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Challenge of healthy & sustainable diets – the role of dairy foods

Professor Julie Lovegrove

Hugh Sinclair Unit of Human Nutrition

University of Reading, UK

World population projections

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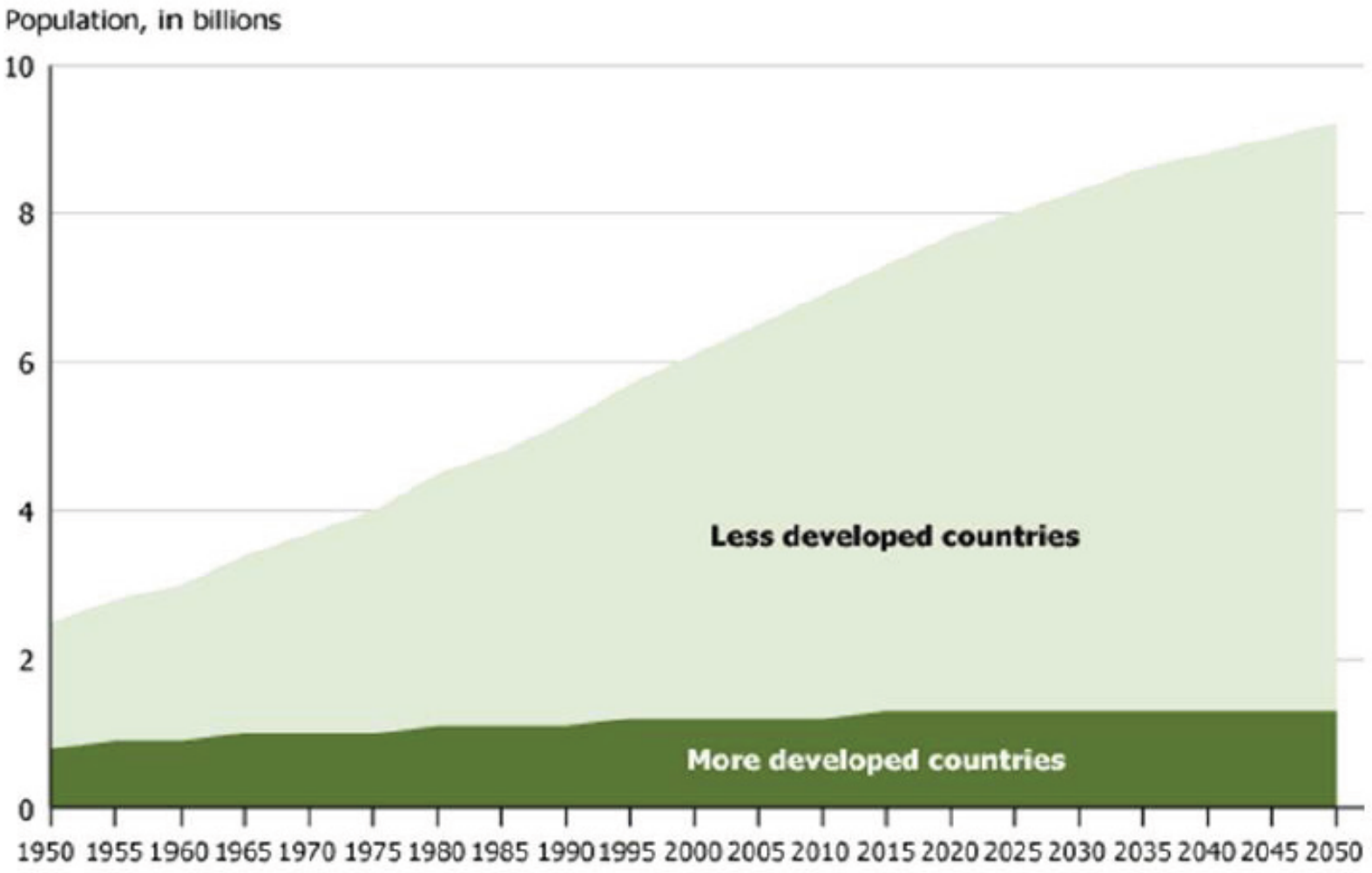

Source: United Nations Population Division, *World Population Prospects, The 2008 Revision*

Increasing & ageing population

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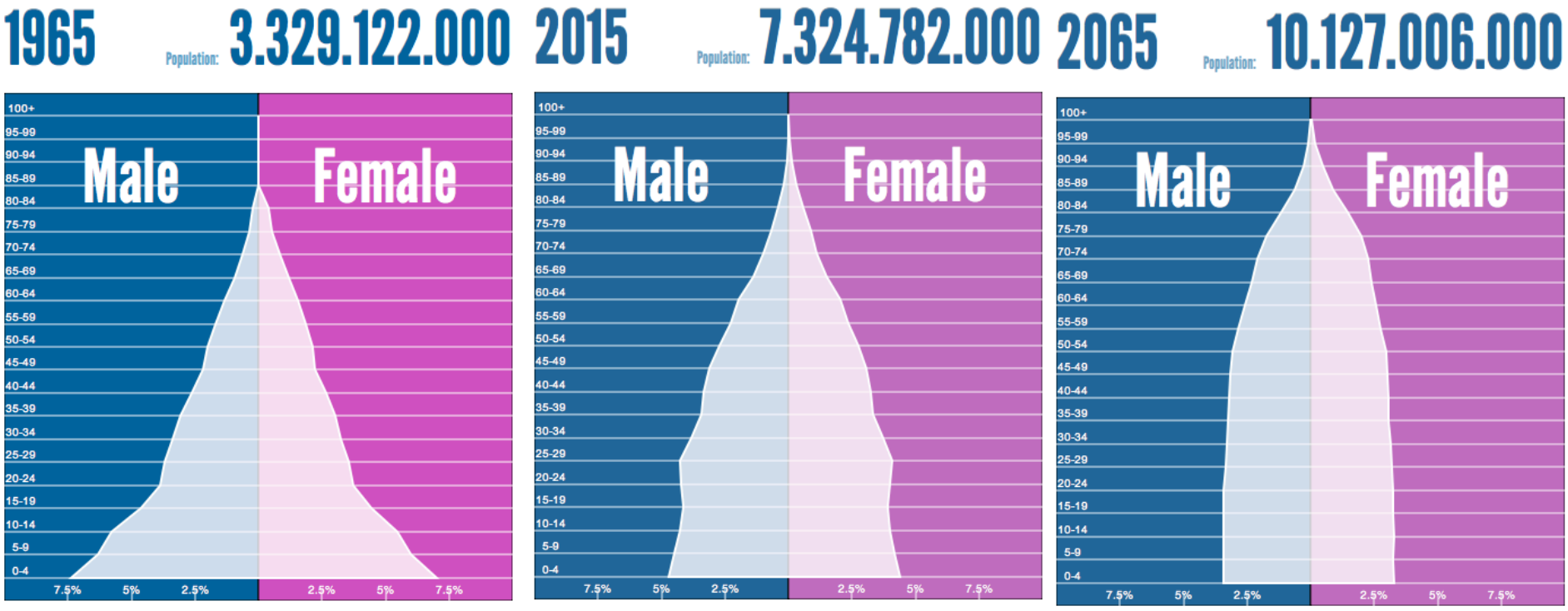

http://populationpyramid.net

Obesity trends 1978-2011

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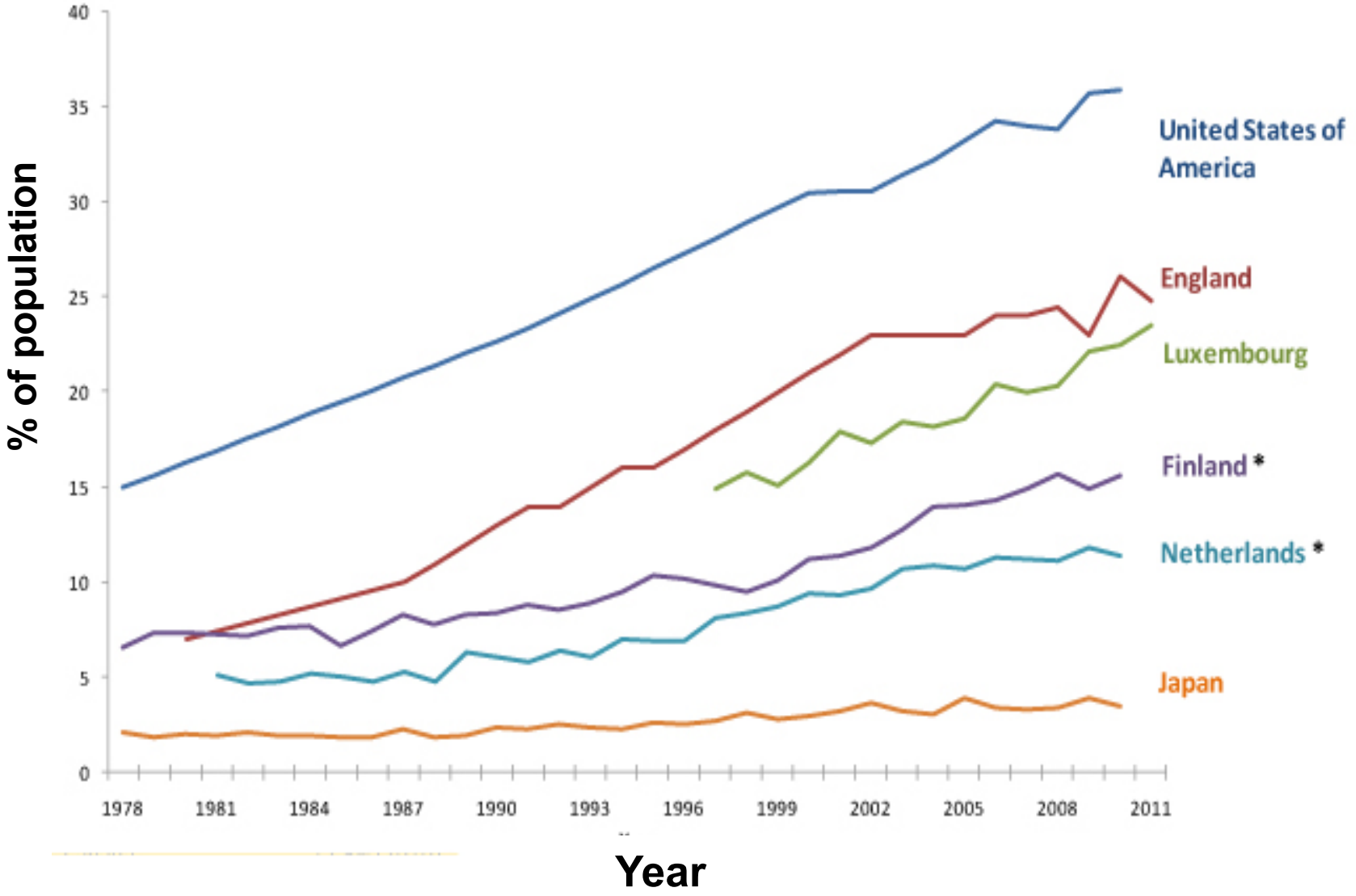

