BDA The Association of UK Dietitians

ONE BLUE DOT®

Eating patterns for health and environmental sustainability

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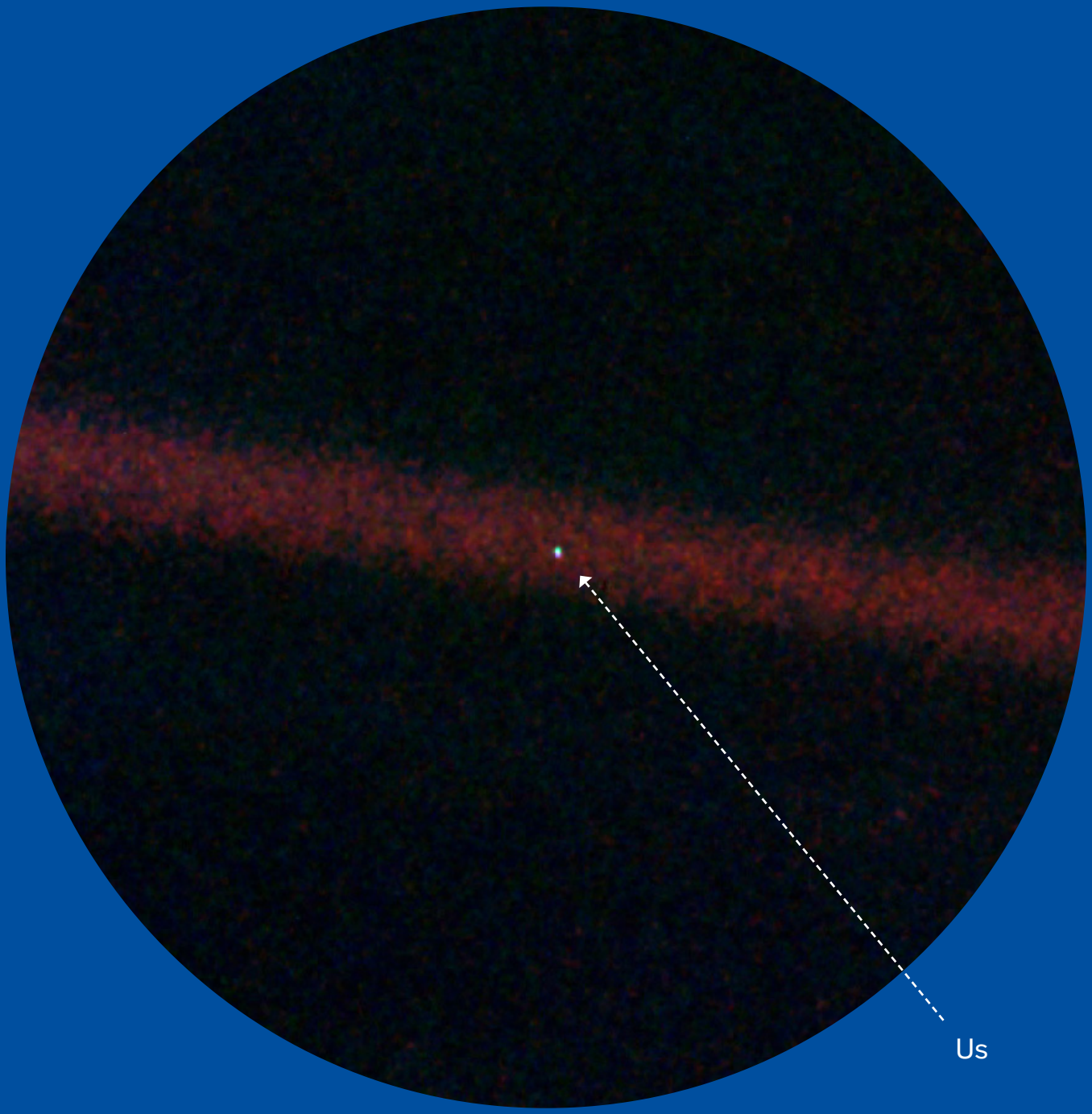
Introduction



Photograph of the Earth taken by the Voyager 1 space probe on February 14th 1990 at a distance of 6 billion kilometers. ©NASA

We are one blue dot

The speck on the photograph taken by Voyager 1 as it left our solar system, is Planet Earth. It sits on the western spiral arm of an unremarkable galaxy in an unremarkable part of space. But it is our home. It is the only one we have and ultimately, the responsibility of taking care of it lies squarely with us.

In this, the early part of the 21st century, it is accepted that our eating habits are having an adverse impact on the environment and we are endangering the future of the planet.

There is mounting pressure for radical change from leading environmental specialists, organisations, and governments - as well as growing public interest and support.

We need to work together to combat climate change. By making dietary changes, it's win-win for the planet and health if we all act now.

BDA Dietitians are perfectly placed to help consumers, clients, and stakeholders navigate the complex messages surrounding this subject. They are able to translate national and international guidance to help the public understand what practical changes they can make to improve both their own health and that of our planet - our one blue dot.

About this guide

This reference guide forms the basis of a toolkit which expands on the BDA's Sustainable Diets Policy Statement. The policy states that the profession should be leading discussions on how our food behaviours can affect both health and the environment. Dietitians are in a strong position to combine healthy eating messages and sustainable diet advice.

The BDA believe that dietitians should be able to reconcile the nutritional and environmental science to give consistent messages about a healthy, sustainable, and varied diet. They should be aware of the challenges that may result for vulnerable groups and individuals (e.g. those suffering ill health, pregnant women, people on low incomes, and older adults) and be able to provide advice on sustainable eating as appropriate.

This reference guide forms the core part of the toolkit. This begins by describing the reasons that dietitians need to understand sustainable diets, before looking in more detail at what a more sustainable diet looks like. With reference to the UK Eatwell Guide, the guide considers specific nutritional issues raised by a more sustainable diet that dietitians will need to consider.

The wider toolkit will be made up of the reference guide, and other documents including practical tips, as well as plenty of links to other useful resources and information sources. The toolkit will, by necessity, remain "live" with updates and extra information.

We are grateful for the assistance of our Sustainable Diets Working Group for drafting this guide and identifying many of the useful links, to Alpro for providing an education grant, and to the many individual dietitians, allies and partners who contributed to the drafting process.

The Environmentally Sustainable Diets Toolkit working group sits under the BDA's Public Health Specialist Group. Its current membership is:

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Our thanks to Brian Cook, Senior Researcher in Health Behaviours, Nuffield Department of Primary Care Health Sciences for his contribution to the 'Motivators and Opportunities' section.

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Why should environmentally sustainable diets be important for dietitians?

From farm to fork to waste

All stages of food production impact on the environment

Our current diets are harming the environment and our health

As dietitians, we are all too aware of the poor eating habits of the nation: low intakes of fibre, fruit and vegetables, and essential micronutrients whilst we are overconsuming energy, saturated fats, and sugars.[1] Our current dietary habits are fuelling obesity, type 2 diabetes, heart disease, and as some cancers.[2]

But, our eating habits also have an impact on the environment and are jeopardising the future security of our planet.

Taking into consideration farming, production, distribution, and delivery through to waste, our current food system has a major impact on the planet:

- Food production contributes 15-30% of total greenhouse gas (GHG) emissions in the UK and therefore contributes significantly to global warming.[3]
- Is a leading cause of deforestation, biodiversity loss, and soil and water pollution.[4]
- Accounts for 70% of all human water use.[4]
- 10 million tonnes of all food produced is spoiled or wasted in the UK every year with the majority (71%) occurring in the home.[5] Some of this is avoidable and represents a waste of land, water and other inputs, and produces 'unnecessary' GHG emissions.[6]
- Over fishing and poor fishing practices have impacted on fishing stocks with 85% of fisheries now fully exploited[7] and/or over fished, the marine vertebrae population has been halved[8] and the marine ecosystem has been damaged.
- Agriculture and livestock farming are by far the biggest contributors to GHG emissions, deforestation, biodiversity loss, and soil pollution, as well as land and water use.[9]

The environmental impact

How current food systems damage our planet

Dietitians as key players in combatting climate change

This section looks at international and UK policies, as well as other stakeholder views. As part of the development of this guide and the preceding policy statement, the BDA undertook an online survey with members (319 dietitians), a workshop at the March 2018 BDA Live event (70 dietitians) and a specially convened focus group (8 dietitians). Feedback was also gathered from members during the development of the policy statement in 2017. This helped the working group to understand dietitians' perceptions and interest in the topic of sustainable diets. It became clear that this is a topic that dietitians feel is of growing importance. A range of possible barriers and challenges were also highlighted.

In particular, dietitians emphasised four key areas they believe we need to focus on to ensure that dietitians can play an important role in the facilitation of sustainable diets, as outlined in our 2017 Policy Statement:

- **Changing the environment and multi-organisation involvement:** Improving the availability of sustainable and healthier foods by developing integrated multi-organisation sustainable polices with government, local authorities, farmers, local producers, and NGOs such as food banks and commercial companies.
- **Improving education and knowledge for health professionals as well as consumers:** A strong focus for under and post graduate dietetic training on sustainable diets, as well as placing sustainable diets on the school curriculum and training other healthcare professionals.
- **Clear and simple language:** Making sustainable diets easier to understand and taking part in conversations which move us towards gaining a consensus.
- **Relevancy:** Ensuring that messages were relevant for different population groups, especially teenagers, and accommodating different cultures. Use of social media was highlighted, especially for the younger generations.

These four key areas of focus have been considered to inform the development of this reference guide and associated toolkit aspects/elements.

Greenhouse Gas emissions, global warming and the food system

Increased Greenhouse Gas (GHG) emissions have a direct impact on global warming which, as well as increasing temperatures, cause extreme weather events (droughts and floods) and water scarcity.[6] Whilst a rise is inevitable, the UN Intergovernmental Panel on Climate Change (IPCC) has proposed a safe limit for global warming increase by 2050. The original IPCC agreement of 2006, set the safe global temperature rise to be between 1.5°C and no more than 2°C above pre-industrialised levels by 2050.[10] However, the more recent IPCC meeting of October 2018, has refined the original agreement and tightened its recommended safe limit for global warming increase to no more than 1.5°C by 2050 if we are to prevent catastrophic consequences for extreme weather conditions: heat, droughts, floods, and poverty.[11,12] The glossary which accompanies this guide will assist you in better understanding terms like CO_2 eq and GHG emissions.

1.5°C

Recommended safe limit for global warming increase

Requires 70-95% reduction in current GHG emissions by 2050[12]

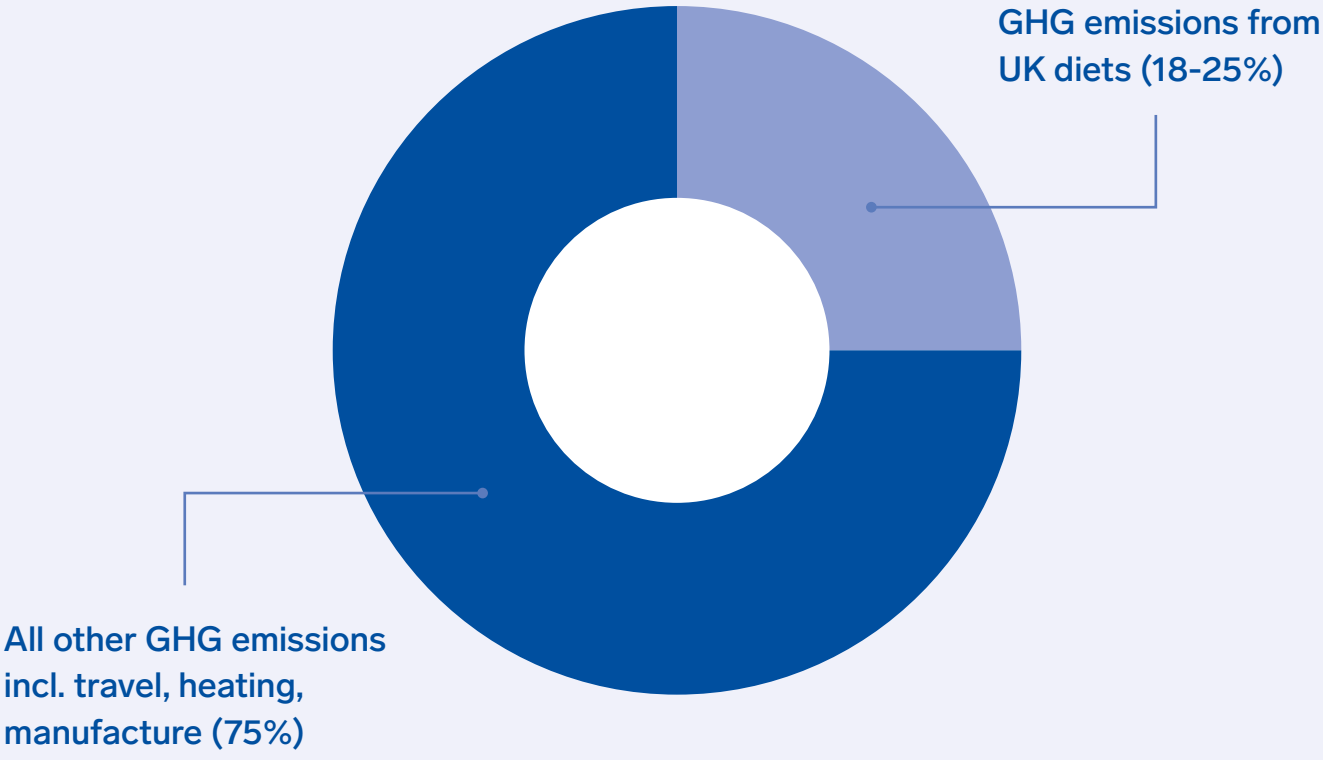
Fig 2.1: The UN Intergov recommendations Climate Change[13]

