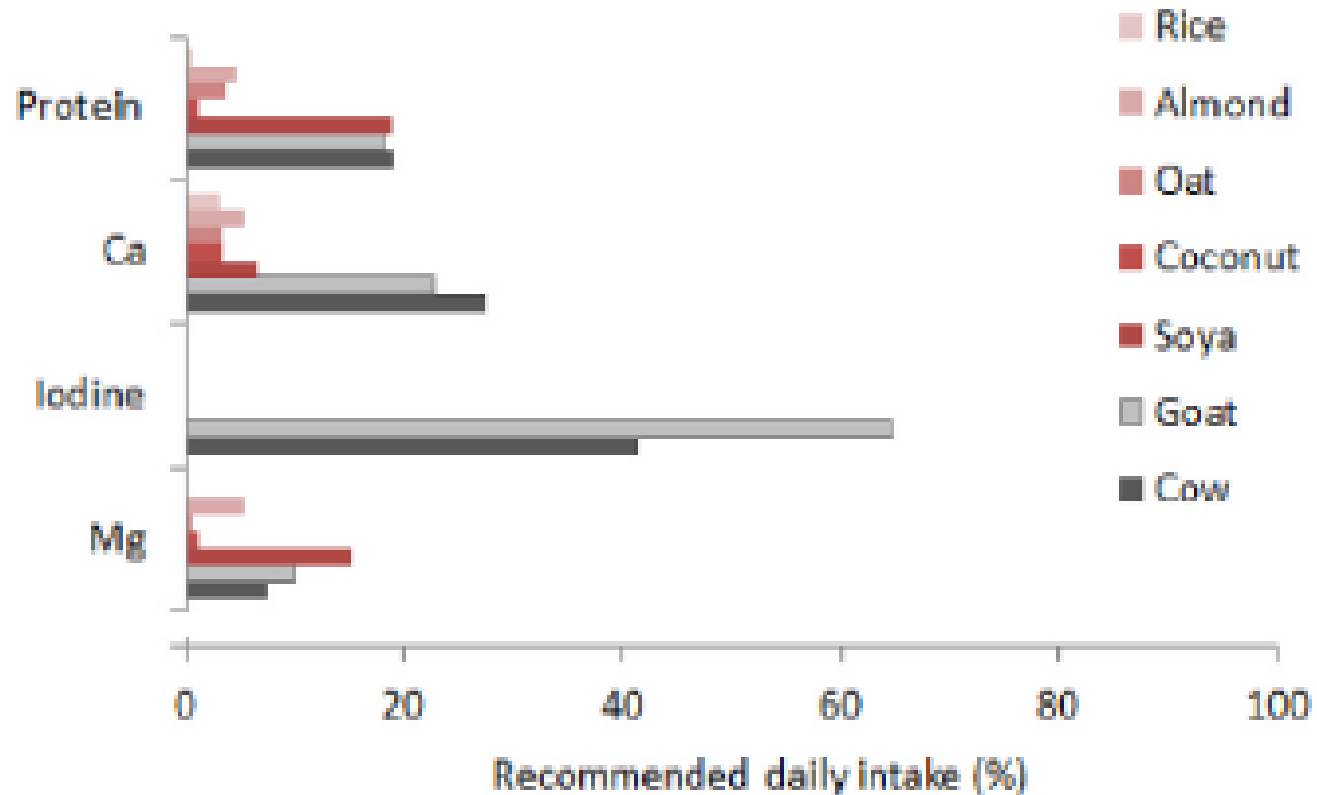
Bioavailability of micronutrients from dairy vs. vegetables/fruit

Melse-Boonstra, 2020



Selection of nutrients provided by 250ml of plant-based drink or milk for adult females