Source: OECD http://www.ecosante.org/index2.php?base=OCDE&langs=ENG&langh=ENG

Leading causes of death worldwide

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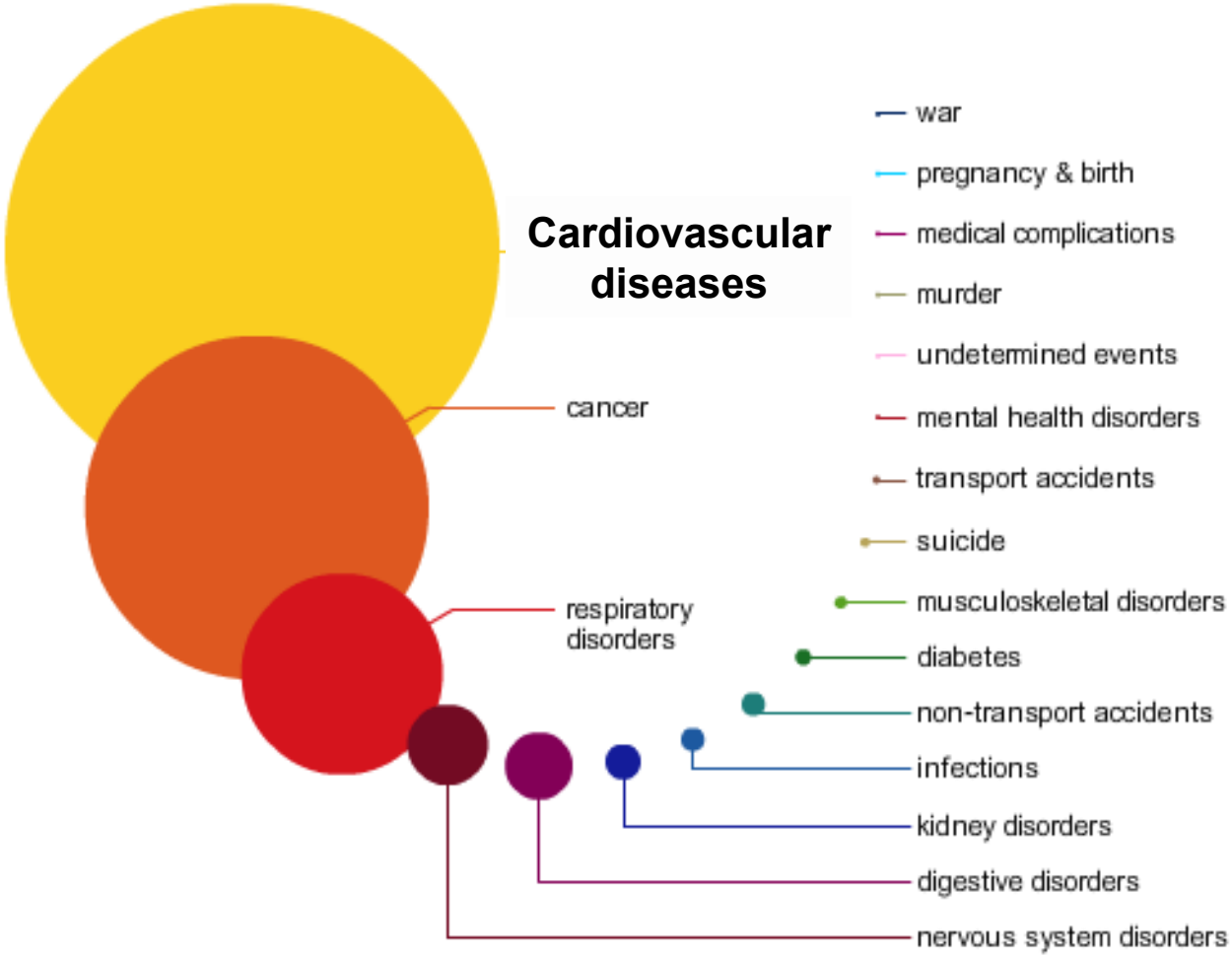

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Milk & chronic vascular disease

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15 March 2013

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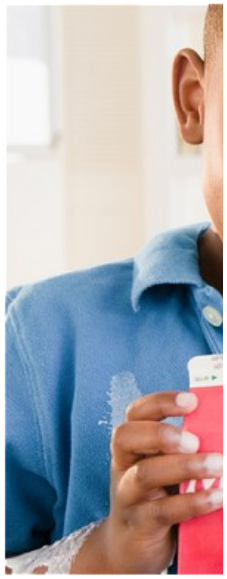
Skimmed mill

Giving toddlers skim
overweight or obese,



Full-fat milk may satisfy childre

theguardian

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Life & style | Food & d

Dairy monste

We used to take it for
the industry faces a
assumptions. So ju
investigates

Anne Karpf
The Guardian, Satu

Does God's c
it managed t
evidence to
essential:
nature in
plummeted, milk's
believe that their health wi
milk is virtually the national emblem
also-ran).

Yet something is bubbling up in the milk pan. The animal welfa
for so long preoccupied with chicken and beef farming, have begun t

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From The Times
January 20, 2007

It's udder confusion

Is the white stuff good for us or should it carry a health warning? Our correspondent blows away some of the froth

Vivienne Parry

To write about milk is to take your life in your hands. There is probably no food that inspires more vehement accusations and counter-accusations than the white stuff. Some are bound to be aired again in the coming days during Food Allergy and Intolerance Week, as stories of bad reactions to milk are used to promote the oat, soya and rice alternatives available.

In the blue corner we have cow's milk as a cause of hosts of allergies, heart disease and breast cancer, not to mention excess phlegm. In the red corner we have milk as intrinsic to bone health, and protective against cancer, diabetes and heart disease. Meanwhile, on the sidelines, there are those advocating organic milk as nutritionally superior.

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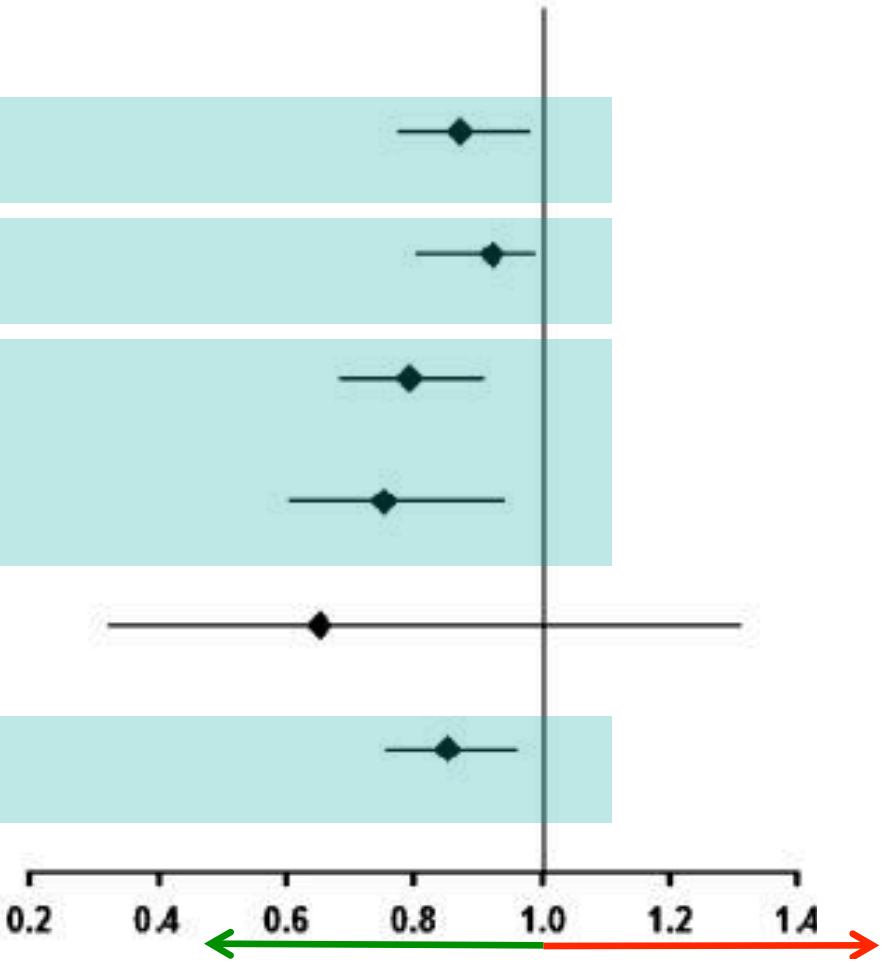
Milk and Chronic Disease