The IPCC's 2018 report, re-emphasises that livestock is by far the biggest contributor to dietary GHG emissions, and urgent changes are necessary if the new target of 1.5°C rise is to be achieved. In the report, as well as focusing on changes to farming practices and food processes needed to mitigate the impact on global warming, it tackles the shifts needed in consumer behaviour change. With regard to diet, the IPCC's report lists specific actions that individuals should be urged to take, including the above.[13]

UK government policy

The UK Government, through the Climate Change Act 2008[14], is committed to an 80% reduction in GHG emissions by 2050 (compared to 1990 levels), and to contribute to global emission reductions to limit global temperature rise to no more than 2°C above pre-industrialised levels. This is supplemented by 5-yearly "carbon budgets"[15] where the government sets out its GHG emission reduction targets. An 80% GHG emission reduction target, equates to reducing our current emissions of 11.9 tonnes per person per annum from all activities (including travel, food, heating, etc.) down to 2.4 tonnes CO_2 equivalent per person by 2050.[16]

Fig 2.2: Current proportion of GHG emissions per person in the UK showing impact of dietary intakes[16]



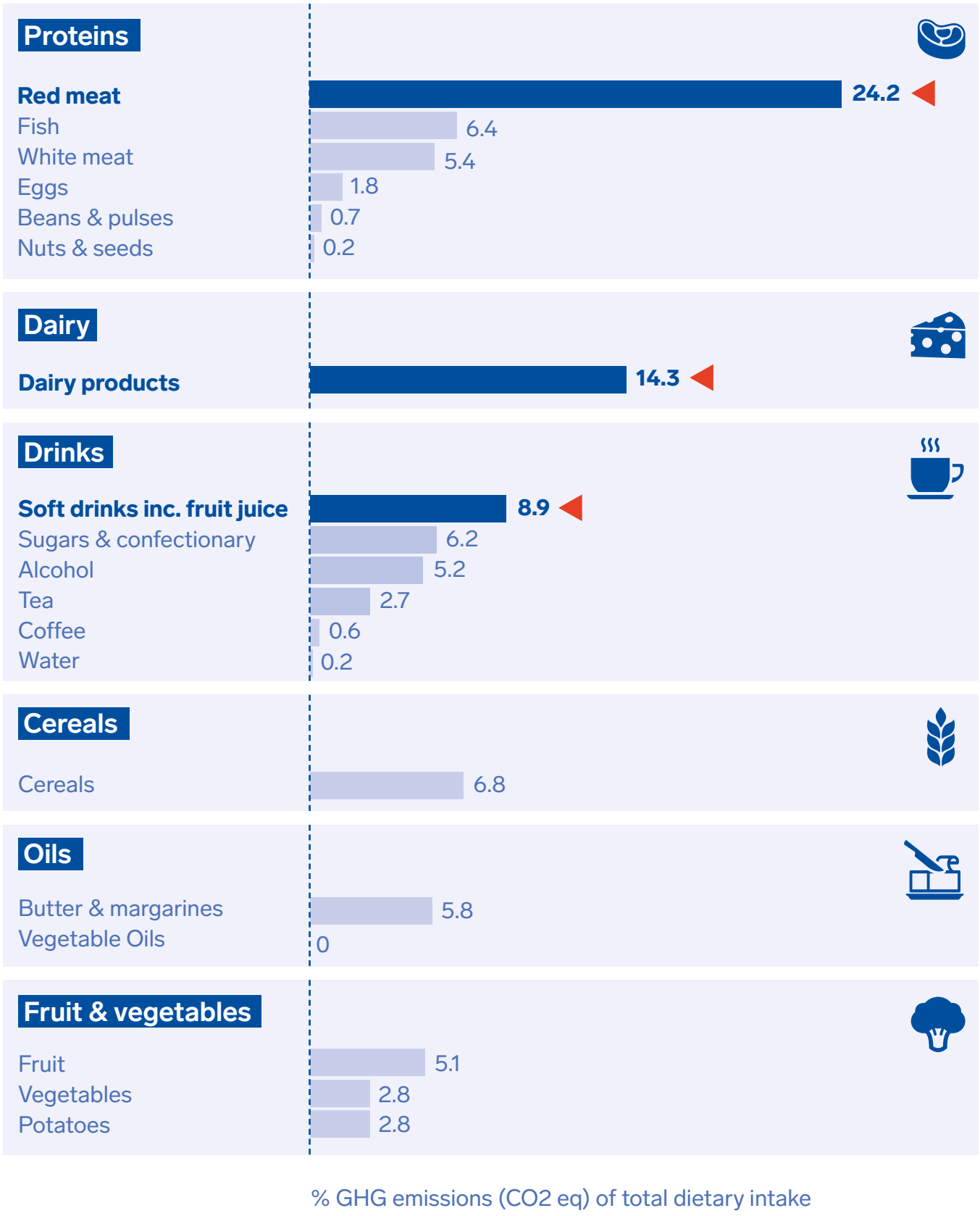
Following the October 2018 IPCC meeting, the government is likely to review its UK targets to come into line with the new global temperature rise limit of no more than 1.5°C by 2050.[12]

Current UK dietary habits (based on the National Diet and Nutrition Survey 2013/14) are estimated to contribute on average 2.1 tonnes CO_2 eq per person per annum. When taking account of typical under-reporting of energy intakes, this may be as high as 3 tonnes CO_2 eq.[17] These values equate to 18% and over 25% of an individual's total (measured by carbon footprint of products, CFP).

The UK outperformed its 2013-2017 targets of a 31% reduction in GHG emissions from 1990 levels by achieving a 43% reduction.[18] However, the latest assessment by the Committee on Climate Change (CCC) has emphasised that the majority of these reductions are attributable to the switch from fossil fuel and that since 2012 the UK has seen very little progress especially with regard to food waste and agriculture, the two biggest contributors to food-related GHG emissions.[19] It is estimated that despite an excellent start, the UK will fail to meet future carbon budget targets, with projections of a 3% and 7% overshoot for the fourth and fifth budgets (2023-2032) respectively.[20]

However, following the October 2018 IPCC meeting, the government is likely to review its UK targets to come into line with the new global temperature rise limit of no more than 1.5°C by 2050.

Figure 2.3: Foods that contribute the most to GHG emissions in the UK diet[17,52]



Agriculture and food waste related emissions have failed to come down

The Committee for Climate Change in the UK voiced their concerns about our lack of progress in agricultural practices, and indeed the overall share of emissions is increasing as other sectors do more to reduce their footprint. Amongst its recommendations, the committee suggests urgent action to "help consumers to make food choices which reflect government nutritional advice and which support lower carbon footprint food products".[21] In practice, this means a reduction in meat (especially beef) and moderation in dairy intakes, with a consequent increase in plant food sources of protein such as beans, legumes, and seeds.

Additionally, the UK's lack of resource efficiency policies including food waste, is a key contributor to the projected overshoot of future carbon targets. Food waste alone (mainly in the home but also in food manufacture) will contribute between 16% and 12% to the projected overshoot in the fourth and fifth carbon budget targets respectively.[20] The committee has highlighted waste as a key priority for the government, recommending that strategies are put into place to ensure that all household food waste is recycled by 2025.[19]

The UK's lack of resource efficiency policies, including food waste, is a key contributor to the projected overshoot of future carbon targets.[20]

Devolved government policy

Sustainability is not just a priority for policy in England, but for each of the devolved governments in the UK. The Climate Change Strategy for Wales sets an even more ambitious target to reduce GHG emissions in Wales by 3% every year and achieve at least a 40% reduction by 2020 compared to figures from 1990.[22] The Welsh Government action plan for the food and drink industry 2014-2020[23] also emphasises a vision of "green growth where [food] businesses are the custodians of our natural resources, businesses that are both environmentally and socially responsible".

In Scotland, the government's climate change plan for 2018-2032[24] went one step further, targeting a 42% reduction in emissions by 2020, and has the specific ambition for agriculture in Scotland to be among the lowest carbon and most efficient food producers in the world. The Good Food Nation policy, first published in 2014, set out an aspiration for Scotland to produce food which is "both tasty to eat and nutritious, fresh and environmentally sustainable".[25]

There are no specific targets in Northern Ireland for emissions reduction. Agriculture is a relatively high contributor to emissions in Northern Ireland and there has been little reduction since 2009 because of its contribution.

In Scotland, the government's climate change plan for 2018-2032[24] went one step further, targeting a 42% reduction in emissions by 2020.

Growing public interest

Aside from the obvious policy drivers, dietitians are going to increasingly encounter individuals who are seeking information on the sustainability and environmental impact of their diets. In the UK the public are becoming more aware of how their eating habits impact on our planet.

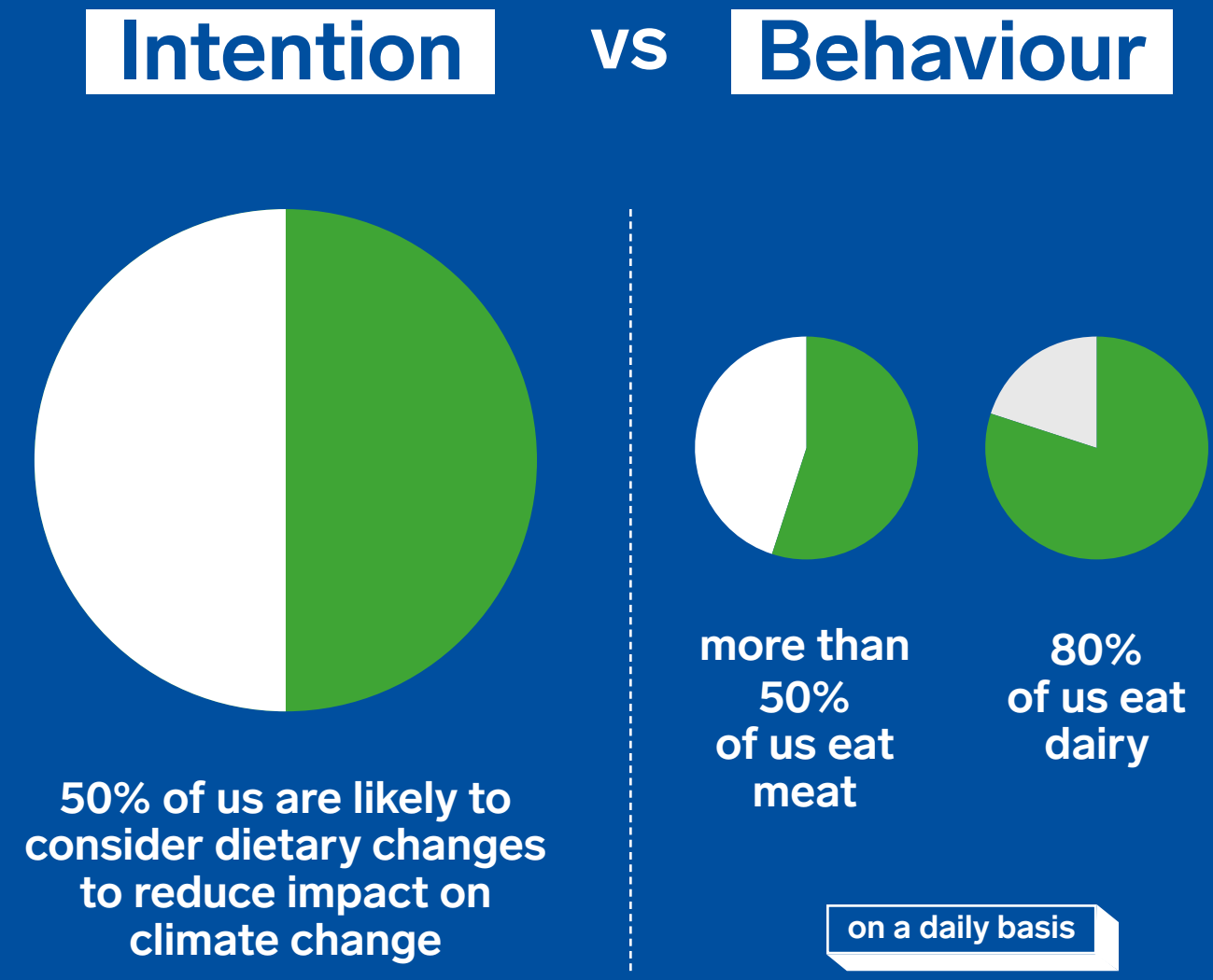
More than seven in ten (74%) people regularly surveyed by the Department of Business, Energy and Industrial Strategy, are very or fairly concerned about climate change.[26] This figure has grown slowly year on year since surveying began in 2012. A ComRes survey[27] has found that taste, value for money, reducing costs, convenience, and the healthiness of food rank most highly, however, over half of the respondents stated that they were likely to consider changes to their diets if doing so would reduce their impact on climate change. Whilst a fifth reported they consumed meat only once or twice a week, another 38% stated they would consider changing their diet in the future. Over half stated that they already seek to choose seasonal fruit and vegetables, whilst another third would consider doing so in the future.