Sterup Moore et al., 2024



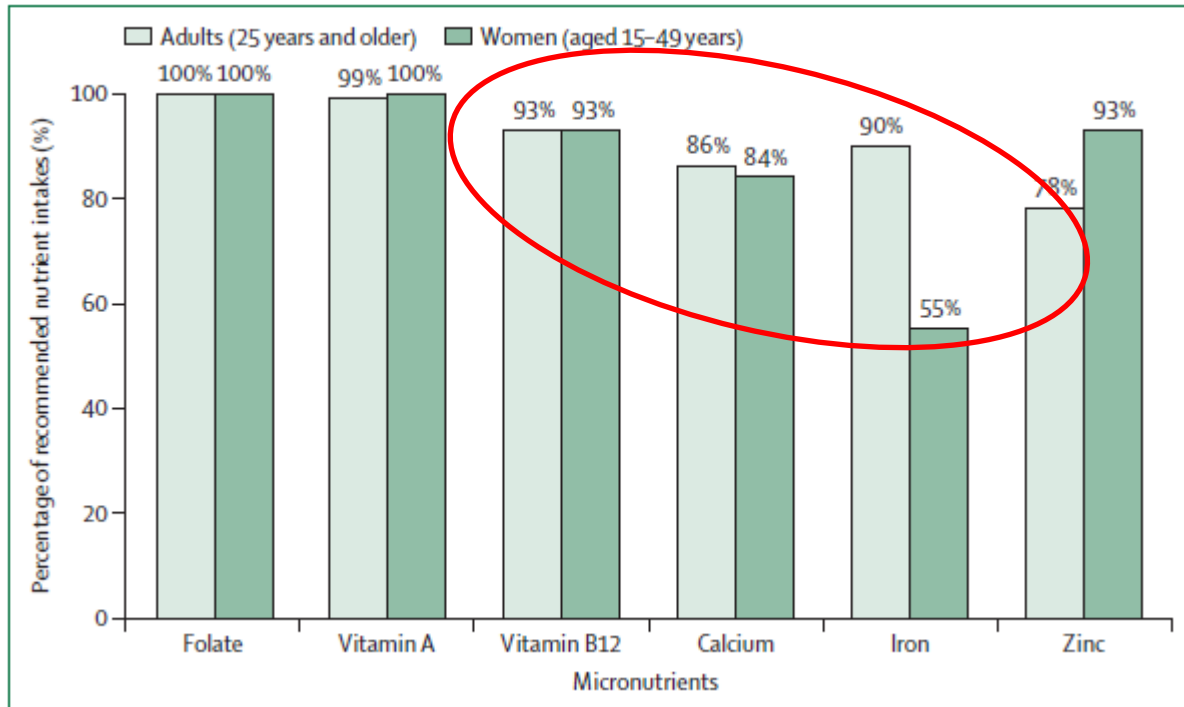
EAT-Lancet diet

Emphasised foods *
 Optional foods *
 Limited intake *

Estimated micronutrient shortfalls of the EAT-Lancet planetary health diet

Ty Beal, Flaminia Ortenzi, Jessica Fanzo

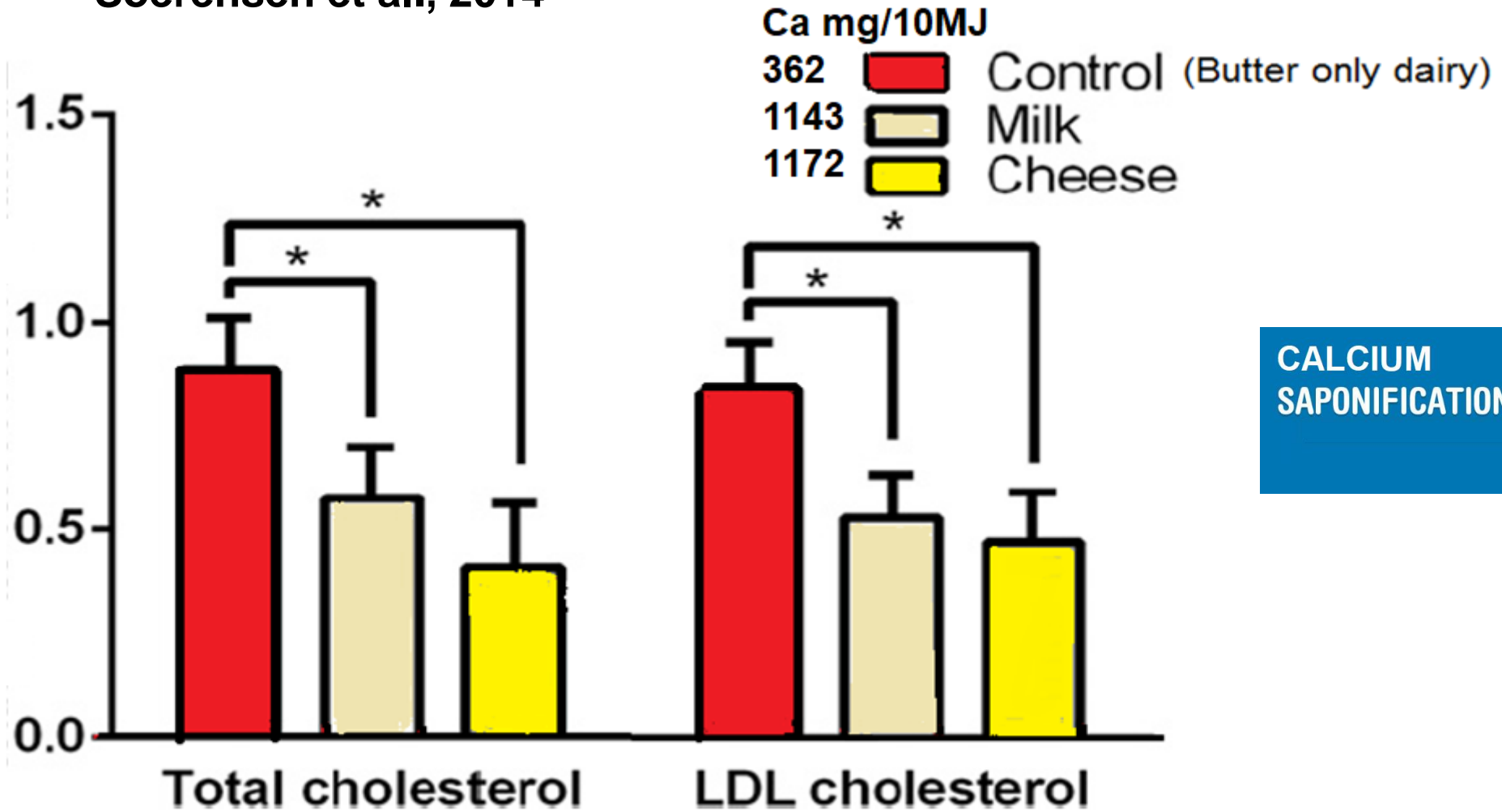
Lancet Planet Health 2023; 7: e233-37



		8.6 MJ/day (2053 kcal)	Macronutrient intake grams per day (possible range)
	Whole grains* Rice, wheat, corn and other		232
	Tubers or starchy vegetables* Potatoes and cassava		50 (0-100)
	Vegetables* All vegetables		300 (200-600)
	Fruits* All fruits		200 (100-300)
	Dairy foods* Whole milk or equivalents		250 (0-500)
	Protein sources Beef, lamb and pork* Chicken and other poultry* Eggs* Fish* Legumes* Nuts*		14 (0-28) 29 (0-58) 13 (0-25) 28 (0-100) 75 (0-100) 50 (0-75)
	Added fats Unsaturated oils Saturated oils		40 (20-80) 11.8 (0-11.8)
	Added sugars* All sugars		31 (0-31)

Role of calcium in the dairy matrix on blood lipid response to dietary fat (~46 SFA g/d)

