
The Case for Protein Diversity

Accelerating the adoption of more sustainable eating patterns in the UK



Understanding dietary sustainability requires the consideration of a wide range of complex and interrelated factors, including the environment, nutrition, health and cultural attitudes towards food. In order to address this complexity and promote more sustainable diets, easily understood advice is needed, which takes account of the complexity of the issues involved. To be effective this advice should be both socially and economically acceptable to the public.

This report examines the impact of the UK's protein-rich main ingredient choices, investigating whether encouraging greater diversity in those choices could result in more sustainable diets by 2030.

The report finds that promoting a greater diversity of protein choices in the UK would, in most cases, be an acceptable message that would lead to better overall outcomes for both health and the environment.

Authors:

Tom Cumberlege, Dr John Kazer, Jamie Plotnek

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Could greater protein diversity in UK food choices result in better sustainability and health outcomes?

The individual and collective choices we make in the UK about the food we eat have a number of local and global implications for the economy, our society and the wider environment. These effects range from climate change and biodiversity loss, through to obesity and ill-health.¹ It is critical that the UK starts addressing these issues now to ensure a long term transition to a more sustainable and secure food system.

To support this transition the Carbon Trust has undertaken detailed review and analysis of available evidence in order to better understand the impact of some of the most popular protein-rich main ingredients eaten today in the UK, as well as some less common options that have the potential for wider adoption. This report uses a quantitative and qualitative framework to demonstrate how increasing protein diversity can provide an effective pathway to a more sustainable, healthy and secure diet. Within the context of this report, diversity refers specifically to eating the recommended daily amounts of protein, avoiding overconsumption.

Based on this research, recommendations are provided on the opportunities and pathways for accelerating change towards more sustainable eating patterns in the UK. This includes suggestions for effective actions to support this transition that could be taken by individuals, businesses, government, campaigners and other influencers, such as food writers or celebrity chefs.

Sustainable diets in context

There has been a rapid growth in global population since the middle of the twentieth century.² At the same time technology has improved and food production has increased to keep pace with demand. But as living standards have been raised and supply chains have expanded and increased in complexity around the world, a significant strain has been placed on the long term ability of the planet to meet human needs and wants.³

The food we eat and the food we throw away has a considerable impact on both the UK and the planet as a whole.⁴ This can be seen in:

- the social and economic costs of unhealthy diets;
- the greenhouse gas emissions from agriculture and food waste;
- the impact on water quality and availability; and
- the loss of biodiversity from turning forests into farmland.

This means that there is both a national and a global imperative to transition towards a more sustainable system for both the production and consumption of food.⁵ But understanding food is a highly complex area, with long term, interrelated, and geographically remote consequences that are not always visible or apparent, especially to the end consumer. Issues go far beyond just the human food sector, as agricultural land and water is increasingly in demand to produce crops for other sectors, such as pharmaceuticals and biofuels.

1 Tilman, D. & Clark, M. (2014) *Global diets link environmental sustainability and human health*. Nature, 515(7528), pp.518–522.

2 UN (2014) *Concise Report on the World Population in 2014*. United Nations Department of Economic and Social Affairs. New York.

3 Royal Society (2009) *Reaping the benefits: science and the sustainable intensification of global agriculture*. The Royal Society. London.