Another Ipsos poll[28] has identified that although over half of respondents ate meat on a daily basis, 48% reported a consumption frequency of three times a week or less. A 2017 survey by the Food Standards Agency found a small decline in red meat consumption from previous surveys, with 85% of respondents reporting to consume red meat less than three times a week: however, this was at the expense of a higher white meat consumption. The survey also identified that dairy consumption occurred on a daily basis for over 80% of the respondents.

In the UK the public are becoming more aware of how their eating habits impact on our planet.[26]

Although the awareness and intention is there, it is clear from the latest UK dietary survey[1] that this has yet to translate into sustainable dietary behaviour change for the majority, and significant barriers will need to be identified and overcome.[29]

Fig 2.4: Intention vs current behaviour in samples of the UK population[27,28]



Intention is there but significant barriers to behaviour change for the majority

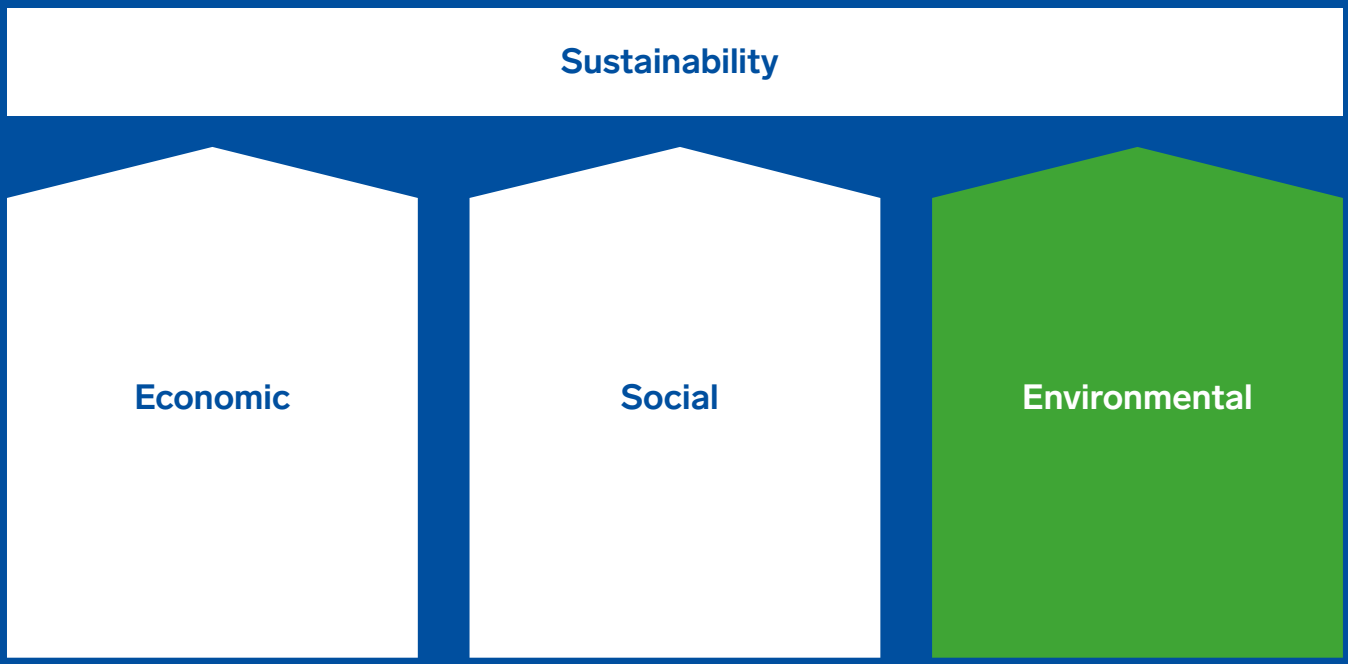
3

What do we mean by a sustainable diet?

What do we mean by a sustainable diet?

Defining what is meant by a sustainable diet is difficult, and there is currently no consensus. The word sustainable itself is used in a number of ways, and there are generally accepted to be three broad 'pillars' of sustainability; 1) economic, 2) social and 3) environmental.[30] All three are important when considering overall sustainability, **but within the context of this reference guide and the BDA's Sustainable Diets policy, we have focused specifically on an environmentally sustainable diet.**

Fig 3.1: The three pillars of sustainability[30]

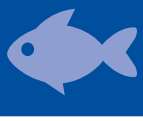


Further complexity is added by the fact that environmental sustainability itself can have a range of meanings, and that there can often be differing priorities – land and water use, GHG emissions, biodiversity, etc. Sometimes one priority can contradict another.

Despite this complexity it is important to have a clear direction of what is meant by the term sustainable diets, at least in relation to this reference guide. In this section we summarise the BDA recommendations and we consider definitions from key organisations and thinkers in the field, which taken together give a good indication of what is meant by an environmentally sustainable diet.

A clear direction

The BDA Environmentally Sustainable Diet recommendations for the UK

Red meat 	**Red meat** ▼ Less than 70g/per person per day or less than 350g-500g per person per week (cooked weight).	**Processed meats.** ✕
Plant proteins 	**Prioritise beans and lentils, soya (beans, mince, nuts, tofu), mycoprotein (Quorn™), nuts and seeds.** ▲	
Fish 	**From sustainable sources and follow oily fish recommendations.**	
Dairy 	**Moderate dairy consumption. Use calcium fortified plant-based alternatives where needed.** ▼	
Potatoes, bread, pasta, rice and other starchy carbohydrate foods 	**Recommend wholegrain. Recommend tubers such as potatoes.** ▲	

continues ↓

Fruit and vegetables 	Seasonal + locally produced vegetables/fruit or tinned/frozen. ▲	Air freighted, pre-packed and prepared fruit and vegetables. ▼
Portion control 	Animal proteins ▼ Dairy produce ▼	High Fat, Sugar and Salt (HFSS) foods ✕
Hydration 	Tap water and tea or coffee over soft drinks. ▲	
Reduce food waste 	Especially perishable fruit and vegetables. ▼	Any food waste should be recycled. ▲

✕ Avoid ▼ Reduce ▼ Moderate ▲ Increase

Current definitions of sustainable diets

United Nations

The official definition of a sustainable diet from the Food and Agriculture Organisation (FAO) of the United Nations, which we use in the BDA Policy Statement, is:

> **'Sustainable Diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate , safe and healthy while optimizing natural and human resources.'**
> FAO, 2010[31]

This definition, perhaps understandably, tries to define sustainable diets in the broadest possible terms, but has been critiqued for including too many stipulations. It is interesting to note however, that within its definition, the nutritional adequacy of a diet for health is included.

Fischer and Garnett

Carlos Fischer and Tara Garnett from the Environmental Change Unit at the University of Oxford[32] provide a more practical definition of a sustainable diet, taking on board key aspects of the FAO definition but with a clear focus on nutritional adequacy for health, or in their words: "low environmental impact diets consistent with good health". The definition can easily be applied to current dietary recommendations.

> '... low environmental impact diets consistent with good health...'

- Diversity – a wide variety of foods eaten.
- Balance achieved between energy intake and energy needs.
- Based around: minimally processed tubers and whole grains; legumes; fruits and vegetables.
- Meat, if eaten, in moderate quantities – and all animal parts consumed.
- Dairy products or alternatives (e.g. fortified milk substitutes and other foods rich in calcium and micronutrients) eaten in moderation.
- Unsalted seeds and nuts.
- Small quantities of fish and aquatic products sourced from certified fisheries.
- Very limited consumption of foods high in fat, sugar or salt and low in micronutrients.
- Oils and fats with a beneficial Omega 3:6 ratio such as rapeseed and olive oil.
- Tap water in preference to other beverages – particularly soft drinks.

For further information on terms and ideas, take a look at our glossary, which forms part of the wider toolkit.

4

A more environmentally sustainable diet can be a healthy diet

A more environmentally sustainable diet can be a healthy diet

Both the FAO and Fischer and Garnett definitions of sustainable diets state that such diets must be nutritionally adequate for the health of a population and therefore, sustainable diets can be synonymous with healthy diets.

However, care needs to be taken as not all healthy eating patterns are guaranteed to be sustainable and a diet that has a low environmental impact is not necessarily nutritionally adequate.[33] For example, sugar has a relatively low environmental burden whilst perishable fruit and vegetables can have a high environmental burden due to the high level of wastage, greenhouse energy use and airfreight.

Overall, the scientific evidence consistently demonstrates some common traits between sustainable and healthy diets. In the main, a lower reliance on livestock products (especially beef and dairy), with a shift to more plant-based proteins (including wholegrains, beans, nuts and seeds), and reduced intakes of pre-packaged or highly processed foods, especially those high in fat, salt, and sugar.

Modelling and real consumption data studies have repeatedly demonstrated that dietary patterns of higher nutritional quality, which are based on healthy plant foods and lower intakes of meat and dairy products, also have lower GHG emissions and better overall sustainability scores. [17,34-41]

Such dietary patterns, whilst meeting national micronutrient recommendations, tend to be lower in energy dense foods and saturated fat whilst providing higher fibre and fruit and vegetable intakes. It is not surprising, therefore, that healthy sustainable eating patterns have been associated with improved health outcomes such as weight management and reduced rates of diabetes and heart disease, and could result in reductions in total mortality by 6–16%.[36,42]

Healthy, sustainable eating habits included in the government's Climate Change Act

As part of the government's Climate Change Act, agriculture and farming are targeted for improved practices to lower their carbon foot print. Changing current consumer dietary habits were a key focus in the fourth carbon budget.[43]

Three dietary scenarios involving various adaptions to current intakes were evaluated for macro and micronutrient adequacy and environmental impact by Scarborough and colleagues – see Table 4.1. Scenario 1 showed significant reductions in all meat and moderation in dairy, and provided the most favourable outcomes for both environmental and health benefits.[43,44]

Additionally, key micronutrients often associated with red meat and dairy consumption were similar to actual dietary intakes across all 3 dietary scenarios.[44] All dietary scenarios, including current intakes failed to meet male zinc dietary recommendations. With regard to iron intakes, despite reductions in red meat, iron increased in scenario one which could reflect contributions made from increased cereal product consumption. As expected, dietary vitamin D intakes were low across all dietary patterns.

Dietary modelling studies involving significant reductions in all meat and moderation in dairy, provided the most favourable outcomes for both environmental and health benefits.

Table 4.1: Three dietary scenarios based on modifications to UK dietary intakes* and the potential impact on health, nutrition and environmental outcomes.[44]

		1	2	3
		1. Reducing current intakes **of all meat by 64% and dairy by 40%.** 2. Plus adapting intakes of **all other food group to meet recommendations.**	1. **Reducing red meat (beef and lamb)** consumption **by 75%** and partly **replacing with more white meat consumption (increasing consumption by 45%).** 2. No other dietary adaptations.	1. **Halving current white meat** consumption. 2. No reductions in dairy or other meat. 3. Moderate improvements in other food groups.
GHG emissions		▼ 19%	▼ 9%	▼ 3%
Land use		▼ 42%	▼ 39%	▼ 4%
Delayed or averted deaths		36,910	1,999	9,297
	Current intakes			
Iron mg/d#	10.5	11.8	10.0	11.1
Calcium mg/d	904	854	908	943
Zinc mg/d^	8.3	7.4	7.6	8.4
Riboflavin mg/d	1.7	1.5	1.7	1.8
Vitamin A mcg/d	799	727	731	812
Vitamin D mcg/d**	2.7	2.3	2.6	2.6
Vitamin B12 mcg/d	5.8	3.9	5.2	5.7

* Meat, dairy and other food group intakes based on 2008 Family Food Survey data. Nutritional comparisons based on NDNS 2000/1 data.
# Iron: similar intakes across all dietary scenarios. None meeting female under 50 year recommendations of 14.8mg/d.
^ Zinc: all dietary scenarios providing similar levels to current intakes. No dietary scenario meets male recommended intakes of 9.5mg/d.
** Vitamin D consistent between current and all 3 dietary scenarios – all below latest recommended intakes of 10mcg/day.

Eatwell Guide: an example of a more sustainable and healthy diet?