Soerensen et al., 2014

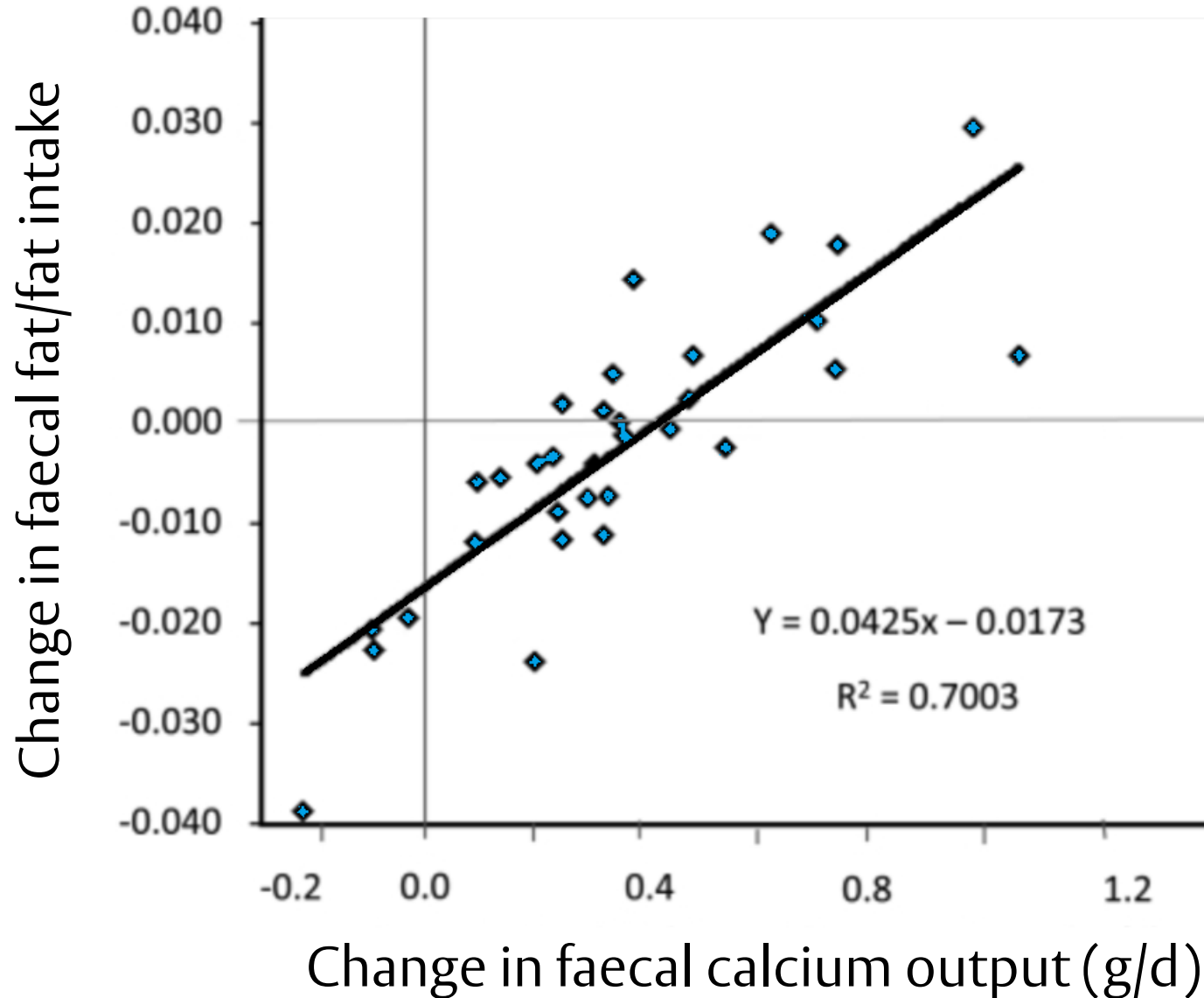


**CALCIUM
SAPONIFICATION ?**