University of Reading

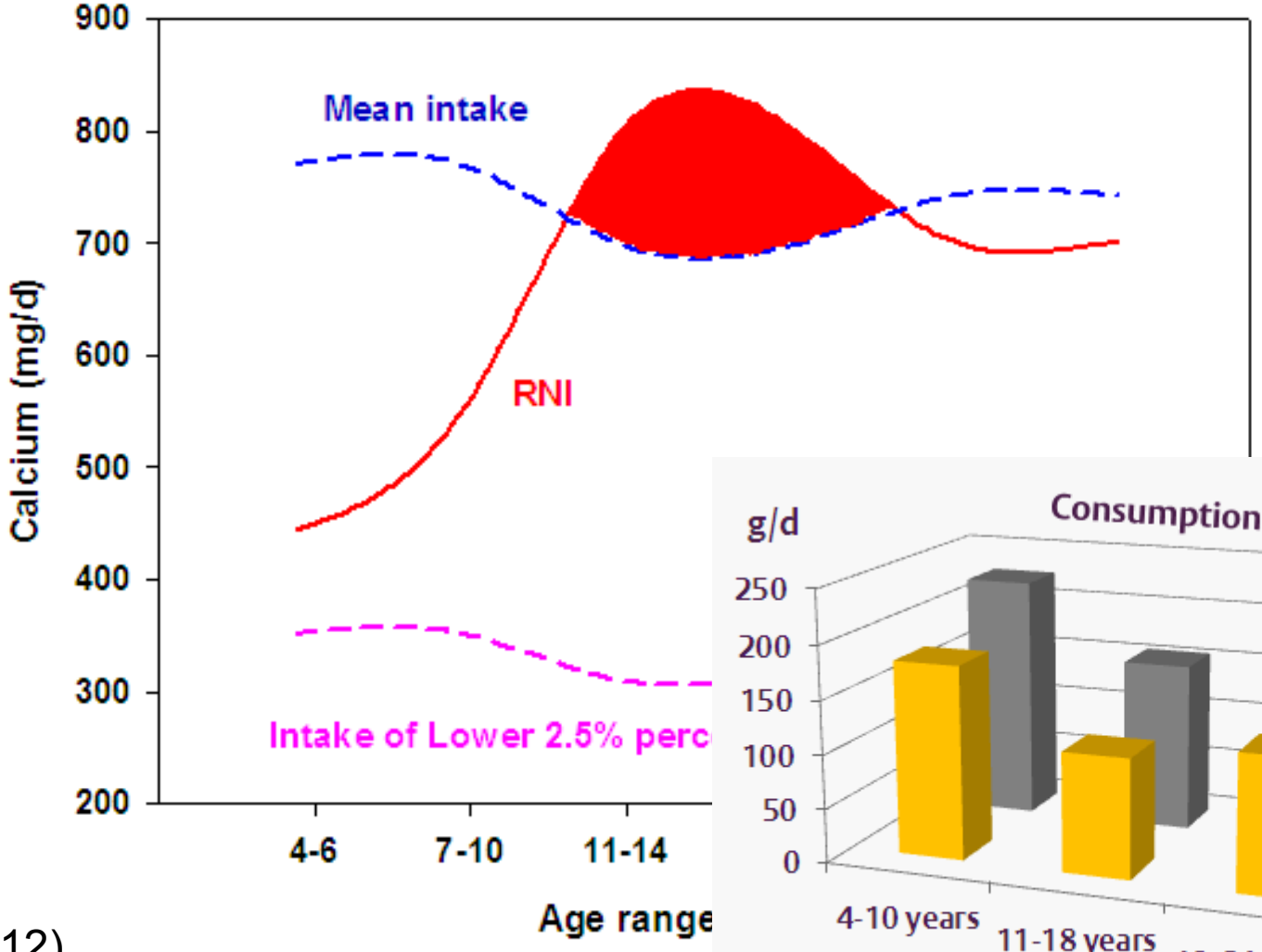
Meta-analysis of prospective studies

Disease	Number of deaths England and Wales 2008	Relative risk (95% CI)
All causes	505,090	0.87 (0.77 - 0.98)
Ischaemic heart disease	76,985	0.92 (0.80 - 0.99)
Thromboembolic stroke	46,446	0.79 (0.68 - 0.91)
Haemorrhagic stroke	7,497	0.75 (0.60 - 0.94)
Sub-arachnoid stroke	8,000[1]	0.65 (0.32 - 1.31)
Type 2 diabetes	5,541	0.85 (0.75 - 0.96)



Elwood et al. Lipids. 2010;45;925-939.

Calcium intake in females vs RNI in UK



NDNS(2012)

Recent studies of UK iodine status

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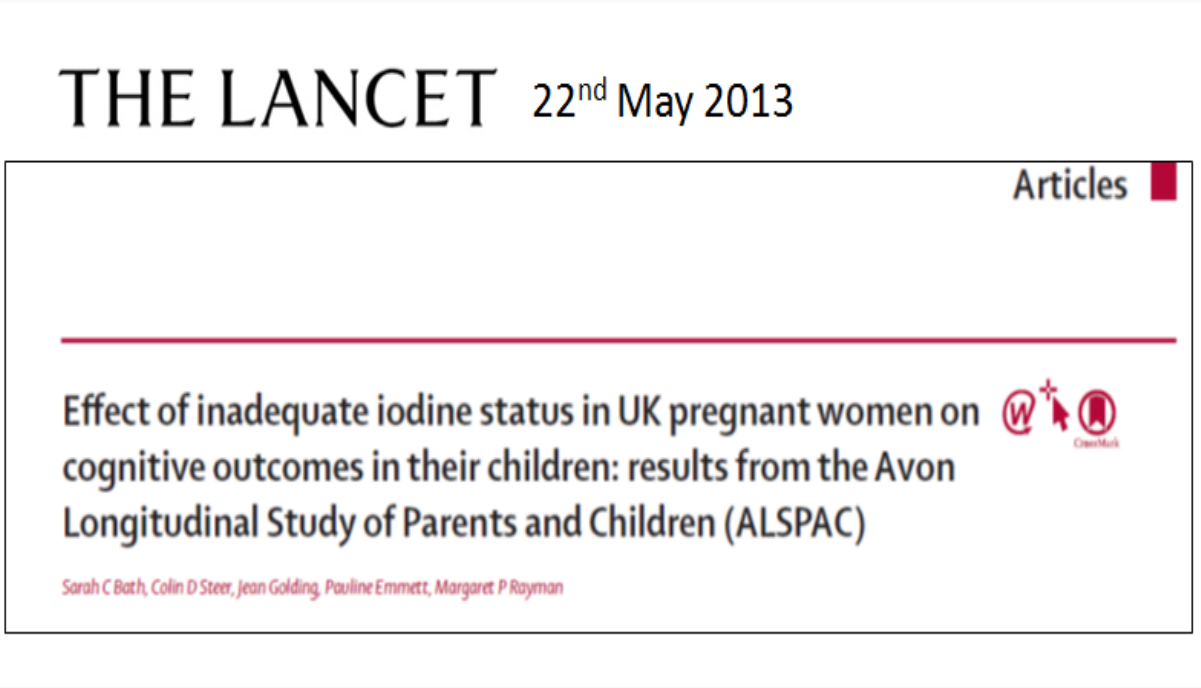
Recent UK studies have shown sub-optimal status in:

- Women of childbearing age[1-3]
- Pregnant women[4-7]


THE LANCET 22nd May 2013

Articles

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 D Steer, Jean Golding, Pauline Emmett, Margaret P Rayman

1. Bath et al. 2008; 2. Rayman et al. 2008; 3. Lampropoulou et al 2012 4.Kibirige et al. 2004; 5.Barnett et al. 2002; 6. Bath et al. 2010; 7. Pearce et al 2010