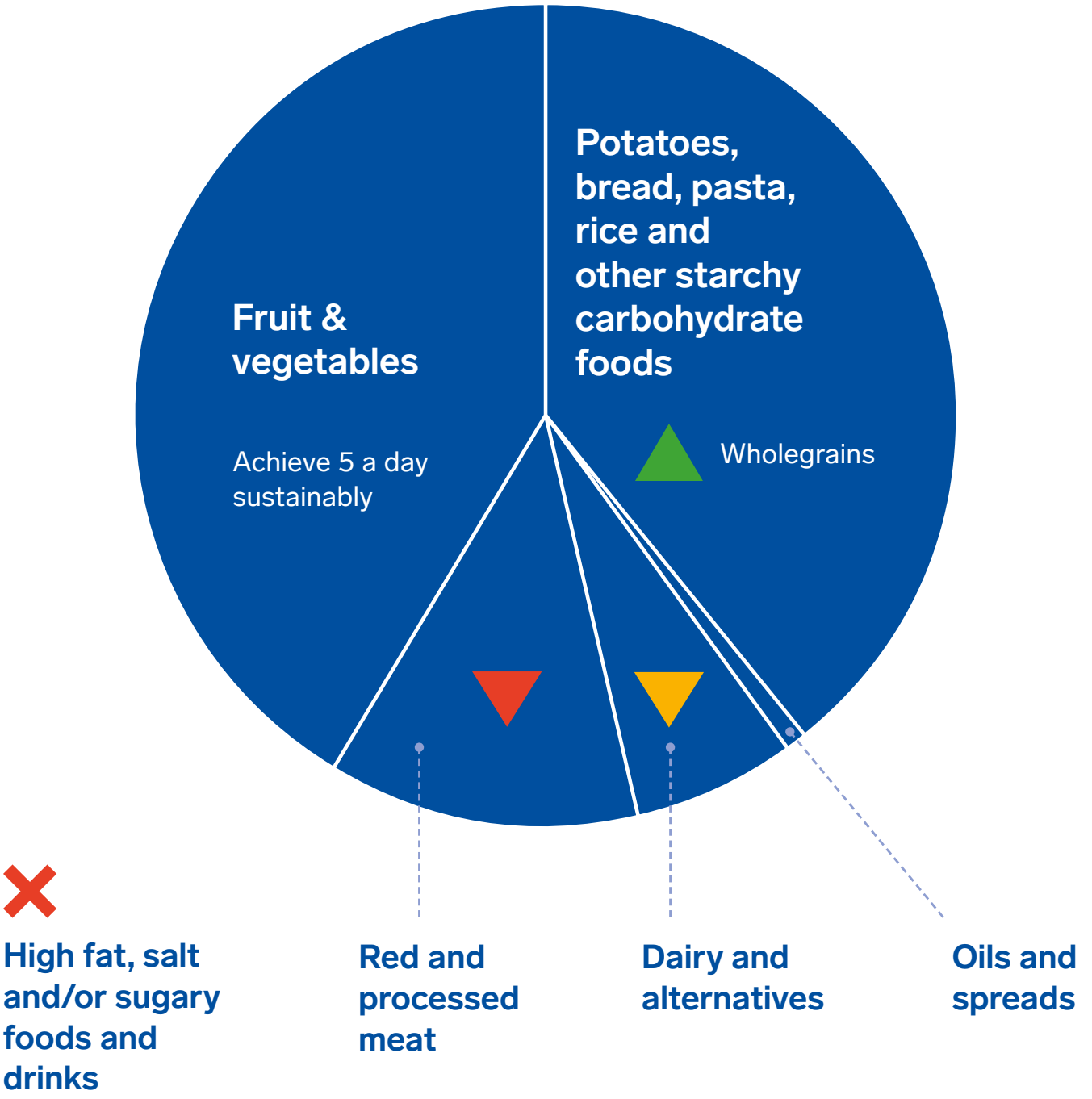
Public Health England sought to address sustainability in its broadest sense within the revised Eatwell Guide while at the same time ensuring that all macro and micronutrients and fibre recommendations were met.[45]

As a result, the Eatwell Guide came with some notable modifications to its predecessor, the Eatwell Plate.

The Carbon Trust analysis of the Eatwell Guide shows a lower environmental impact than the current UK diet[16] attributed to a number of factors, including an increase in potatoes, fish and bread, vegetables, and fruit, alongside reduced amounts of meat, dairy, rice, pasta, pizza, and sweet foods. The Carbon Trust estimates that if individuals moved from current eating patterns (NDNS 2010/2011) to the Eatwell Guide recommendations, a 31% reduction in GHG emissions, 17% saving on water use and 34% reduction in land use could be achieved. Based on the more recent assessment of UK dietary habits, estimating 2.1-3 tonnes CO_2 eq per person per annum,[17] this means an individual's food related emissions would reduce to 1.5-2.1 tonnes CO_2 eq by 2050. This is a significant reduction and does not include the impact of improved farming and food production practices or reductions in waste which would further lower the carbon foot print.

The Carbon Trust analysis of the Eatwell Guide shows a lower environmental impact than the current UK diet.[16]

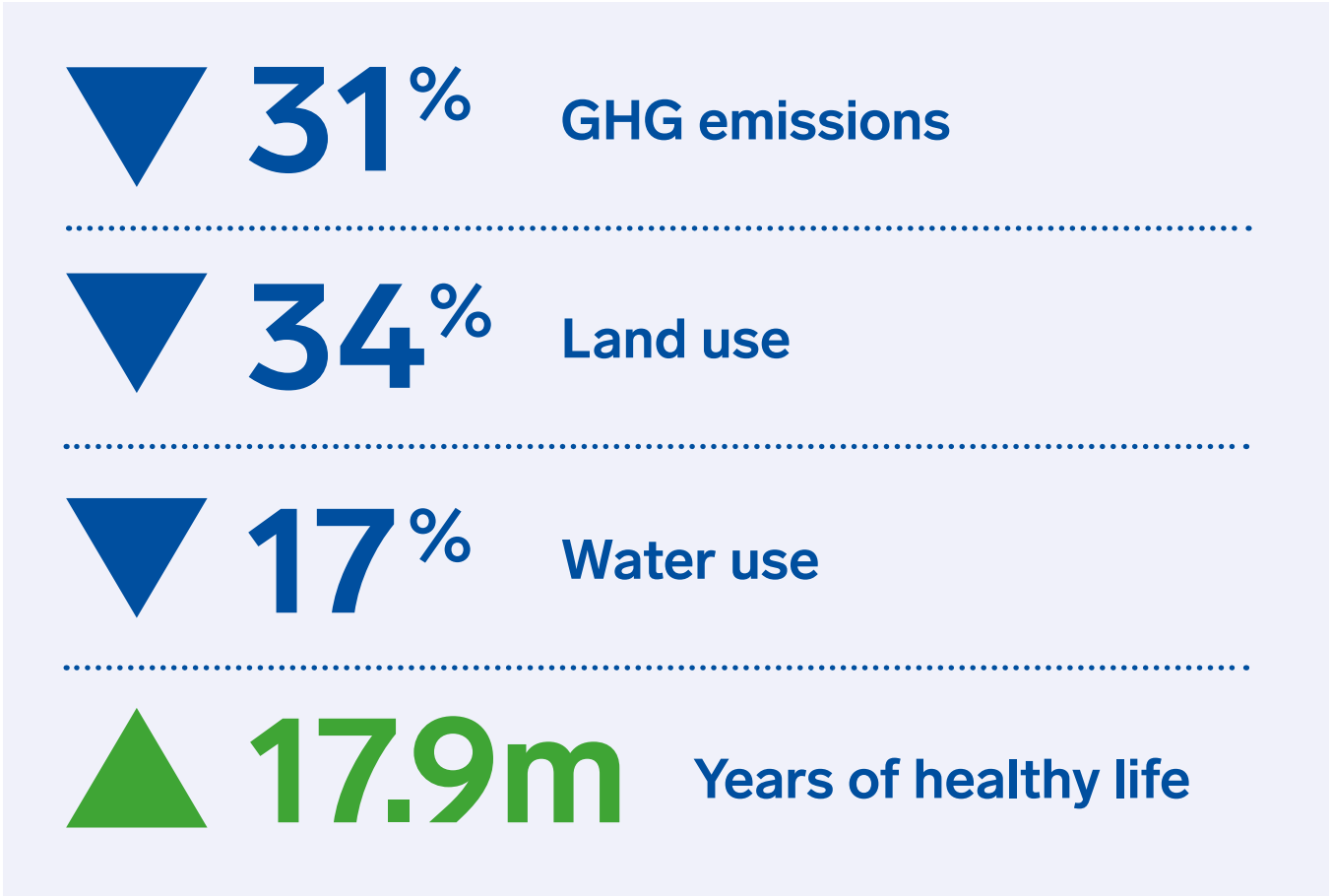
Figure 4.2: Summary of the changes when the Eatwell Plate was updated to the Eatwell Guide[45]



As well as environmental benefits, the Eatwell Guide, if all recommendations are met and energy requirements are not exceeded, would increase life expectancy by more than 5 months and avert 17.9 million disability-adjusted life years over the lifetime of the current population as a result of reduced incidence of type 2 diabetes, cardiovascular disease, and colorectal cancer.[46]

The UK is not alone in adopting sustainable factors into national dietary guidelines. The current dietary guidelines of countries such as Canada,[47] Belgium,[48] and the Netherlands[49] have also placed sustainability at the core of their recommendations.

Figure 4.3: Benefits of adopting Eat Well Guide recommendations[16,46]

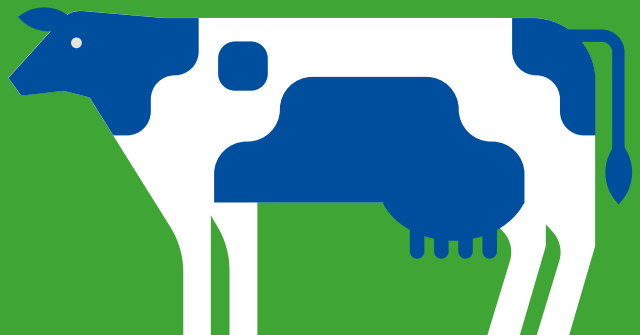


Reducing Red and Processed Meat (RPM)

The environmental impact

Red and processed meats have the single biggest environmental impact of any type of food, with beef and dairy cattle in particular contributing significantly to the environmental burden.[17,50-52] Livestock farming accounts for 10% of the UK's total GHG emissions and is by far the biggest contributor to food related GHG emissions, deforestation, biodiversity loss, and soil pollution, as well as land and water use:[9]

Red and processed meats have the single biggest environmental impact of any type of food.[17,50-52]



Livestock farming:

- Contributes 45% of food related GHG emissions (compared to food manufacture contribution at 12%, transport at 12% and the remaining from food preparation and food waste).[3]
- The most recent assessment of UK dietary intakes (NDNS 2008/2009-2011/12) found that red meat alone (including beef, lamb, pork, goat, and venison) was responsible for 24.2% of dietary related GHG emissions whilst white meat contributed 5.4%.[17] The authors took into account under-reporting and provided values based on 'plausible' food intakes over the course of a day.
- An earlier assessment by Green and colleagues[52] using NDNS 2008/2009–2010/11, found similar findings and also provided a more detailed breakdown of GHG emissions of different types of red meat. Results were presented as per capita per year.
  - Based on this analysis: Beef consumption was by far the biggest single food contributor to dietary GHG emissions at 22.7%, lamb contributed 5.3%, whilst white meat contributed another 5.7%.[52]
- Cattle are by far the largest contributors due to being ruminants (methane gas emitters) and the most commonly farmed animal.[9,17,53,54]
- One third of UK's forests and former woodlands are used solely to rear livestock and grow crops (mainly for animal feed production).[9]
- Livestock farming uses up the majority of the water supply.
- Finally, livestock farming is responsible for degrading 33% of UK soil, polluting 1/3rd of water supply and has the biggest impact on biodiversity loss.[9]

Figure 4.4 illustrates that, taking into consideration regional and process variability, shifting our reliance from meat (especially red meat) to plant food sources of protein will significantly reduce both GHG emissions and land use.

Figure 4.4: Mean GHG emissions, land use and water use values of different foods providing 100g of protein[55-57]

These are average values based on a combination of data sets from around the world, therefore there will be significant variability depending on country of origin and practices used[6]. See table below.

	GHGe as kg CO_2 eq per 100g of protein	Land use m^2 per 100g of protein	Stress weighted water use 1000s litres per 100g of protein
Nuts	0.3	7.9	140.8
Peas	0.4	3.4	12.6
Other pulses	0.8	7.3	10.5
Peanuts	1.2	3.5	23.6
Tofu	2	2.2	3.2
Eggs	4.2	5.7	16.2
Poultry meat	5.7	7.1	8.2
Fish (farmed)	6	3.7	18.2
Pig meat	7.6	11	41.3
Cheese	11	40	81.9
Dairy cattle	17	22	60.7
Shellfish (farmed)	18	2	86.2
Sheep meat	20	185	70.9
Beef meat	50	164	17.4

"Water stress" considers several physical aspects related to water resources, including water scarcity, water quality, environmental flows, and the accessibility of blue (stored) water for human consumption. Therefore a product with high stress weighted water use, implies it is using blue water (storage water) for irrigation due to dry conditions which is depleting water stores that could be used for human consumption in an area whose overall water levels are already scarce. Crops relying more on rainfall will utilise more 'green' water, thus their stress-weighted water use will be lower.