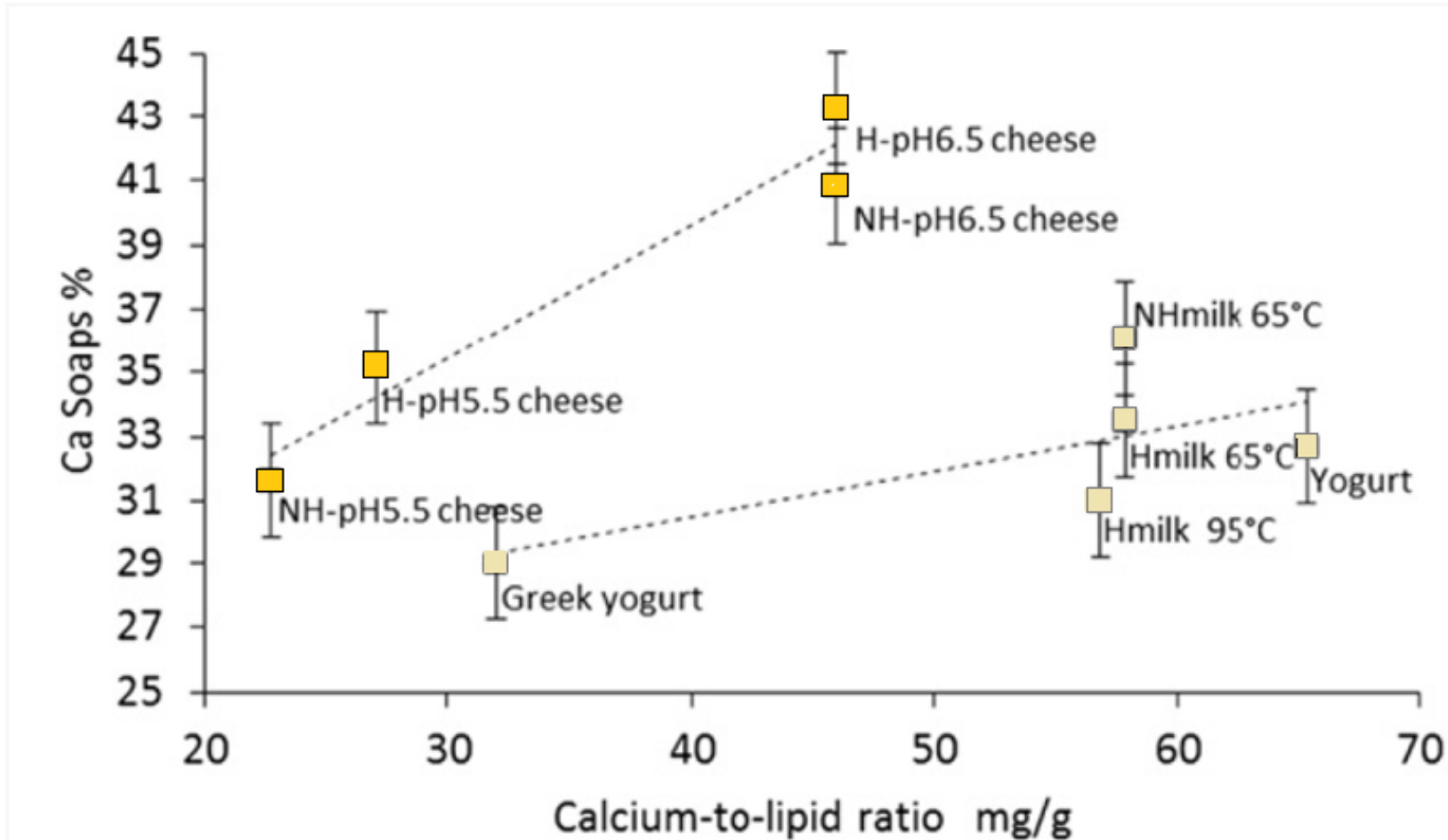
Changes in faecal fat excretion vs. calcium intake