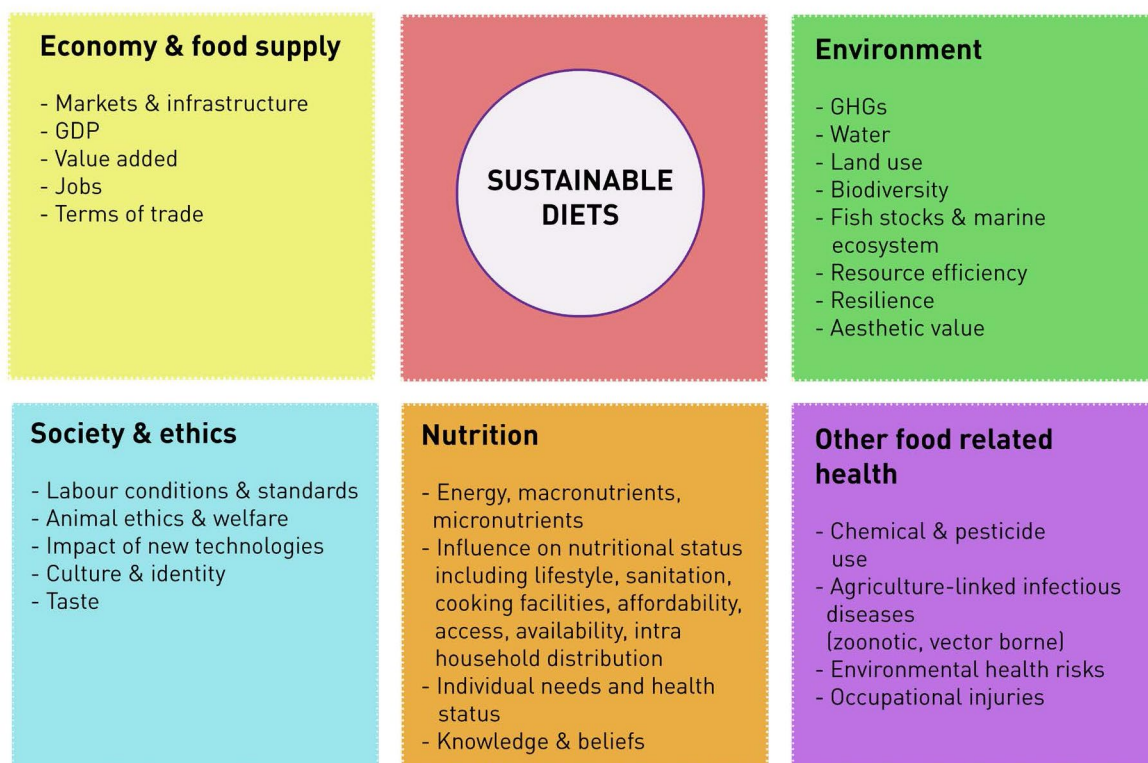
4 Johnston, J.L., Fanzo, J.C. & Cogill, B. (2014) *Understanding sustainable diets: a descriptive analysis of the determinants and processes that influence diets and their impact on health, food security, and environmental sustainability*. Advances in nutrition, 5(4), pp.418–29.

5 Godfray, H.C.J. et al. (2010) *Food security: the challenge of feeding 9 billion people*. Science, 327, pp.812–818.

Demand for land and water resources also impacts the biodiversity of earth's natural environment, increasing threats to species and fragile ecosystems. As a result of this there has been a significant amount of recent effort from academics, campaigners, governments, and some notable parts of the food and agriculture industries into understanding these issues and investigating how to reduce the impact of producing food and encourage more responsible consumption.⁶

It is worth noting here that although this paper focuses on sustainable consumption for the UK, food systems are of course a global issue. For example, there are important challenges around ensuring greater levels of equity and access to sustainable diets in low-income developing countries, which are outside the scope of this paper.

To give a picture of the complexity involved in sustainable diets, a number of the key factors, and their issues and interdependencies are illustrated in the chart below.



Source: Adapted from Garnett, T. (2014) *What is a sustainable healthy diet?*. Food Climate Research Network. Oxford.

Many of these issues are starting to be addressed by industry and government, and there are a growing number of initiatives focusing on improving the sustainability of food production, or reducing food waste. Successes have only served to highlight the tremendous, untapped opportunity to improve efficiency in areas such as agriculture, manufacturing, packaging, logistics and disposal. For example, a study carried out for EBLEX of 60 beef and sheep farms found that it was possible to directly link reductions in greenhouse gas emissions produced by livestock to increased profitability for farmers.⁷ In many cases there is a clear business case for improving efficiency. This can often be achieved without the involvement or awareness of the consumer. But improving production efficiency without changing demand will be insufficient to meet the challenges of providing a sustainable, secure global food system.⁸

As well as changing how food is supplied, it is therefore also necessary to look into methods for promoting more sustainable demand through behaviour change. This will have a crucial role to play in changing consumption patterns in order to reduce food waste, as well as adjusting the intake of protein and other dietary elements to improve environmental and health outcomes.