Table 4.5: Fuller summary of the original data by Poore and Nemecek 2018 highlighting the significant variability in values for GHGe and land and water use.[55-57]

Functional unit	Per 100g protein											
	GHG Emissions kg CO_2eq				Land Use m^2				Stress-Weighted Water Use litres			
Environmental measure	5th %ile	Mean	Median	95th %ile	5th %ile	Mean	Median	95th %ile	5th %ile	Mean	Median	95th %ile
Beef meat cattle	19	50	30	135	35	164	85	456	103	17,419	221	95,685
Dairy cattle	7.6	17	17	29	6.2	22	13	54	21,365	60,692	61,893	108,521
Sheep meat	12	20	20	30	24	185	64	362	129	70,927	129	297,490
Pig Meat	4.3	7.6	6.5	15	4.6	11	8.3	21	32	41,327	33,525	94,147
Poultry Meat	2.3	5.7	4.3	12	3.7	7.1	6.4	12	12	8,186	193	38,132
Cheese	4.6	11	8.4	27	3.6	40	9.1	146	787	81,907	36,442	358,171
Eggs	2.6	4.2	3.8	7.7	3.8	5.7	5.1	7.9	369	16,206	16,782	34,931
Fish (farmed)	2.4	6.0	3.5	14	0.1	3.7	2.5	12	2,417	18,229	3,720	58,695
Crustaceans (farmed)	5.0	18	10	78	0.4	2.0	0.6	3.5	15,570	86,160	32,998	666,721
Other Pulses	0.4	0.8	0.6	1.9	1.9	7.3	5.7	20	0	10,499	0	49,582
Peas	0.2	0.4	0.4	0.8	1.0	3.4	3.0	9.2	0	12,578	0	118,810
Nuts	-2.5	0.3	-0.8	6.6	2.5	7.9	5.3	16	0	140,778	79,219	494,586
Peanuts	0.5	1.2	1.3	2.3	1.6	3.5	3.0	5.9	908	23,605	16,941	74,536
Tofu	0.9	2.0	1.6	4.5	1.0	2.2	2.1	3.7	8	3,196	20	19,677

Additionally, the overall environmental impact will also depend on many other factors including, biodiversity loss, deforestation, pollution of water, and degradation of soil.[6]

Meat protein's potent environmental impact is also reflected in studies looking at dietary patterns which consistently show a direct correlation between the quantity of meat in the diet and the projected environmental burden.[36,37,44,58]

The health impact

Attempts to reduce rates of obesity, type 2 diabetes, cardiovascular disease, and cancers by the government,[45,46] WHO,[59] and many health organisations include limiting red meat (especially processed meat) and/or shifting towards a more plant-based diet as overarching dietary recommendations.

In 2011, SACN recommended that high red meat consumers (>90g per day) should reduce intakes to no more than 70g per day, to reduce colorectal cancer risk without compromising iron intakes.[60] The Eatwell Guide has prioritised plant proteins over animal proteins whilst assessing that micronutrients including iron and zinc are not compromised for the general population.[44] Current intakes of red meat alone in the UK, taking into consideration under-reporting within the national diet and nutrition survey data, is estimated to be at 90.5g per day.[17] WHO[59] has been emphasising more plant-based diets for a number of years and dietary recommendations from the WCRF[61,62], and Heart UK[63] focus on reducing red and processed meat intakes whilst increasing plant proteins. The WCRF has specifically recommended that processed meat should be avoided whilst red meat is limited to no more than 350-500g cooked weight per week.[62] This equates to 50-70g red meat daily which, if consumed, is no more than government guidelines.[45,60]

In the main, reductions in red and processed meats are associated with reduced risk of colorectal cancer and reduced intakes of saturated fat and salt while the inclusion of plant proteins in the diet results in an improved fat profile, lower energy density and significantly increased fibre content.[44,64-67] These dietary modifications are associated with reduced incidence of obesity, cardiovascular disease, type 2 diabetes, and some cancers.[38,41,42,44,46,68-70]

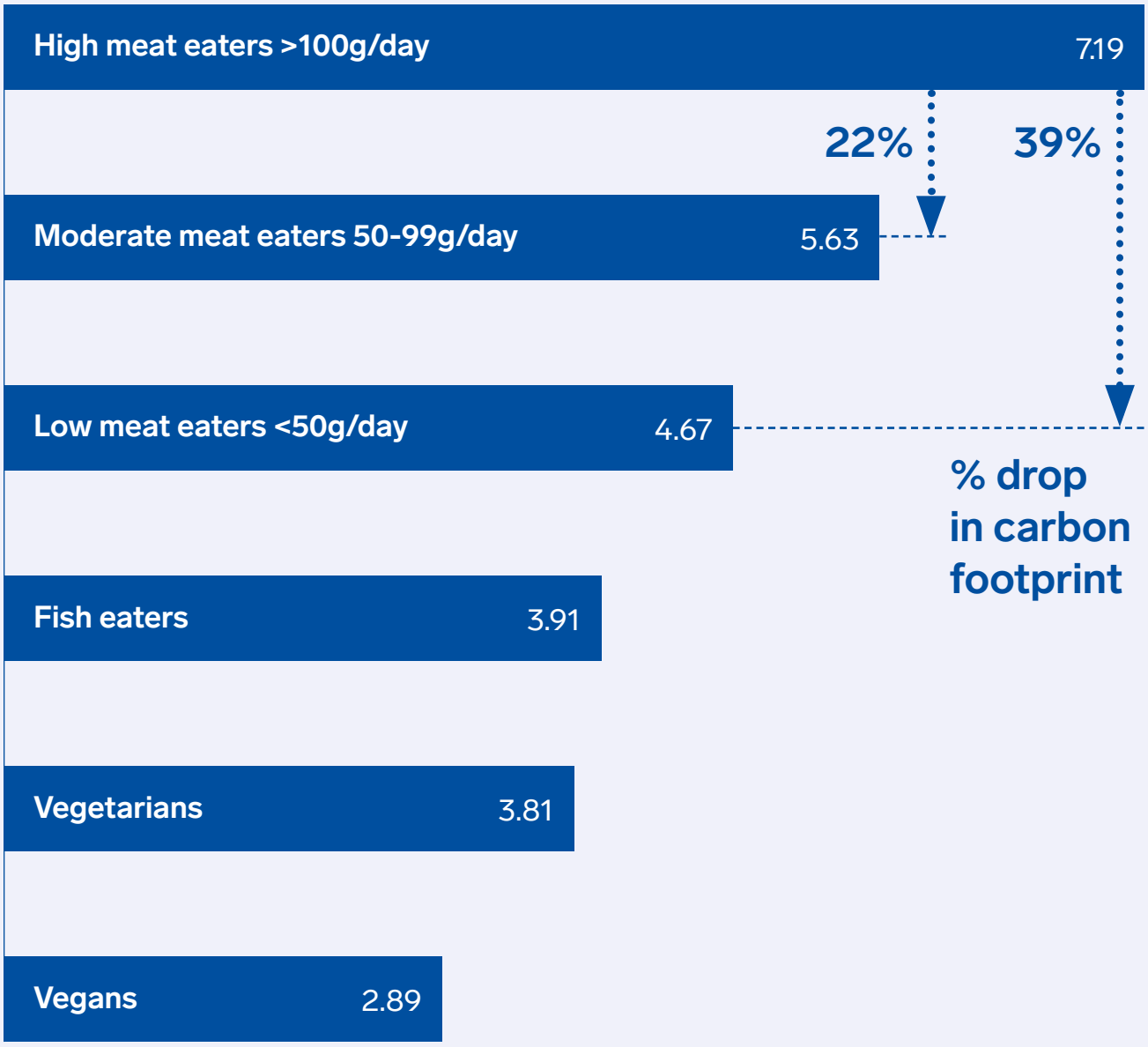
UK's meat eating habits and how they impact on the environment

Figure 4.5 highlights that reduced intakes, and not avoidance, of meat can significantly reduce our carbon foot print.[58] A reduction in current UK consumption of total meat (108g per day)[1] for adults to 50-99g would reduce our carbon foot print by around 22% whilst a further reduction to below 50g per day would result in a 39% reduction. It is expected that similar savings would be made to land and water use as well as biodiversity loss, soil degradation and water pollution.

More recent UK consumption data (NDNS data set 2008/2009 and 2013/2014), further emphasise that switching to more plant protein sources is key to reducing the environmental burden and improving the nutritional quality of the diet (see Figure 4.5).[17]

A reduction in current UK consumption of total meat (108g per day)[1] for adults to below 50g per day would result in a 39% reduction in our carbon footprint.[44]

Figure 4.5: Daily mean GHG emissions (kg CO_2 eq) per person consuming a self-selected diet of 2,000kcal.[58]



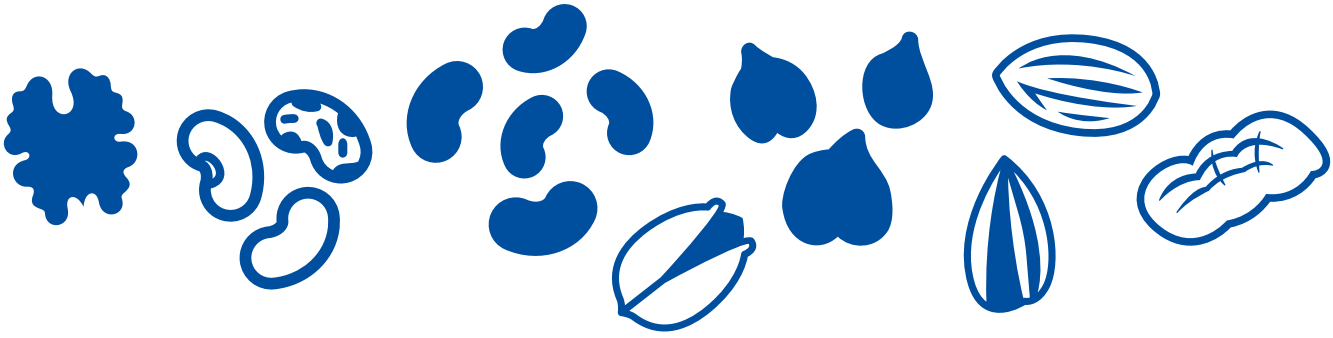
Increase consumption of plant food sources of protein

A key part of a more sustainable diet is to consume more plant sources of protein in place of animal proteins. As discussed above, it is clear that shifting dietary patterns towards more plant sources of protein such as beans, pulses, nuts, and seeds will help reduce both the environmental and health burdens we are currently facing.

Protein quality

Protein quality and quantity is not compromised when switching to more plant-based diets, whether meat and dairy are included at reduced quantities or totally excluded. Plants contain all essential amino acids and diets entirely based on plant foods which meet daily energy requirements will also meet all essential amino acid requirement.[71-74] Thus the terms 'complete' and 'incomplete' or 'high biological value' and 'low biological value' should be used with care as these only reflect the quantity and quality of essential amino acids in one serving of a single food and do not provide an assessment of the overall ability of a diet to meet requirements.

The graphs and tables above demonstrate the significantly lower GHG emissions, water use, and land use needed to produce 100g plant proteins versus 100g of animal protein. Additionally, it has been demonstrated that plant-based diets which meet national dietary needs have an overall lower environmental impact compared to high meat diets.[33,36-38,41,42,46]



Moderate dairy intake

Compared to ruminant meat products, dairy products produce significantly lower GHG emissions, however, their footprint remains a major contributor to dietary emissions and is significantly higher when compared to plant-based alternatives. In terms of actual consumption in the UK, the most recent assessment of the NDNS data found dairy products to be the second biggest contributor after red meat at 14.3%.[17] These findings concurred with the earlier assessment by Green and colleagues[52] estimating dairy (milk, yogurts, cream, cheese, ice-cream, dairy desserts) to be responsible for 16.3% of total dietary GHG emissions and second only to beef consumption. Green et al also identified cheese as the most GHG emission intense dairy product. Table 4.6 below shows that despite cheese consumption being significantly lower (29.2g per day) compared to milk, yogurt, cream, and dairy desserts (>377g/d), it was responsible for almost 40% of dairy GHG contributions.[52]

Table 4.6: UK dairy consumption and estimated GHG emissions contributions[52]

Dairy category	Consumption g/day	GHGe (kg CO_2 eg per capita per year)	% contribution to total dietary GHGe	% contribution of dairy category only
Milk, yogurts, cream, dairy desserts	377.5	138	9.2%	56.4%
Cheese	29.2	97	6.5%	39.9%
Ice cream	5.1	9.3	0.6%	3.7%
All dairy	411.8	244.3	16.3%	NA

These factors are reflected in the government's more sustainable Eatwell Guide where the dairy section has been reduced by almost a third (from 11.1% to 7.9% of total food weight).[45] This means that dairy can continue to contribute to important calcium and iodine intakes in the UK diet.

Environmental impact of dairy and plant-based alternatives beyond GHG emissions

Whilst this document relies mainly on GHG emissions as an indicator of climate change impact, the Sustainable Nutrient Rich Foods index (SNRF))86 is a new measure which reflects both the climate and nutritional impact of food products. Using this system, dairy milk is rated as a food with good nutrients and medium climate change impact.

As well as considering GHG emissions from plant based dairy alternatives, it is important to also take note of other environmental factors such as land and water use which could mitigate any benefits of a lower GHG emission value. Table 4.7 highlights that soya dairy alternatives (tofu and soya drinks) are significantly more sustainable compared to dairy (cheese and milk) across all measures: GHG emission, land use and water use.

Data on plant-based drinks other than soya is limited. However, the data that does exist indicates that the overall environmental impact of plant-based drinks will be more favourable than dairy milk.[75]

Table 4.7: Environmental impact of dairy milk, dairy cheese, tofu and soya drinks per average serving – from farm to household waste. Value ranges reflect the 5th and 95th percentiles. Taken from Poore & Nemecek 2018 supplementary data.[55,57]

Dairy vs soya alternatives	Serving size	GHG emissions kg CO_2 eq	Land use m^2	Stress-Weighted Water Use (Litres)
Cheese	30g	0.3-1.8	0.2-9.9	53.1-24,177
Tofu	75g	0.1-0.5	0.1-0.4	0.9-2,263
Milk	200ml	0.3-1.4	0.16-6.4	40.2-16,284
Soya alternative to milk	200ml	0.1-0.3	0.06-0.2	0.4-1,153

There is more information on plant-based milks in the One Blue Dot FAQ document which accompanies the reference guide. The FAQ highlights the variability in the environmental impact data available and different stages of the product lifecycle used for different foods, making comparisons sometimes difficult. Of importance, is the need to consider all environmental factors when assessing the sustainability of a product and not just GHG emissions, which although important, are not a reflection of the total environmental cost and sometimes trade-offs need to be made.