Nutrient composition of milk

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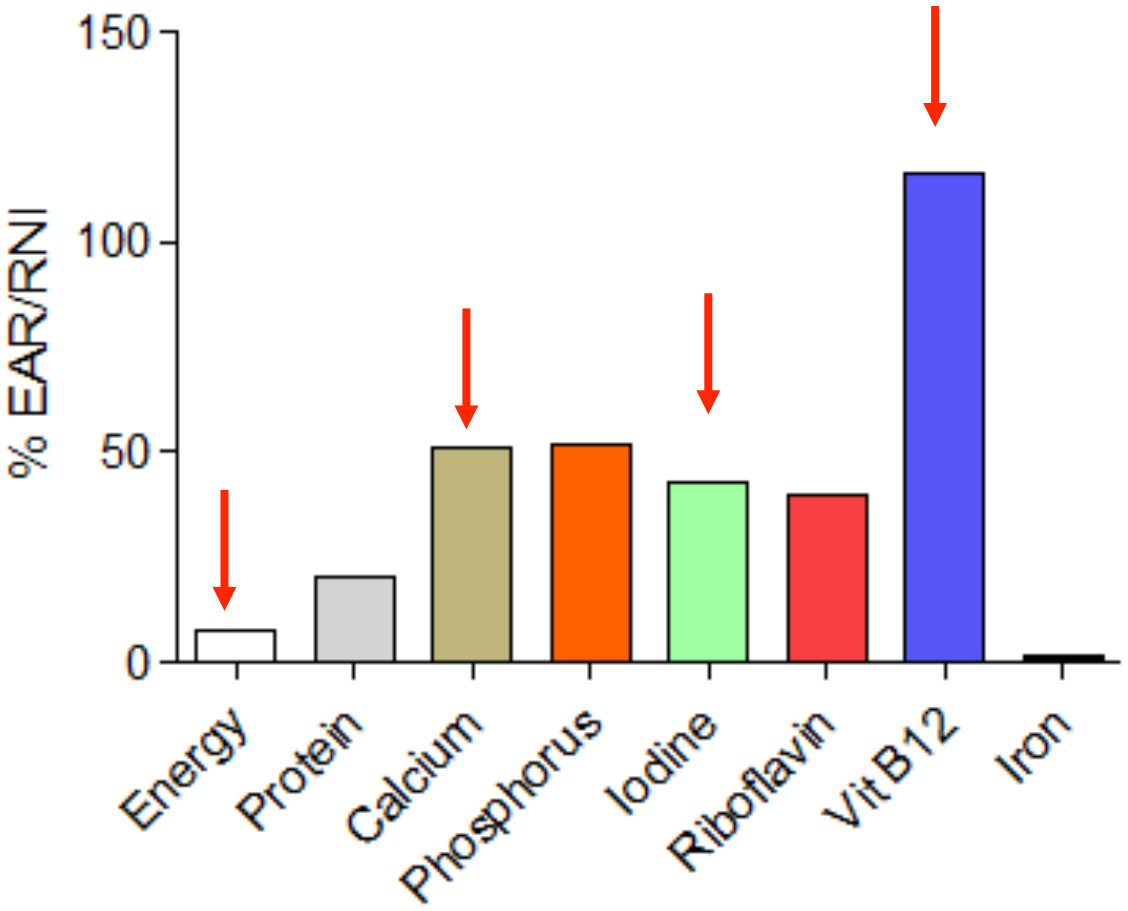
Contribution of dairy to nutrient intakes in UK adults



Data from: National Diet and Nutrition Survey (2014)

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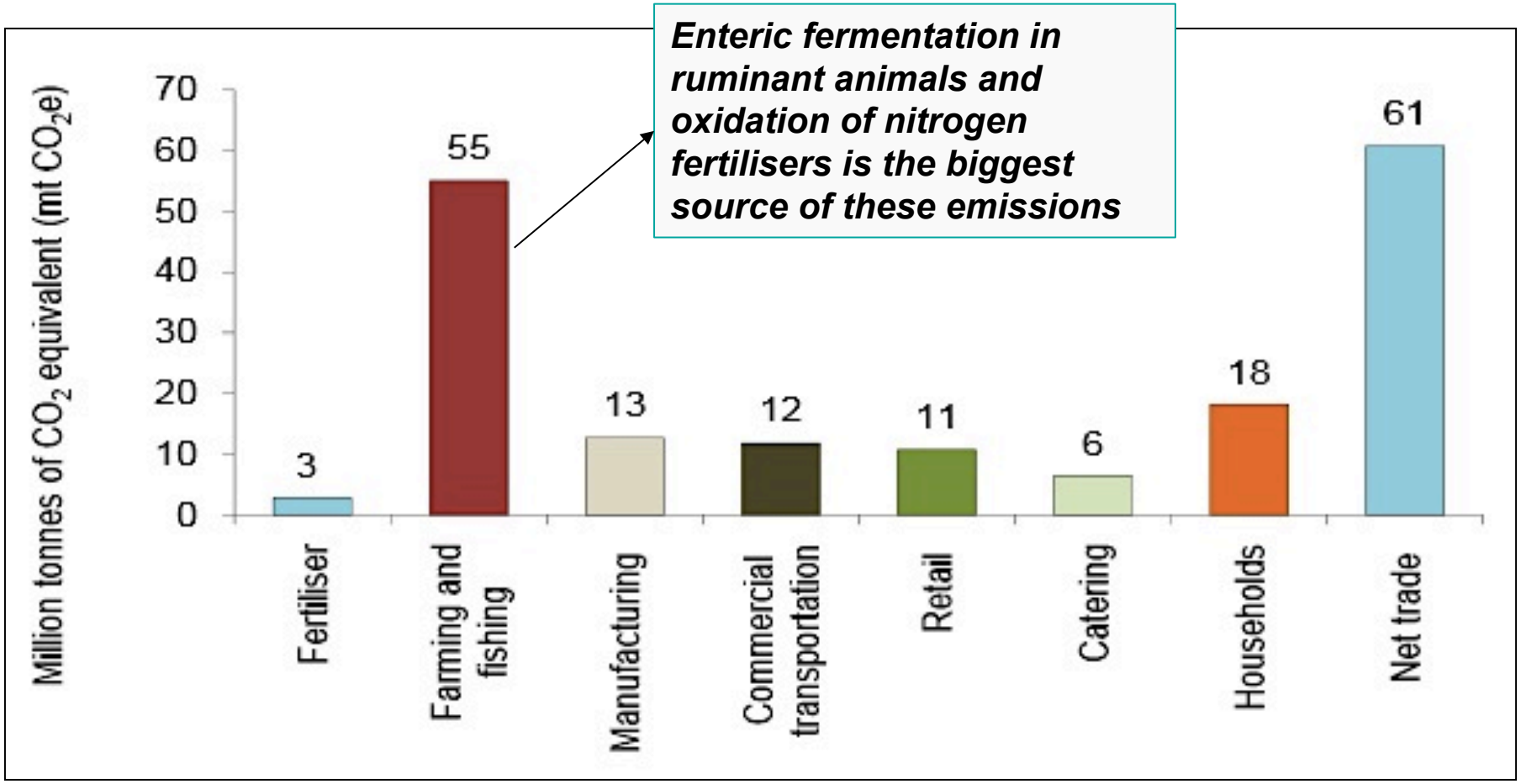
Environmental & Financial costs of milk & dairy consumption

GHGE from UK agri-food sector (2011)



From: Environmental accounts (ONS), Food Transport Indicators (Defra), Energy Consumption in the UK (DECC), British Survey of Fertiliser Practice (Defra), Consumption Emissions (Defra)

How to stop cows burping is the new field work on climate change

Lewis Smith Environment Reporter

They have become the fashionable target for environmentalists, but four-wheel-drive vehicles may be less damaging to the environment than the cows and sheep essential to the rural economy.

The methane emissions from both ends of cattle and sheep are causing so much concern in government that it has ordered researchers to find ways to cut down on the emissions from livestock, which account for about a quarter of the methane — a greenhouse gas 20 times more powerful at driving global warming than carbon dioxide — pumped into the atmosphere in Britain. Each day every one of Britain's 10 million cows pumps out an estimated 100-200 litres of methane.

This is the equivalent of up to 4,000 grams of carbon dioxide and compares with the 3,419g of carbon dioxide pumped out by a Land Rover Freelander on an average day's drive of 33 miles.

With the United Nations Food and Agriculture Organisation predicting that methane emissions from livestock could increase by as 60 per cent by 2030, the issue is being treated with some urgency.

Scientists attempting to find new foods for cattle have already exploded the myth that most bovine emissions come from the rear. They have found the majority come from belching.

Attempts to find a diet for cattle that will result in less flatulence are being made by researchers as part of a government-backed project.

A study in New Zealand suggested that the methane output could be reduced by up to 50 per cent and small-scale research in Britain has found that "significant quantities" could be prevented from getting into the atmosphere. A Department for Enivonment, Food and Rural Affairs spokesman said: "Recent research suggests that substantial methane reductions could be achieved by changes to feed regimes in farm animals.

"Improving the longevity of dairy cows may also result in decreased methane production as a result of a reduction in the total number of animals needed to produce the same quantity of milk."

He added that in the longer term the department was also looking at the feasibility of reducing methane from livestock by genetically engineering the digestive system.

Sheep are now being sealed in polytunnels in field experiments to find out if the results of laboratory tests can be matched outdoors. They were chosen in place of cows because they are ruminant but more manageable for research. Mass spectrometers analyse the air in the polytunnels before the sheep eat and the fug afterwards when they have digested their food.

The key to reducing the methane from livestock is, researchers believe, to make the diet of the cattle and sheep more easily digestible.

Michael Abberton, of the Institute of Grassland and Environmental Research in Aberystwyth, said rye grass with a high sugar content, white clover and bird's-foot trefoil, a traditional meadow flower also known as "bacon and eggs", all show promise. "Contrary to popular myth the methane comes mainly from belching rather than from the other end," he said yesterday. "We know the diet of the animal does have an impact on the methane emissions. There are a range of approaches we can take.

"We are, for example, working on high-sugar rye grasses which are designed to increase the effectiveness of the processes in the animal's gut."