Weaver et al., 2011



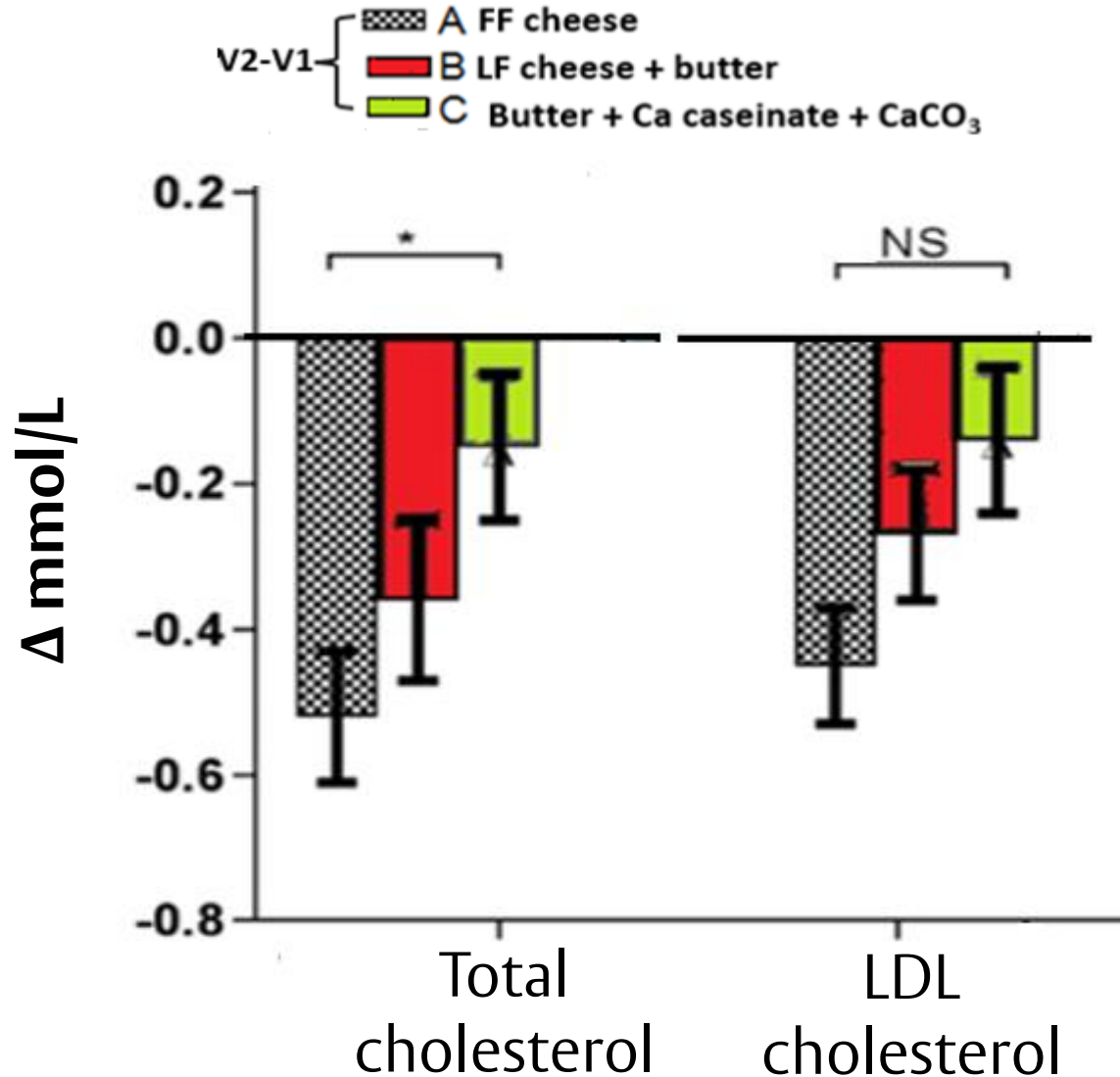
Effect of matrix type and Ca:lipid ratio on soap formation *in vitro*