Dairy farm and production processes gradually improving to help reduce the environmental burden

Acknowledging the heavy environmental burden of dairy farming, in 2007, Dairy UK set out its roadmap for improvements in dairy production processes in the UK to reduce its burden. 10 years on, they have been successful in improving energy efficiency and effluent waste management (only 5% factory waste going to landfill and a target of zero factory waste sent to landfill by 2020).[81] The report highlights that they still have a way to go and they have set further targets to improve biodiversity and soil quality.

Nutritional quality of plant-based drinks

Most non-organic variants are calcium fortified with a similar content and bioavailability to dairy milk.[82-85] Additionally, most plant-based drinks are also fortified with vitamins B2, B12 and D[82] and some are now also fortified with iodine.

Meet fruit and vegetable intake targets

While the consumption of plant proteins would be more environmentally sustainable, assessing the environmental impact of fruits and vegetables is more complex and trade-offs between health and environmental impact may have to be taken into consideration. The environmental impact of fruit and vegetables will vary significantly depending on how and where they are produced. Consuming fruit and vegetables out of season which are produced in greenhouses and/or require heating, refrigeration, or airfreight and are perishable resulting in waste will mitigate any environmental benefits.[6,54]

Perishable fruit and vegetables make up the majority of household waste which is a major source of potent GHG emissions.[5] The environmental impact of using more affordable frozen or tinned fruit and vegetables is not necessarily greater than opting for fresh produce which will also require refrigeration, are often air freighted and make up the largest proportion of unavoidable food waste.[54,87,88] Other considerations include water use, pesticide use and the impact on soil and water quality.

Seasonal, locally produced fresh vegetables and fruits are a better choice, with tinned and frozen produce reducing waste from perishability.[5]

Examples of particularly GHG intensive fruits and vegetables from the Food Climate Research Network[89]:

- **Air freighted produce: Typical examples include US berries and cherries, African green beans and peas, and pre-prepared salads produced outside Europe.**
- **Unseasonal Mediterranean style produce: Grown either in heated greenhouses in the UK or under protection (sometimes heated) overseas. Examples include tomatoes, courgettes, aubergines, peppers, and salads.**
- **Pre-prepared, trimmed or chopped produce: Examples include salad bags and bowls, fruit salads, and cut pineapple.**
- **Fragile or highly perishable foods: These foods are prone to spoilage, which represents a waste of the energy embedded in their production, transport, and storage.**

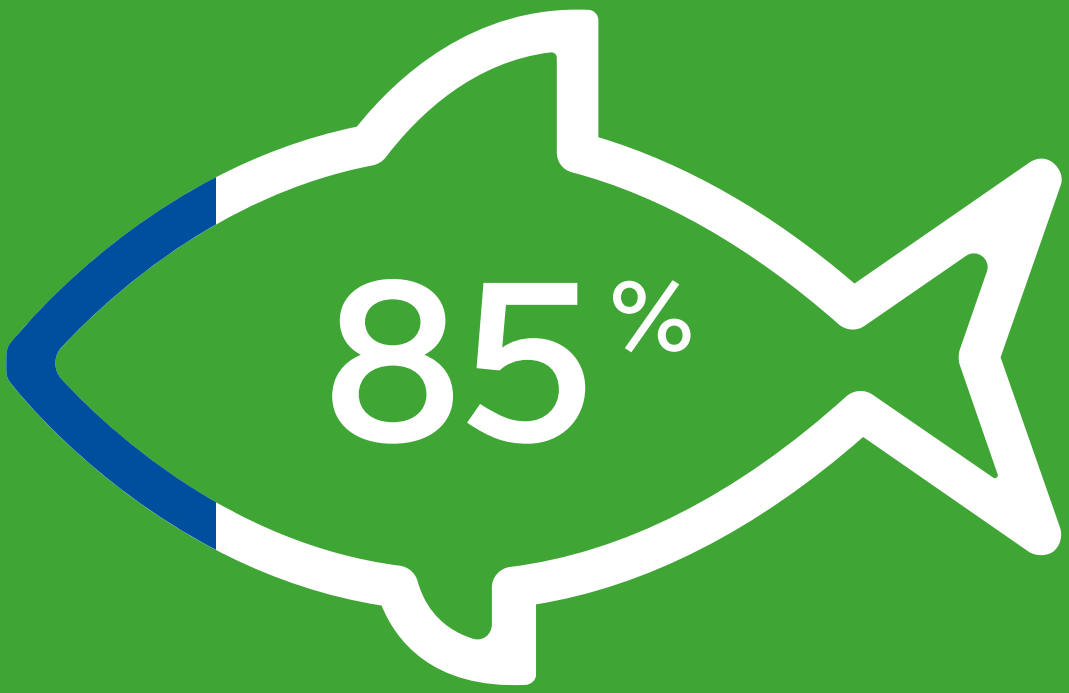
Currently few of the age groups monitored by the NDNS are managing to eat the recommended at least five portions of fruit and vegetables per day, with just 8% of children aged 11-18 and 31% of adults aged 19-64 achieving this.[1] Increasing awareness and nudging consumers towards more sustainably sourced fruit and vegetables and how to reduce waste will help bring down emissions whilst achieving the recommended 5-a-day. Based on current emission, land use, and water use data, a plant-based diet which includes fruit and vegetables to recommendations, will still lower GHG emissions significantly.[41,42]

Consuming fruit and vegetables out of season mitigates any environmental benefits.[6,54]

Consume fish from sustainable sources

Consuming sustainably sourced fish is paramount for the environment: 85% of fisheries are now fully exploited or overfished, the marine vertebrae population has halved in the last 50 years and there is extensive degradation of the marine ecosystem.[6]

Sustainable fish sources are those that can continue indefinitely and do not have an impact on the wider ocean ecosystem. A 'certified fishery' has received certification from the Marine Stewardship Council (MSC). The MSC standards are based on three principles: sustainable fish stocks, minimizing environmental impacts, and effective management.[90]

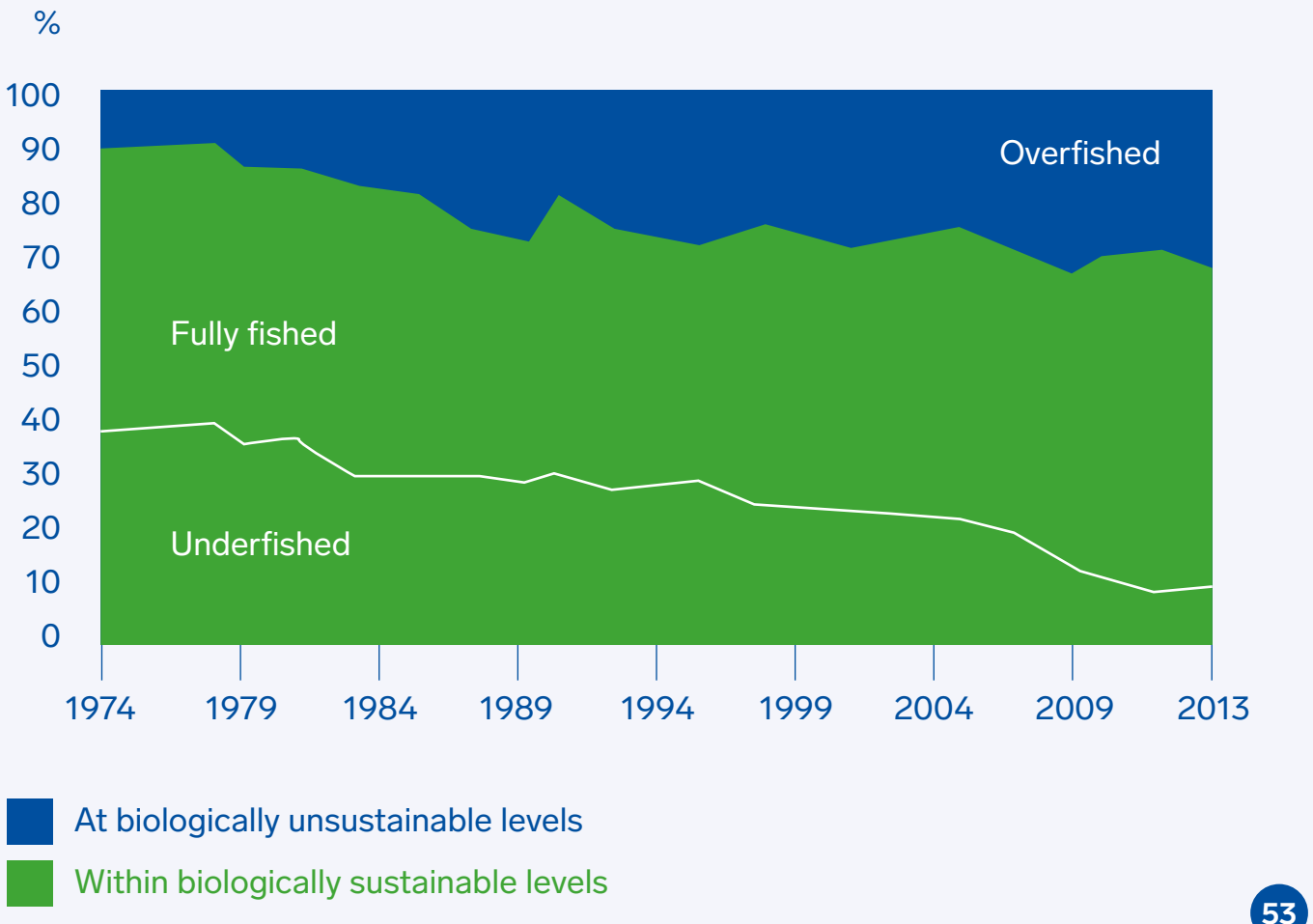


85% of fisheries are fully exploited or overfished[6]

Additionally for farmed fish, the Aquaculture Stewardship Council (ASC) logo represents sustainably farmed fish.[91] The Marine Conservation Society (MCS) maintains a "Good Fish Guide" which can be used to identify which fish and shellfish species are most at risk and which are most sustainable.[92]

It is important to eat a variety of fish species both for health and sustainability. The recommendation remains that the public should consume two portions of fish, one of which should be oily, per week. Reliance on marine foods should be for long-chain omega 3s and iodine only as other sources of lean and plant-based proteins are plentiful in typical UK diets.

Figure 4.8: The state of our fisheries: Global trends in the state of world marine stocks since 1974[90]



Sustainable hydration

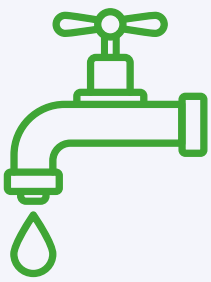
Tap water remains the most sustainable and healthiest source of hydration and should always be recommended as such. Tea and coffee, although contributing slightly more GHG emissions (3.5% of the UK's dietary carbon footprint) compared to tap water, are still good sustainable hydration sources.[17,52]

However, soft drinks and fruit juice are the third biggest contributors to our dietary GHG emissions (9-10%).[17,52] Soft drinks require more energy to produce and have significantly higher transport costs as a result of a range of ingredients. Although the government's recent taxation on sugary soft drinks will bring about appreciable health benefits, it will do little to help reduce the environmental burden as consumers are simply switching to unsweetened variants rather than reducing their overall consumption.[93] The impact of plastic waste from drinks packaging is also significant, and efforts should be made to encourage people to use refillable water bottles or public water fountains to rehydrate, plus to choose easily recyclable packaging.

Tea and coffee are commonly referred to as an important and healthy source of hydration.