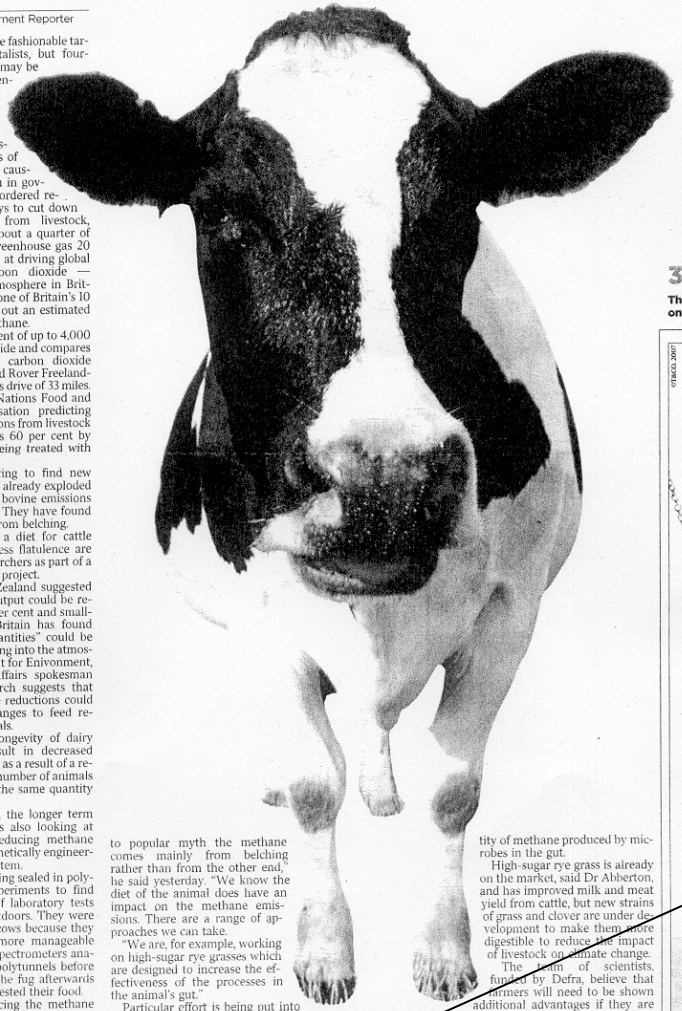
Particular effort is being put into investigating how bird's-foot trefoil can be made to grow more abundantly in pastureland as the tannin it contains is thought to be especially helpful in reducing emissions.

The mechanisms within a ruminant's stomach that produce methane are not fully understood, but the scientists believe that if they make the food more digestible it will reduce the quantity of methane produced by microbes in the gut.

High-sugar rye grass is already on the market, said Dr Abberton, and has improved milk and meat yield from cattle, but new strains of grass and clover are under development to make them more digestible to reduce the impact of livestock on climate change.

The team of scientists, funded by Defra, believe that farmers will need to be shown additional advantages if they are to be persuaded to go to the expense of introducing new strains.

The £750,000 project, led by the University of Wales, Aberystwyth, will run for three years and will also consider how emissions of nitrogen, another greenhouse gas, can be reduced in livestock. Agriculture accounts for 37 per cent of methane and 67 per cent of nitrous oxide emissions in Britain.



4,000g

The equivalent grams of carbon dioxide emitted by a cow producing an estimated 100-200 litres of methane a day

3,419g

The carbon dioxide pumped out by a Land Rover on an average day's drive of 33 miles

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3,419g

4,000g

The equivalent grams of carbon dioxide emitted by a cow producing an estimated 100-200 litres of methane a day

Dairy and environmental impact

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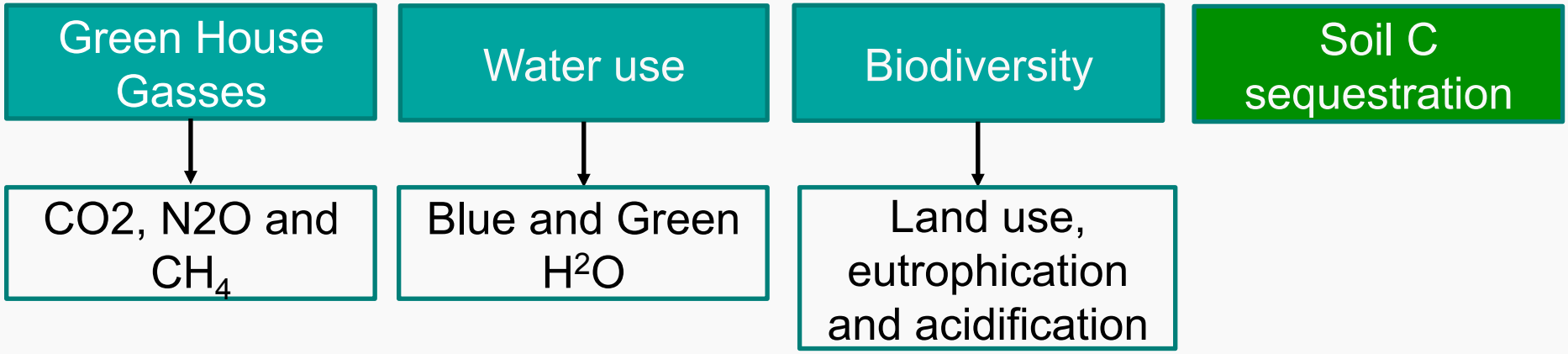
The production of dairy products globally has a number of environmental impacts:



Dairy and environmental impact

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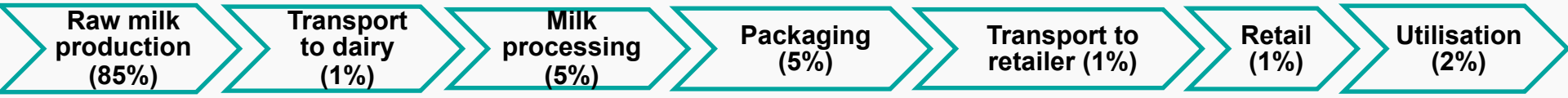
Milk has a relatively high environmental impact.



The current UK diet

- 5181 gCO_2e/day
- 12051 L water/day
- 6.1 m^2 land/day
- 68 gNe/day
- 41 SO_2e/day

Life cycle analysis – Food chain

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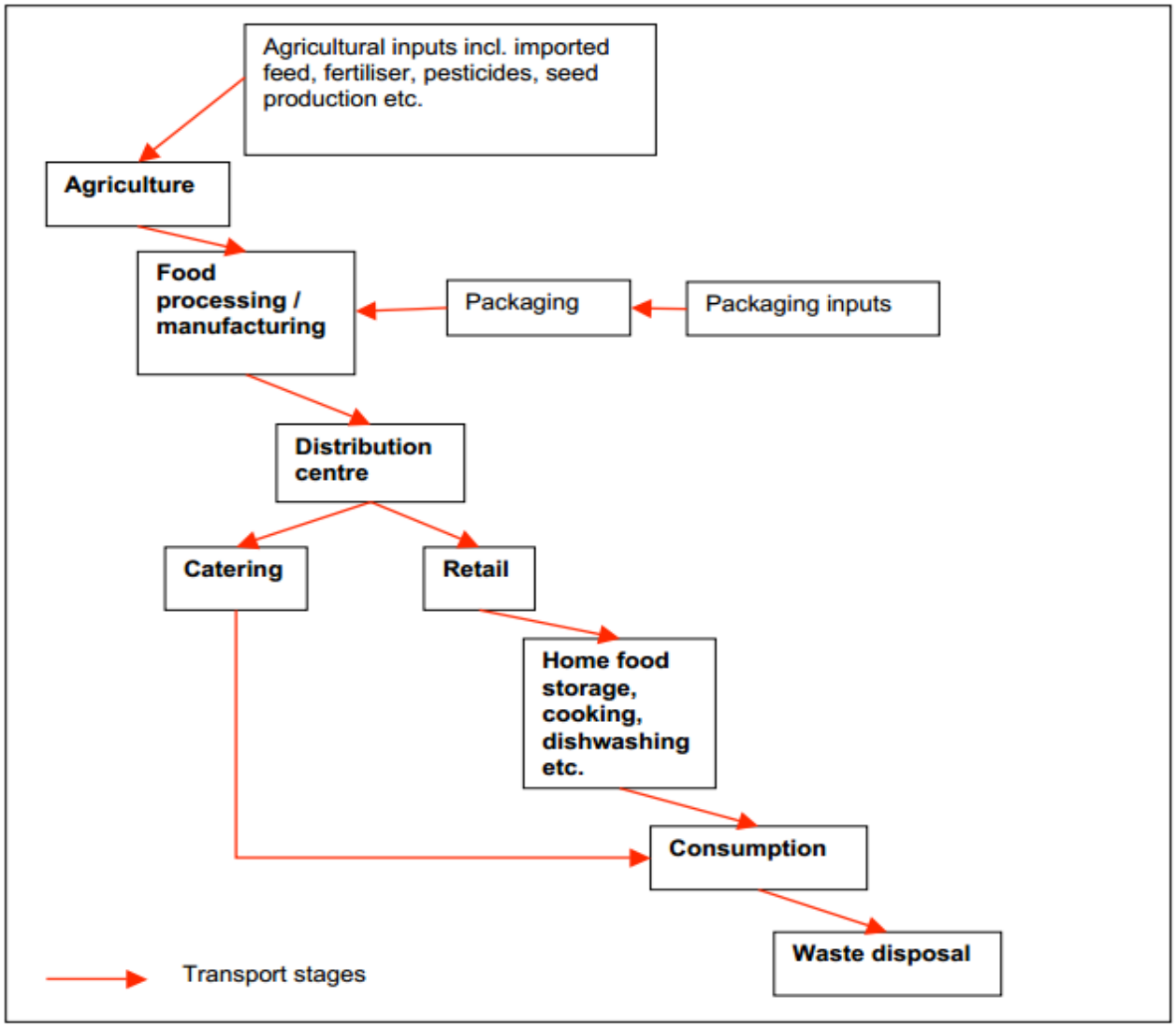

GHGE of food groups within UK

Low GHGEs (<1.0 kg CO_2e/kg edible weight)	Medium GHGEs (1.0–4.0 kg CO_2e/kg edible weight)	High GHGEs (>4.0 kg CO_2e/kg edible weight)
Potatoes	Chicken	Beef
Pasta, noodles	Milk, butter, yogurt	Lamb
Bread	Eggs	Pork
Oats	Rice	Turkey
Vegetables (eg, onions, peas, carrots, sweet corn, brassicas)	Breakfast cereal	Fish
Fruits (eg, apples, pears, citrus fruit, plums, grapes)	Spreads	Cheese
Beans, lentils	Nuts, seeds	
Confectionery, sugar	Biscuits, cakes, desserts	
Savory snacks	Fruits (eg, berries, banana, melons)	
	Salad vegetables	
	Vegetables (eg, mushrooms, green beans, cauliflower, broccoli, squash)	

[1] All GHGE values were adjusted to represent the edible weight as cooked and/or the edible portion of each product and adjusted to reflect the import: domestic production ratio of produce consumed in the United Kingdom. GHGEs were based on the preregion distribution center rather than a full life-cycle analysis. CO_2e, carbon dioxide equivalent; GHGEs, greenhouse gas emissions.