6 Garnett, T. et al., 2015. *Policies and actions to shift eating patterns: What works?*. Chatham House. London.

7 EBLEX (2012) *Down to Earth: the beef and sheep roadmap phase 3*. Agriculture and Horticulture Development Board. Kenilworth.

8 Bajželj, B. et al. (2014) Importance of food-demand management for climate mitigation. *Nature Climate Change*, 4(10), pp.924–929.

Main ingredient protein choices and rules of thumb

The question investigated in this paper specifically looks at changing one aspect of food consumption – increasing the diversity of main ingredient protein choices. This was selected because meals in the home are frequently built around these dietary elements.⁹ They often account for the most significant proportion of the environmental and health impact of a meal, as well as being the most expensive element.¹⁰

Within the UK meat is the most common source of dietary protein. In fact the majority of the population can be classed as high meat eaters.¹¹ For much of the population, excluding the elderly, there is also a general overconsumption of protein.¹² As such a greater diversity of protein-rich main ingredients is likely to involve a downward shift from current levels of meat consumption, as well as an overall reduction in protein intake.

The challenge with changing patterns of demand is that dietary choices are deeply embedded within our socio-cultural identity and do not change easily. Although these are also well-established, change can occur and does occur on a generational timescale. If we compare what we eat in the UK today to when we first started collecting nutritional data nationally, it shows a remarkable transformation in just over two generations to embrace a far wider selection of culinary styles and tastes.¹³ However, it should be noted that this includes similar levels of total meat consumption.

But the British have the potential to be comparatively adventurous eaters when compared with other developed nations. This willingness to adopt new food choices is a positive sign that change is possible. But the challenge lies in ensuring that the direction, type and speed of the change are on course to meet various social, health and environmental challenges.

Given the complexity of the issues involved in changing behaviour, positive shifts are often achieved through promoting the adoption of heuristic solutions – simple rules of thumb – which will tend to result in better overall outcomes. The intention behind developing and promoting these rules is that in most cases this simple guidance will create net positive change.

For example, there are high levels of awareness for the government's 5 A Day campaign, launched in 2003 following a recommendation from the World Health Organisation. Similar campaigns have also been adopted within other countries, such as the USA and Germany. Although it should be noted that awareness by itself is not an effective way of driving change. There is a well-established gap between beliefs and actions when it comes to food choices.¹⁴

Some of the challenges and suggested solutions for positive behaviour change are discussed in more detail below. However, at first glance greater diversity of main ingredient protein choices appears to be a practical, socially acceptable and realistic pathway to change food choices in the UK, in a way which would reduce the country's environmental impact and improve public health. But before looking at how this might be achieved, it is first necessary to consider in more detail whether following this pathway would in fact lead to better overall outcomes.

9 Shepherd, R. & Ratts M. (2006) *The Psychology of Food Choice*. CABI Publishing. King's Lynn.

10 WWF-UK (2011) *Livewell: a balance of healthy and sustainable food choices*. World Wide Fund For Nature. Woking.

11 Scarborough, P. et al. (2014) *Dietary greenhouse gas emissions of meat-eaters, fish-eaters, vegetarians and vegans in the UK*. *Climatic Change*, 125(2), pp.179–192.

12 Bates B. et al. (2012) *National diet and nutrition survey. Headline results from years 1, 2 and 3 (combined) of the rolling programme (2008/2009–2010/11)*. Department of Health. London.

13 Forster. R & Lunn. J (2007) *40th Anniversary Briefing Paper: Food availability and our changing diet*. *Nutrition Bulletin*, 32, pp.187–249.

14 Vermeir, I. & Verbeke, W. (2006) *Sustainable Food Consumption: Exploring the Consumer "Attitude – Behavioral Intention" Gap*. *Journal of Agricultural and Environmental Ethics*, 19(2), pp.169–194.