Soft drinks and fruit juice are the third biggest contributors to dietary GHG emissions.[17,52]

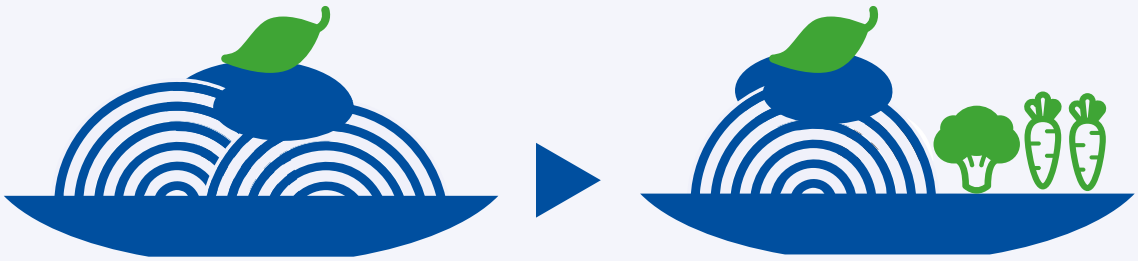
Tap water remains our most sustainable source of hydration.[17,52]



Eating less energy-dense foods

In the simplest terms, overall dietary intake in the UK is too high, especially of energy dense, micronutrient poor foods.[1] The majority of the population needs to significantly reduce energy intake if we are to make headway with reducing obesity and obesity related diseases.[94] Currently, 63% of adults and 28% of children aged 2-15 years are overweight or obese.[95] To tackle this, the government is taking aggressive action to curb the offerings of high sugar foods, portion sizes, and calories by all out of home food suppliers.[93,94,96] Correcting the over consumption of food and in particular animal proteins has been recognised as the most significant change that can be made to improve the sustainability of diets.[97]

Figure 4.9: An example of altering energy density and improving sustainability in a typical meal



Spaghetti Bolognese
Made with 100% beef mince and a large portion of spaghetti

Spaghetti Bolognese
Made with 50% beef and 50% beans and pulses, average amount of spaghetti with a side of carrots and broccoli

Waste less food and drink

Wasted food and drink, regardless of its source, is harmful to the environment because of all of the land, water and energy used in its production as well as the release of potent GHGs (methane) by decomposing organic matter in landfill.[6,54] Household waste accounts for 70% of all food and drink waste which equates to approximately 25% of all food purchased.[5] More importantly, 60% of food waste is avoidable. WRAP estimates that the UK needlessly wastes 6 million tonnes of food every year, which is responsible for 20 million tonnes of GHG emissions (4% of UK's total GHG emissions).[5] Food waste has continued to gradually increase and, without government policy in place, it is unlikely to reduce. The government has been advised that policies to reduce food waste are paramount if the UK is to meet its future carbon foot print targets.[19,20]

70%

Household waste accounts for 70% of all food and drink waste which equates to approximately 25% of all food purchased.[5]

60%

60% of food waste is avoidable.[5]

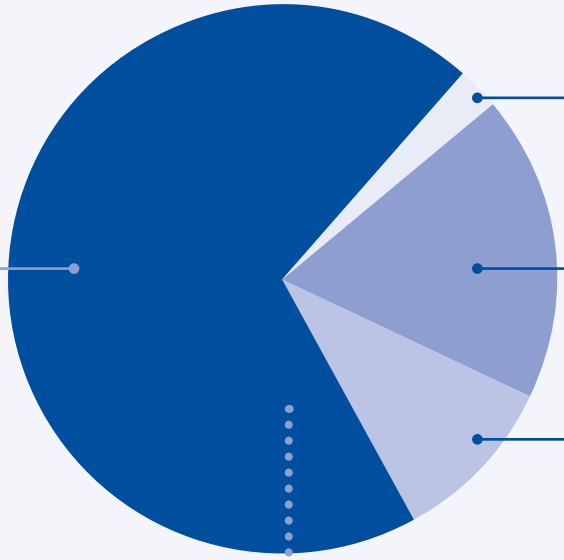
Figure 4.10: Courtauld Commitment 2025 Food Waste Baseline

The Courtauld Commitment 2025 baseline covers food waste from UK households, retail, manufacturing, and the hospitality industry and food service sector in 2015.[98]

10.2 million tonnes total waste

156kg per person

Waste by sector



Household
7,100,000t (£15bn)

Retail
260,000t (£0.8bn)

Hospitality industry + food service sector
1,000,000t (£2.9bn)

Manufacturing
1,850,000t (£1.4bn)

Household waste

Avoidable

Most of this is avoidable fruit and vegetable (especially salad) waste.

£470

The average household lost £470 a year because of avoidable food waste, whilst those with children incurred a loss of £700, with the average person in the UK losing £200 a year.[99]

1.5Mt less food waste per year by 2025 if Courtauld Commitment 2025 targets are met

What is NOT meant by an environmentally sustainable diet

Given the broad definitions of sustainable diets, it is also important to consider what is not meant (for the purposes of our policy and this reference guide) by an environmentally sustainable diet.

Vegetarian or Vegan diets

As per the Fischer and Garnett definition[32] and modelling undertaken on UK dietary habits,[17,31,34,35,44,52,58] sustainable diets can be, but do not necessarily equate to vegetarian or vegan diets, although these do have a lower environmental impact than the typical UK diet. Research has shown that linking more sustainable or "plant-based" eating to vegetarianism and veganism will significantly lower the likelihood of the majority of the UK population changing their eating behaviour.[100] Therefore, for the majority of the UK population, emphasis should be placed on a significant reduction in meat and dairy consumption alongside increasing consumption of plant foods to improve the sustainability and nutritional quality of a diet.

The BDA believes that Dietitians are best placed and able to provide sustainable diet messages to meet all types of circumstance/eating preferences, including vegetarian and vegan diets.

Animal Welfare

Although animal welfare is an important consideration for many people when thinking about their food choices, it is not something that is usually within the definition of an environmentally sustainable diet.

However, it is beneficial that dietitians understand animal welfare issues, as they can be key motivators for some individuals to adopting a diet lower in meat and dairy. For more information on animal welfare standards the following links may be helpful:

UK Government Animal Welfare policy:
https://www.gov.uk/guidance/animal-welfare

RSPCA Farm Animal Welfare assurance scheme:
https://www.rspcaassured.org.uk/farm-animal-welfare/

Compassion in World Farming guide for consumers:
https://assets.ciwf.org/media/7432869/compassionate_food_guide_web_download.pdf

5

Summary of specific nutritional considerations

Summary of specific nutritional considerations

Some dietitians and consumers have concerns that an environmentally sustainable diet places individuals at risk of deficiency for some key micronutrients and protein. The evidence-based Eatwell Guide and some international recommendations e.g. in Sweden and Germany demonstrate that a healthy sustainable diet that is predominantly based on plant foods can be nutritionally adequate.

For most adults who choose to consume the recommendations set out in the Eatwell Guide of reduced amounts of meat, dairy, and eggs and increased plant based protein sources, nutritional deficiency is unlikely. This section sets out some of the specific nutritional considerations of eating a more environmentally sustainable diet - and some of the population groups which dietitians should be aware of. Full details on these considerations and ideas on alternative sources of key nutrients are available within the full toolkit resources.

Protein

There is often concern that reducing meat and dairy intake will lead to reduced protein intake. The Reference Nutrient Intake (RNI) for protein is 0.75g per kilogram body weight per day in adults. This equates to approximately 56g/day for men and 45g/day for women aged 19-50 years in a person of healthy weight. However, NDNS data[101] shows that most adults eat more protein than they require (87g for men and 67g for women). The reduction in protein food intakes required to balance the Eatwell Guide can easily be achieved by a shift away from meat, meat products and animal proteins.

Including more plant protein sources will increase variety in the diet, provide antioxidants and go towards achieving 5-a-day, as well as boosting fibre intake. As covered previously, fish can be consumed for long chain omega 3 fats, iodine and other micronutrients, but not for protein.

More detailed nutritional information on protein and plant based proteins is available in the One Blue Dot resources for dietitians:

bda.uk.com/obd_nutritional_considerations

bda.uk.com/obd_key_nutrients

Iron

Red meat is the best source of bioavailable iron and for many people, a sustainable diet would still include some meat. SACN modelling estimates that red and processed meat contributes 12% of men's total iron intake and 9% of women's. This same research has shown that reducing red meat amongst those in the UK who consume large amounts (90g+) would have little impact on iron status of the adult population.[102]

Men are unlikely to struggle to meet iron requirements from plant-based sources due to relatively lower iron requirements. However, in more vulnerable groups, such as toddlers, girls and women of childbearing age, low iron intake is a concern as low iron stores remains a health issue (even with current intakes of red meat). Fifty-four percent of girls aged 11-18 and 27% of women aged 19-64 have iron intakes below the Lower Reference Nutrient Intake.[1] However, when assessing the prevalence of poor iron status (below the threshold for both haemoglobin and plasma ferritin), this only translates to 9% of girls aged 11-18 years old and 5% of women aged 19-64 (NDNS Yr 7&8).[101]

In their report SACN highlighted the discrepancy between the high proportion of certain population groups having iron intakes below the recommended amounts and the low prevalence of poor iron status in these groups. They suggested this as an action for research as the DRV may be set too high.[60]

Interestingly individuals following a plant-based diet have adequate iron intakes and meet national and international recommendations.[66,67,102] Despite relatively lower iron bioavailability and lower overall iron stores, evidence of an increase in iron deficiency anemia amongst those consuming diets solely placed on plant foods, such as vegetarian diets, is lacking.[103]

Up to a point, the absorption rates of iron increase in individuals with low iron stores over time. In fact research shows that individuals can adapt to inefficient iron absorption in order to maintain iron status.[104,105] This may be due to an adaptation to the inhibitory effects of phytate on non-haem iron absorption.[106,017,109] A study showed that after consuming a high-phytate diet for eight weeks, non-haem iron absorption increased by 41% compared to baseline values.[108]

According to the 2016 position paper of the Academy of Nutrition and Dietetics[110], the absorption process appears to adapt effectively in the case of Western vegetarians because their haemoglobin values, and most other measures of iron, are within the normal range although iron stores are typically lower but not abnormal.

Alternative sources of iron for vulnerable groups include fortified breakfast cereals, nuts and seeds, or vegetables. Recent research has found the non-haem iron found in soya, is absorbed relatively well and does not appear to be affected by the classic inhibitors of iron absorption.[146,147]

Supplements are a useful option, although a number of studies have identified low adherence to supplementation, in particular to iron supplementation.[117-120] This may be due to side effects, lack of understanding or inconvenience . Nonetheless, policies that advocate fortification with iron or the provision of supplements (in addition to current folic acid and vitamin D supplements) may be required and should be supported by dietitians.

More information for the public on iron:

bda.uk.com/foodfacts/iron

More detailed nutritional information on iron and sustainable diets is available in the One Blue Dot resources for dietitians:

bda.uk.com/obd_nutritional_considerations

bda.uk.com/obd_key_nutrients

Zinc

Red meat is also a significant source of zinc in the UK diet, and animal foods more generally are a major source of zinc. Good plant food sources of zinc include fortified breakfast cereals, beans and lentils, sunflower seeds, pumpkin seeds and nuts. Food preparation methods such as soaking and sprouting of beans, grains, nuts and seeds can improve its absorption.

SACN modelling estimates that red and processed meat contributes 32% of men's total zinc intake and 27% of women's.[60] Children in particular have low zinc intake, with 27% of girls aged 11-18 and 18% of boys reporting intakes below the LRNI.[101]

As with iron, for vulnerable groups consuming red meat below the SACN recommendations, supplements may need to be considered. Like iron, the bioavailability of zinc from plant sources is likely to be lower due to the presence of phytates.

Fully understanding the impact of reduced zinc bioavailability and intake has been somewhat hindered by the lack of sensitive clinical measures for zinc status.[103]

More detailed nutritional information on zinc and sustainable diets is available in the One Blue Dot resources for dietitians:

bda.uk.com/obd_nutritional_considerations

bda.uk.com/obd_key_nutrients

Calcium

A reduction in milk and dairy consumption would make an important contribution to a reduction in our environmental footprint. The Eatwell Guide has taken this into consideration as well as the need to meet the nation's calcium needs by reducing the recommended dairy contribution to the UK diet from 11 to 8% by food weight. Some concern exists about the impact for certain population groups falling below the LRNI: 22% of 11-18 females, 11% of 11-18 males and 11% of 19-64 women.[115] It is therefore important that dietitians are able to make recommendations to

patients to ensure they are consuming sufficient calcium, and this can include dairy products.

It is important to note that milk is not the only major contributor of calcium in the diet. Milk and dairy products contribute 34% of calcium intakes in 11-18 year olds whilst cereal product (mainly from the mandatory fortification of white flour) contribute 39%. Similarly with adults aged 19-64 years, dairy accounts for 34% and cereal products for 31% of total calcium intakes[101]. While milk and milk-products form 43% of calcium intake in the UK population, other sources, including especially white bread and products made with white flour (which are fortified) also play a significant role.[102]

Most non-organic plant-based drinks and yogurt alternatives are fortified with calcium to a similar level and with comparable bioavailability to dairy. These have the added advantage of providing vitamin D (not present in UK dairy) which will further enhance calcium bioavailability and contribute to bone health.

As well as considering calcium amounts in food, we also need to take into account bioavailability. Milk and milk-products have calcium bioavailability of around 30%. Bioavailability of calcium from plant foods, which is related to oxalate content of foods and, to a lesser degree, phytate and fibre, is an important consideration.

Absorption from high-oxalate vegetables, such as spinach and Swiss chard, may be as low as 5%, and so despite their high calcium content, they cannot be considered good sources. In contrast, absorption from low-oxalate vegetables, such as kale, turnip greens, Chinese cabbage, and pak choy, is about 50%. Soya foods such as calcium-set tofu and calcium-fortified soya drinks have similar bioavailability to milk and so can be considered good alternatives to dairy.[124-124]

Dietary patterns in East Asia can be a useful consideration here – studies have shown that high intake of fruit and vegetables is associated with better bone health in these populations, despite the high incidence of milk intolerance. In client groups where calcium excretion is a concern, dietitians can advise on other lifestyle factors which can influence this e.g. smoking, caffeine intake and the benefits of physical activity.