Macdiarmid et al AJCN 2012:96;632-639.

Dairy and UK GHG emissions

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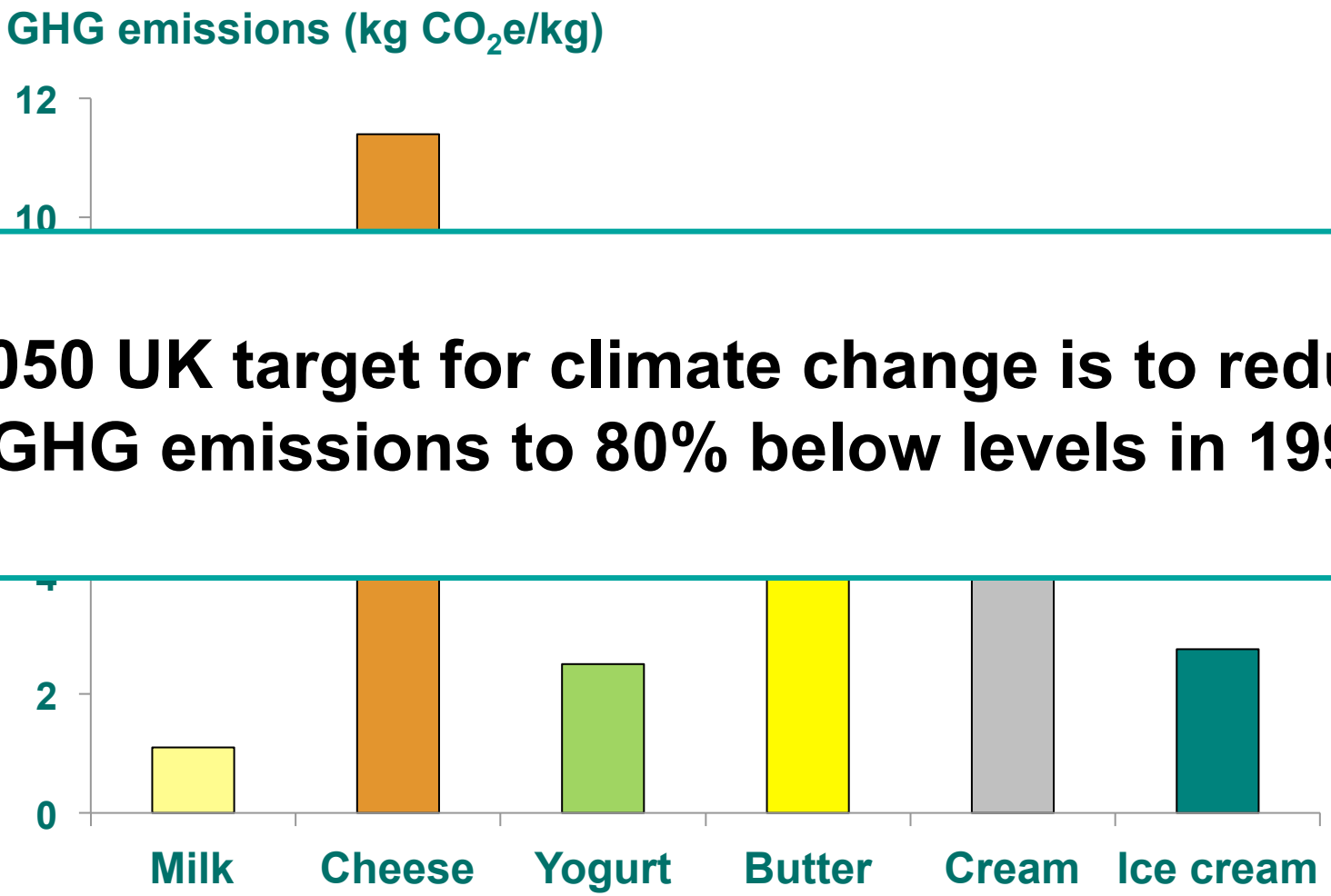

2050 UK target for climate change is to reduce GHG emissions to 80% below levels in 1990

Dietary patterns among UK adults associated with high and low dairy intakes

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Trends in UK dairy consumption

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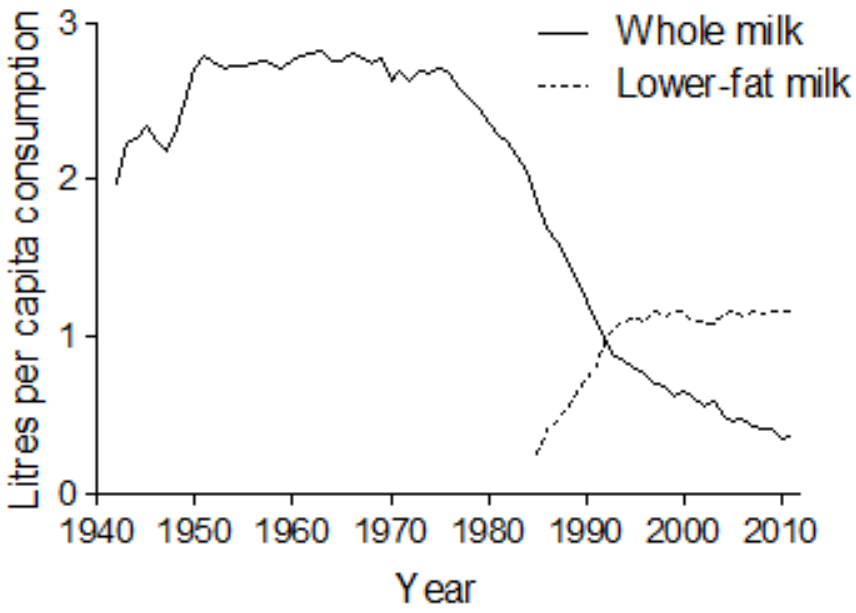
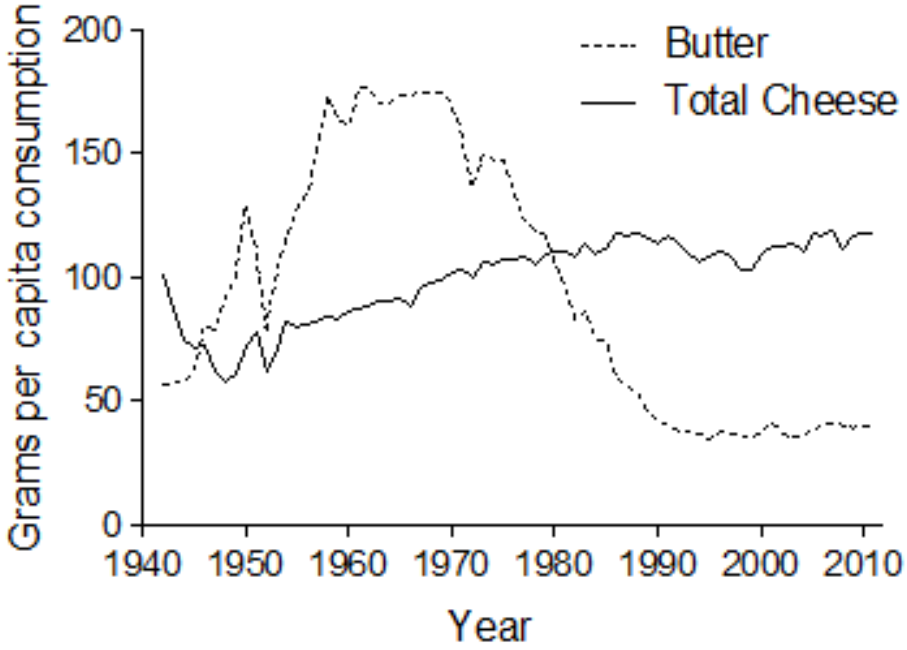
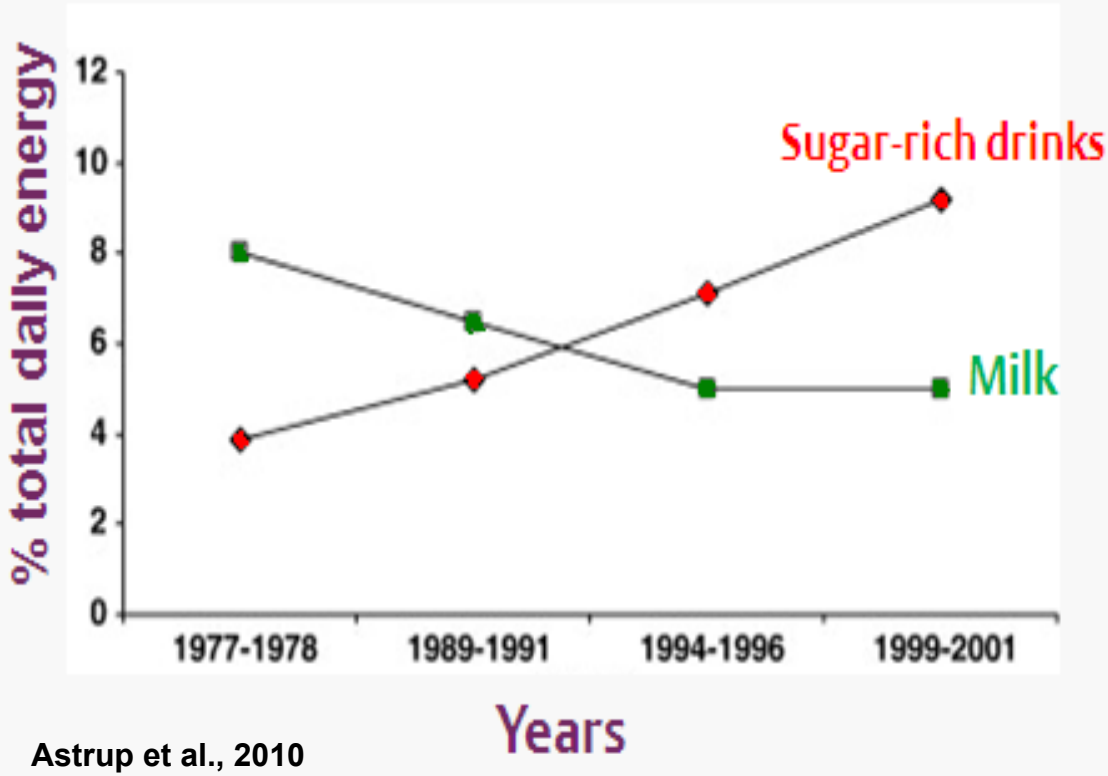