Lamothe et al., 2017

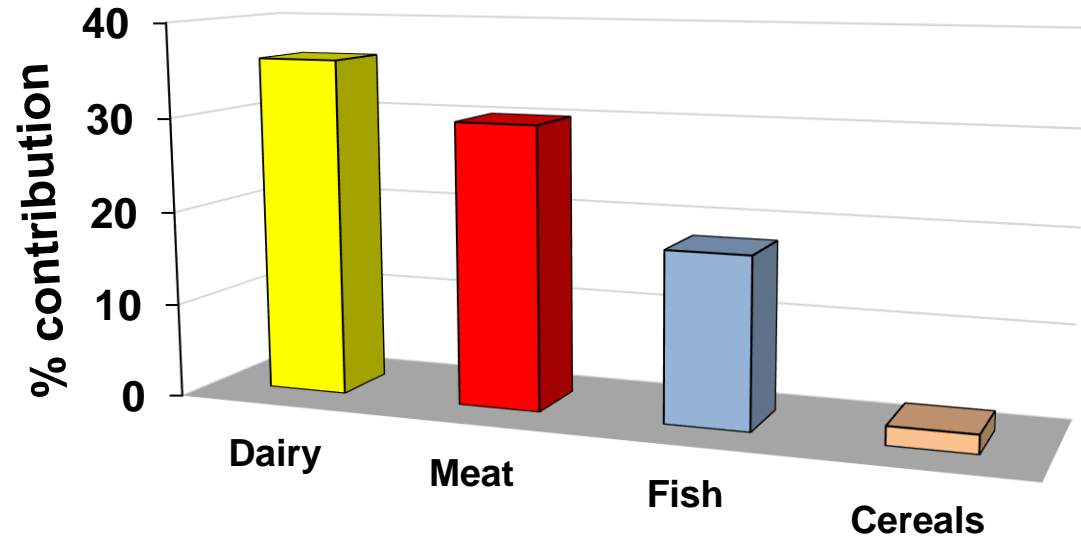


Response to dairy fat differs when in cheese matrix (~40g fat/d; 6w parallel)

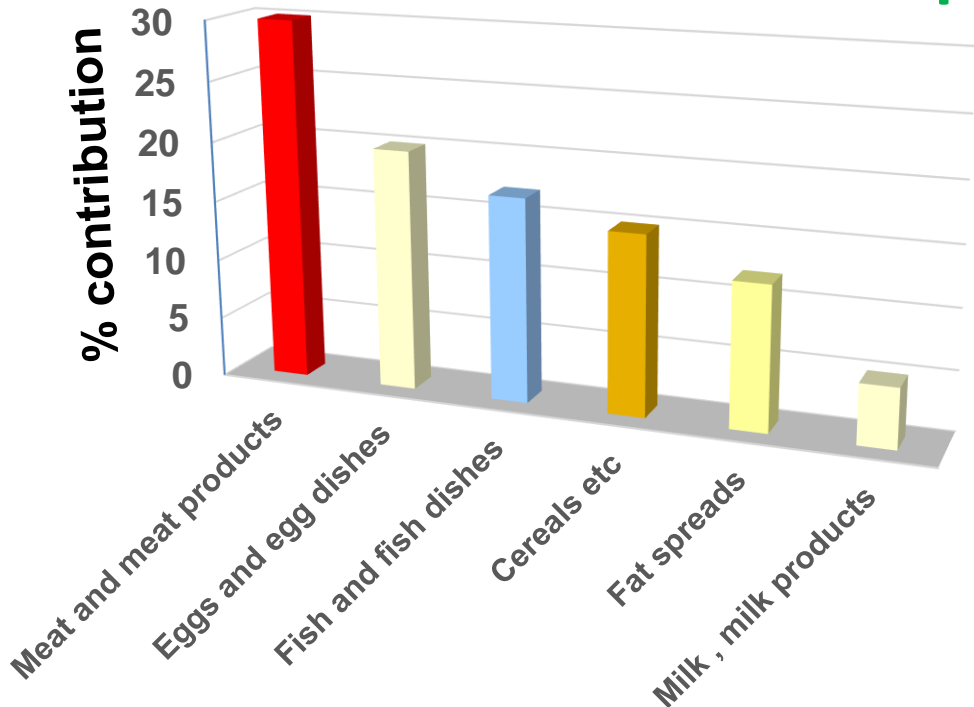
Feeney et al., 2018



	Daily intake of:		
	A	B	C
Energy (MJ)	2.0	2.2	2.0
Protein (g)	31.2	30.0	27.3
Fat (g)	40.8	43.2	39.2
Ca (mg)	828	900	817



Micronutrients that plants cannot supply!



Dietary supply very low



A few final thoughts

- Replacing dairy protein with plant protein **is not simple**.
- It may lead to **reduced protein quality** and **lower intake of micronutrients**, which will have **poorer bioaccessibility/ bioavailability**.
- Good evidence of increased health risk if more dairy-derived foods are excluded from diets of UK female adolescents and women OCBA and **especially a risk to bone health**.
- The dairy matrix is complex and has **beneficial roles in Ca/P/Mg intake and reducing fat digestion** mediated partly by Ca etc.

But.....

- Good evidence that **increased** plant-based foods are needed in UK diets **for fibre** at least....

Eating patterns for health and environmental sustainability



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Eating patterns for health and environmental sustainability