More information for the public about calcium:

bda.uk.com/foodfacts/Calcium

More detailed nutritional information on zinc and sustainable diets is available in the One Blue Dot resources for dietitians:

bda.uk.com/obd_nutritional_considerations

bda.uk.com/obd_key_nutrients

Iodine

Similar to calcium, NDNS data has shown that iodine intake is low amongst children and women and is a particular concern for pregnant women. 27% 11-18 girls, 14% of 11-18 boys and 15% of 19-64 women are estimated to be below the LRNI for iodine.[1] However, it is important to note that iodine intakes are a poor measure of adequate iodine status and according to the latest NDNS, iodine status as measured by spot check urinary analysis, was found to be adequate across all age groups.[101]

Iodine content in milk varies significantly, depending on seasons and farming practices. Iodine in milk is a by-product of iodine added to animal feed or used as a disinfectant, and organic farming practices or areas of origin can lead to lower iodine content.[125]

Plant-based drinks are rarely fortified with iodine, however, with the current focus on this mineral, the leading soya brand is now fortified with iodine. Iodine supplements should be considered for at risk groups or those with higher demands e.g. pregnant and lactating mothers. Iodine supplements are of mixed quality, and patients should be recommended supplements containing “potassium iodide” or “potassium iodate” and they should not exceed the daily adult requirement of 150 mcg. Supplements created from seaweed and kelp should be avoided as total iodine content can vary significantly and it is possible to overdose.[126]
All marine-source foods are good sources of iodine.

More information for the public on iodine:

bda.uk.com/foodfacts/Iodine

More detailed nutritional information on zinc and sustainable diets is available in the One Blue Dot resources for dietitians:

bda.uk.com/obd_nutritional_considerations

bda.uk.com/obd_key_nutrients

Vitamin B12

Vitamin B12 is only available from animal sources and a few fortified plant foods - breakfast cereals, plant-based drinks, fortified yeast extract such as Marmite. Even so, for most adults still consuming reduced amounts of meat, dairy, and eggs, achieving the 1.5 µg/day recommended by government should not be a challenge.[127] Supplements are strongly recommended for individuals following a vegan diet.

More detailed nutritional information on zinc and sustainable diets is available in the One Blue Dot resources for dietitians:

bda.uk.com/obd_key_nutrients

Omega 3

As stated, SACN advice remains that people should consume two portions of fish a week of which one should be oily[128] in order to ensure sufficient long chain omega 3 intake. A portion is 140g of fresh fish or one small can of oily tinned fish. All fish and aquatic products should be consumed in small quantities and from certified fisheries, and people encouraged to eat a diverse range of fish, including from more sustainable populations. NDNS data[101] indicates that all age groups on average consume less than the recommended amount of oily fish.

Non-marine sources of the omega 3 fat, alpha linolenic acid, include nuts and seeds e.g. walnuts and pumpkin seeds; vegetable oils e.g. rapeseed and linseed; soya and soya products.[129] However, research indicates these are good sources of alpha-linolenic acid (ALA), but are much less effective sources of eicosapentaenoic (EPA) and docosahexaenoic acid (DHA), which are related to health benefits.[130] Algae may be a promising sustainable source of EPA and DHA for the diet.[131] However, products available produced from algae are currently very expensive.

More information for the public on Omega 3:

bda.uk.com/foodfacts/omega-3

Selenium

Although there is good selenium intake in the very young, intakes are exceptionally low in all other age groups for both men and women with 25-76% falling below the LNRI[1]. Despite fish being an exceptionally good course of selenium, cereal products and meat are the key sources in the UK diet.[1] 5-6 Brazil nuts daily will meet recommendations for older teens and adults, whilst 2-4 will meet the needs for younger age groups.

More detailed nutritional information on zinc and sustainable diets is available in the One Blue Dot resources for dietitians:

bda.uk.com/obd_key_nutrients

Vitamin D

There is a significant drive for vitamin D food fortification in many countries, including the UK, due to the prevalence of sub-optimal status and lack of dietary sources.[149,150]

Studies comparing vitamin D status between meat eaters and vegetarian and/or vegans reflect lower intakes and status in vegans and vegetarians. However,

vegans still maintain serum 25(OH)D levels above 50nmol/L in winter and summer months.[151,152]

Red meat, although providing some vitamin D, has a low concentration at 0.2-0.8mcg per 70g serving. Additionally, unlike other countries such as the US, UK dairy is not standardly fortified with vitamin D. Thus, reducing intakes of both meat and dairy will have little, if any, impact on vitamin D status or vitamin D related health outcomes.

More information for the public on Vitamin D:

bda.uk.com/foodfacts/vitamin_d

More detailed nutritional information on zinc and sustainable diets is available in the One Blue Dot resources for dietitians:

bbda.uk.com/obd_key_nutrients

6

Motivators and opportunities for a more sustainable diet

Motivators for a more sustainable diet

Food price

All food prices have in recent years risen at rates higher than wages, and meat and fish have been no exception.[132] As already fairly expensive commodities, meat and fish have become less affordable, so people may be driven to reduce their intake for financial reasons.

Taste

One of the biggest drivers for foods choices is taste and/or taste perception. Therefore, to encourage the behaviour change needed to adopt a sustainable eating pattern, recommendations must ensure that taste will not be compromised and convince individuals that this is the case.

Accessibility

We can choose from a wider variety of food and drink products, and personalise our diets more easily than at any time in human history. Despite some areas of concern (e.g. food deserts in cities, rural villages), new product development, access to world foods, and online retail make it easier to access the foods we want in the UK. Plus, apps/digital technology mean we can identify products which meet our preferences.

The more accessible sustainable food choices are made, the more likely it is for consumers to eat more sustainably. Therefore, an integrated multi-organisational approach is fundamental, bringing together government, NGO's, food providers, local authorities, and consumers.

Health

As has been discussed throughout this reference guide, reducing red meat intake in particular and increasing plant food intake is beneficial to health. Some people may be motivated to improve their diet in this way and as a consequence improve the environmental sustainability of their diet.

International considerations

The impact of our food choices and over consumption on the rest of the global human population may well be a driver for some. Nearly 800 million people in the developing world are undernourished and about two billion are deficient in key micronutrients.[133] There is an increasing demand for food from a growing human population, and a challenged food system that is already stressed by the degradation of global ecosystems.[134] The FSA's 'Our Food Future' Report highlighted a range of concerns from members of the public about the safety and sustainability of the food system at a global level.[135]

Food Waste

Linked to food prices, some people will desire to waste less food, potentially for environmental but also for financial reasons. The total cost of wasted food in UK homes is estimated to be worth £13 billion per year.[136]

Popular champions

UK food writers like Jack Monroe and Jay Rayner, celebrity chefs like Hugh Fearnley-Whittingstall and environmentalists like Sir David Attenborough have popularised discussions on eating well for the planet with their followers. Although growing awareness has not translated into behaviour change for most, this could still be used as a driver alongside other strategies.

Animal welfare

Many people choose to reduce their meat or dairy intake for ethical reasons related to animal welfare, and in doing so, reduce their environmental impact. This is a complex area as animal welfare considerations are not necessarily entirely compatible with sustainable diets - often the most environmentally sustainable forms of meat or dairy production have the worst animal welfare implications.

This concern for animal welfare extends to those animals harmed indirectly by the production of meat, fish or dairy, such as deforestation for cattle ranching and soya based animal feed, or environmentally unsustainable fishing practices.

Language

Many perceive eating plant-based food as restricted to vegetarians or vegans. A 2018 conference looked at 'How Language Can Advance Sustainable Diets'[100] and found that the descriptions of more sustainable, plant-based foods can play a critical role in this negative perception. It was shown that putting these dishes in a vegetarian section of a menu can reduce consumer ordering by 56%. Similarly, calling a dish "healthy" - a typical term used for plant-based food - can suppress perceptions of taste and how filling a food will be. New research, however, is finding that changing the language of food on menus and in dining environments can help overcome these perceptions and significantly impact consumer behaviour.

Recent experiments suggest that giving vegetables indulgent names and descriptions can increase sales.[153] Researchers changed the names of vegetables to sound more indulgent (e.g., "slow roasted caramelised zucchini bites") and this led to a 25% increase in the number of diners choosing them compared to basic labelling ("zucchini").

Creating supportive environments

Individual lifestyle counselling involving motivational and educational sessions with trained health professionals can be effective in promoting more sustainable diets, but are unlikely to be a scalable option. Research has shown that the environments within which food choices are made (physical, economic, digital, social, cultural, and more) exert a very significant impact on decisions people make. The environments we navigate every day contain a huge number of cues that we interact with, mostly below the level of awareness. Research points to a number of strategies that can be harnessed to reshape food environments into ones that support healthy sustainable diets. However, much of the research has been done in experimental or virtual settings and more work needs to be done in real consumer environments to understand what works.

Increasing availability

Increasing the relative availability of healthier, more sustainable food choices (e.g. increasing the proportion of vegetarian sandwiches from 25% to 50%) may lead to more consumers choosing veggie options. A recent review of interventions in vending machines (in schools, universities, hospitals, and worksites) found that five of the seven studies that increased the availability of healthier foods saw increased sales of these foods with no loss of overall sales.[154] Making more choices available means that there's greater variety for different tastes but it also has the effect of helping to normalize these options. This is especially important for meat-free choices that often suffer the stigma of being seen as only for those who identify as vegan or vegetarian.

Decreasing portion size

Decreasing the portion size of meat in a restaurant meal has been shown to decrease meat consumption, but just as important, the research also found that there was no negative impact on customers' perceptions of their restaurant experience.[155]

Research has shown that placing vegetarian meals at the end of a menu and in a separate section decreases the selection of those meals even by vegetarians.[157]

Positioning

A recent systematic review of evidence on "nudges" to reduce meat consumption found that positioning vegetarian choices to give them priority over meat items could be a promising way to reduce the demand for meat in some settings.[156] In these experiments, meat options were repositioned to appear after, rather than before, vegetarian options in online meal booking systems or on restaurant food menus. Other research has shown that placing vegetarian meals at the end of a menu and in a separate section decreases the selection of those meals even by vegetarians.[157]

Promoting shifting social norms

Marketers often draw attention to what others are doing as a way to influence consumers' choices. Most famously, for years many McDonald's restaurants displayed "over 99 billion served" on their signs. Some studies have looked at the effect of promoting sustainability norms on food purchases. As part of a survey, researchers at Stanford told people standing in line at a café that "over the last 5 years, 30% of Americans have started to make an effort to limit their meat consumption". Customers were more likely to order a meat-free lunch (34%) compared to a control condition (17%).[158]

7

Barriers to more sustainable diets

Barriers to more sustainable diets

Awareness

Despite the growth in people interested in sustainable diets and reducing meat consumption, as mentioned above, many people still show general ambivalence to the environmental impact of their food.

Research by Chatham House indicates that many people are not aware of the environmental impact of meat/livestock production, especially compared with other protein sources.[137] Despite being the joint fourth biggest contributor to climate change, fewer than 30% of those surveyed across 12 countries believed meat and dairy production to be a major contributor to climate change, considerably below those who highlighted heating buildings and waste disposal, despite them contributing significantly less to emissions.[138]

Convenience and difficulty

The importance of convenience to people's food choices is not unique to sustainable diets, it also impacts on people's willingness or ability to consume higher quality, healthier diets.[139]

Cooking and preparing fresh food, and reducing intakes of highly processed foods, in order to eat more sustainability challenges convenience. In Our Food Future, the Food Standards Agency found young people in particular were concerned that moving away from highly convenient foods would be difficult.[135] YouGov have found that nearly one in eight people in the UK avoided cooking food from scratch.[140] Taste is important and skills to recognise food are falling, along with preparation skills, so recommendations should be feasible.

Additionally, any changes to day to day behaviour is a significant barrier to most consumers, therefore encouraging someone reliant on convenience foods to cook more of their meals will be a significant barrier to overcome.

Food culture

UK food culture includes a significant consumption of meat, fish and dairy. The BBC's Good Food Nation Survey 2016 found that many people still regard meat as a core part of every meal - (49%) stating that 'a meal isn't a meal without meat'[141]. Studies have shown that there is an unwillingness to accept the role of meat in contributing to climate change and a resistance to changing their own meat consumption.[142]

As has already been highlighted, men eat considerably more meat than women, above the currently recommended upper limit from SACN. Meat has historically had an association with power, wealth and success, and more modern stereotypical associations of meat with strength and virility have been exploited by advertisers. Modern studies have found participants rate omnivorous men as more masculine than vegetarian men.[143] Messages should be around meat reduction and advice should consider challenging groups.

Expense

Price remains one of the strongest influencing factors that governs choice. There is a perception that healthier eating, especially the higher consumption of fresh fruit and vegetables, is more expensive.

It has been shown that positive pricing policies on healthy foods can influence dietary choices.[144,145] Due to inequalities in society, however, there are limits for some communities as to how much control they actually have over their food choices. Adults from lower income groups, for example, are known to be more likely to cite cost as an important influence on their eating habits. Recent research has shown, the lower the income, the higher the proportion of income is spent on food.[148]

Dietitians should have the skills to show how a more sustainable diet can be cost effective in relation to a 'traditional' diet, especially by replacing meat with plant protein alternatives such as beans and pulses. This may also need to be accompanied with training to help provide the cooking skills necessary to prepare such a diet. A recent costing based on the Eatwell Guide suggested making changes to the diet to improve sustainability would not lead to significant change in the price of the diet.[43]

Modelling based on the Eatwell Guide

To achieve the health gains in the Eatwell Guide, the UK population would need to increase consumption of fruits and vegetables, carbohydrate-based foods, fish, and legumes, while reducing consumption of red, processed, and white meats, dairy products, and foods high in fat and sugar. Scarborough et al found that the impact on total food and drink costs for the individual would on average be insignificant, actually reducing slightly from 2016 - £6.02 to £5.99.[46]

However, the paper notes the possible impact on the agricultural system on the overall economy.

8

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