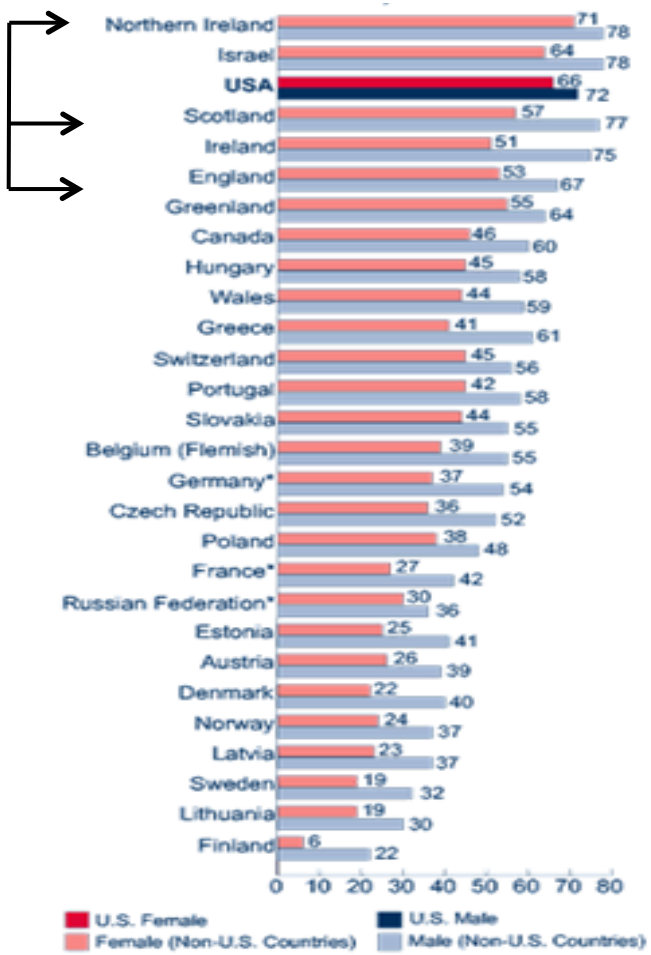
Data from: MAFF NFS, Defra FFS, DairyCo

Milk intake beaten by soft drinks



Astrup et al., 2010

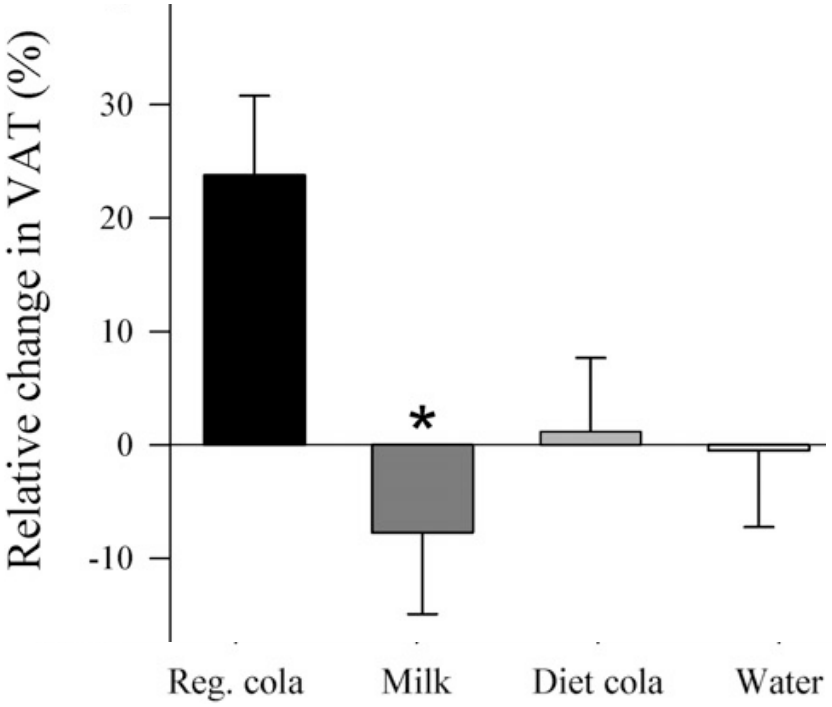
How often do you drink soft drinks?
% drinking daily, 15 year olds



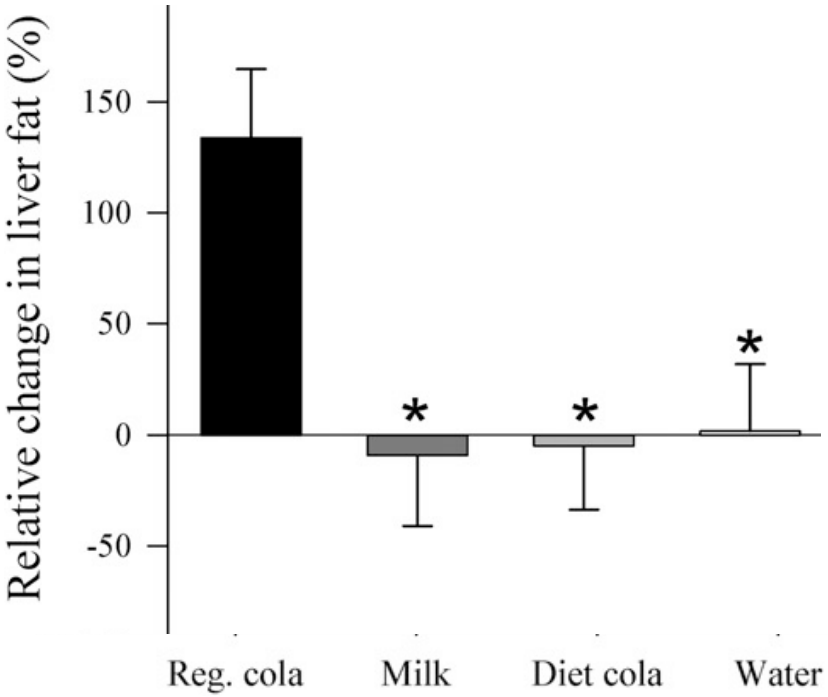
Sugars-sweetened beverages increase liver, muscle and visceral fat

University of Reading

Visceral adipose tissue



Liver fat



47 subjects drank 1 L of 1 of 4 test drinks daily for 6 months

Maersk et al., AJCN. 2011;95:283-9

Link between nutrition, financial and environmental costs

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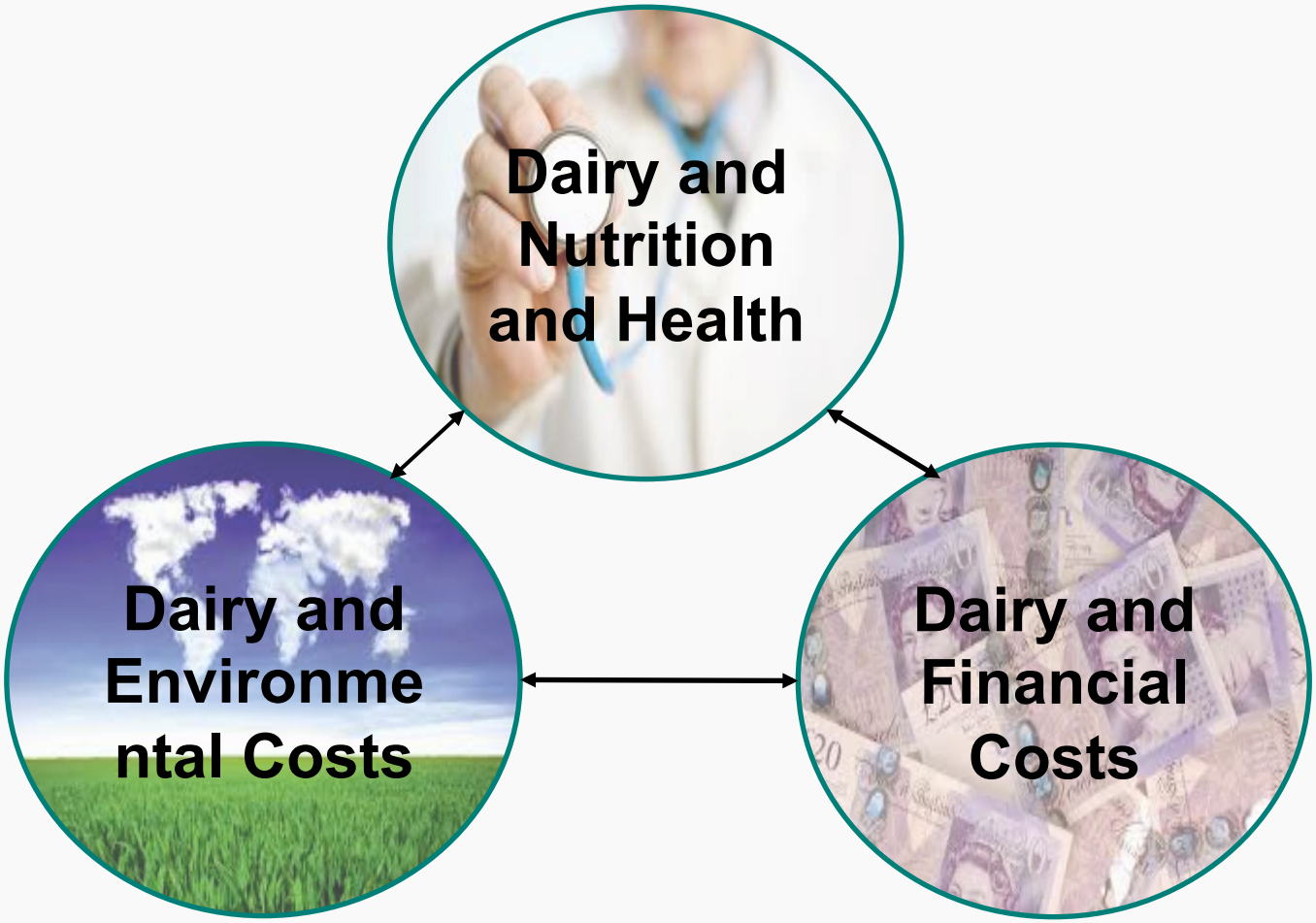

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Preliminary results

Financial and environmental costs of milk & dairy consumption

‘Healthy diet’ vs current diet

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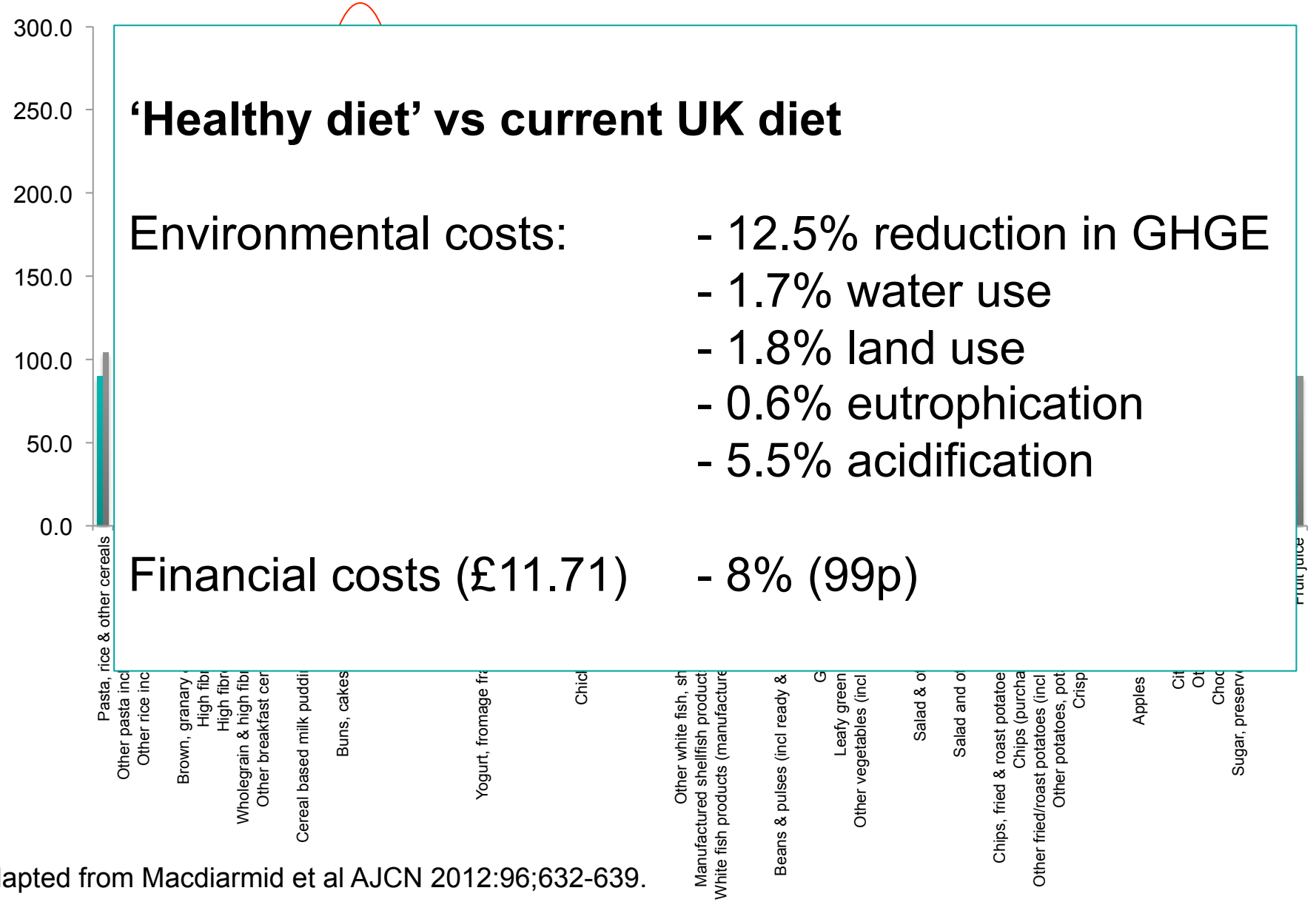

‘Healthy diet’ vs current UK diet

Environmental costs:

- 12.5% reduction in GHGE
- 1.7% water use
- 1.8% land use
- 0.6% eutrophication
- 5.5% acidification

Financial costs (£11.71)

- 8% (99p)

Adapted from Macdiarmid et al AJCN 2012:96;632-639.

New Nordic Diet

University of Reading

Product categories	ADD	NND
	$kg \cdot person^{-1} \cdot y^{-1}$ (% imported)	$kg \cdot person^{-1} \cdot y^{-1}$ (% imported)
Berries (g)	9.8 (64)	147.4 (0)
Butter (j)	1.9 (43)	0.0 (0)
Cabbage (f)	7.6 (47)	12.9 (0)
Candy, sweets, etc (k)	22.3 (59)	0.0 (0)
Cheese (b)	13.5 (27)	11.3 (0)
Coffee, tea, cocoa (i)	14.6 (99)	14.6 (99)
Convenience (k)	10.4 (61)	0.0 (0)
Dairy products (b)	129.4 (1)	130.7 (0)
Fish and seafood (c)	11.7 (54)	27.9 (0)
Fruit, excluding berries (g)	242.3 (65)	345.3 (0)
Herbs and spices (f)	2.2 (37)	5.5 (0)
Jam (k)	3.8 (5)	0.0 (0)
Juice (h)	45.5 (5)	45.5 (0)
Legumes (f)	3.6 (42)	15.2 (0)
Meat, total (a)	70.8 (39)	46.0 (0)
Chicken	29.4 (27)	21.3 (0)
Pork	11.1 (28)	4.0 (0)
Beef	28.7 (55)	8.8 (0)
Venison	0.3 (0)	4.2 (0)
Mushrooms, lettuce (f)	20.5 (47)	24.9 (0)
Nuts (f)	1.6 (94)	13.3 (0)
Oils, excluding rape seed oil (j)	9.6 (16)	0.0 (0)
Oils of rape seed (j)	0.1 (74)	8.3 (0)
Pasta, industrial (k)	10.2 (62)	0.0 (0)
Potatoes (f)	56.2 (16)	83.6 (0)
Roots, excluding potatoes (f)	19.0 (49)	89.2 (0)
Rice (f)	6.7 (100)	0.0 (0)
Soft drinks (k)	160.6 (7)	0.0 (0)
Sugar (k)	4.3 (9)	4.3 (0)
Vegetables, other (f)	79.8 (51)	91.3 (0)
Wheat, processed products (k)	38.8 (9)	0.0 (0)
Whole-grain products (e)	35.9 (9)	74.8 (0)
Wine, beer, alcohol (d)	128.2 (48)	107.2 (0)
Other ingredients (k)	1.8 (28)	1.9 (0)
Total mass (kg)	1170 (35)	1313 (1)

NDD gives:

-35% Global warming potential

-30% Socioeconomic costs

Saxe, AJCN. 2014;99;1117-25

Conclusions

- Increasing & ageing population with high chronic disease burden
- Milk and dairy provide key nutrients in the UK diet.
- Milk and diary relatively high costs, but lower per unit nutrient
- Milk and dairy products can be part of a nutritionally adequate, financial and environmentally sustainable diet.