Assessing the impact of main ingredient diversity

In order to assess the actual value of improving diversity in main protein choices in the UK, the Carbon Trust has undertaken a quantitative and qualitative evaluation of various main protein choices, looking at economic, social, and environmental assessment criteria.

Within the context of the assessment undertaken, a sustainable and desirable diet for the UK has been defined as:

A diet that provides necessary and sufficient food to support an enjoyable and healthy lifestyle, within the planetary, economic and social boundaries that we want to maintain.

This definition includes a number of key concepts that are further expanded below.

- **Necessity:** food needs to meet recommendations for dietary health.
- **Sufficiency:** food needs to be affordable, and should not be excessively consumed or wasted.
- **Enjoyment:** diets should be varied, interesting and attractive.
- **Health and wellbeing:** food should contribute to a healthy lifestyle, balanced with exercise.¹⁵
- **Planetary boundaries:** food production should not exceed long term physical environmental limits.
- **Economic resilience:** the long term security of food supply should be maintained.
- **Social acceptability:** the social and ethical impact of food should be acceptable and culturally relevant given the UK's ethnic/religious diversity.

The Carbon Trust has assessed the impact of main ingredient choices against these criteria using a variety of metrics and approaches, looking at whether adopting greater diversity by 2030 would have an overall positive sustainability outcome.

Given available datasets for analysis, this approach involved grouping protein-rich main ingredients into five broad categories:

- **livestock products**, such as meat, dairy and eggs;
- **fish and seafood**;
- **plant-based protein-rich foods**, such as grains, pulses, nuts and seeds;
- **meat alternatives**, such as tofu and mycoprotein¹⁶; and
- **future foods**, including insect protein, algal protein and lab-grown meat.

A methodological framework was developed to take the available data and quantitatively assess the current social, economic and environmental sustainability impact of these protein choices. This looked at the impact of our average diets in the UK against various metrics.

- **Social:** assessing health and wellbeing impacts from eating too much or too little of a food type, using 'disability-adjusted life years' (DALYs)¹⁷ as the key metric and setting a healthy life expectancy of 86 years.

¹⁵ It is worth noting that recent work by Tim Spector, Professor of Genetic Epidemiology at King's College, London, suggests that greater diversity of microbes in the gut may help health and wellbeing. This has not been factored into this assessment, but could add further positive benefits to greater diversity in the diet.

¹⁶ Mycoprotein is a protein derived from fungi, which is most commonly recognised as the main ingredient of Quorn products.

¹⁷ DALYs are a commonly used metric adopted by a number of organisations, including the World Health Organisation and World Bank, indicating the number of 'healthy' life years lost through ill health, disability, or early death. We used DALYs here because our health sustainability focus is upon the role of food in cardio-vascular disease.

- **Economic:** maintaining or reducing the proportion of household expenditure on food, based upon current average (mean) total household expenditure of £473 per week.
- **Environmental:** looking at individualised quotas on carbon emissions, water use, and land use, based on boundaries set around the UK's 2050 climate change targets, global freshwater availability and current global agricultural land area.

Before presenting the findings, it should be noted that given the complexity of the issues involved, there are some caveats that need to be put in place for the quantitative assessment. It should be noted that the methodology assesses the general impact across the UK, rather than an individual diet. It is also important to highlight that the metrics in some cases did not take into account other challenges, such as overfishing and the effect on marine ecosystems. Similarly, in some categories the impact is rated as higher because not enough is eaten, rather than too much. These caveats have been noted in the table below.

The social, economic and environmental sustainability impacts of proteins from the current average UK diet

	Social impact (health & wellbeing)	Economic impact (household food prices)	Environmental impact (climate, land & water)
Fresh meat			
Processed meat	Too much salt		
Dairy	Need more Calcium [†]		
Eggs			
Fish & seafood	Need more in our diet [†]		Avoid over-fishing*
Whole grains & pulses	Need more in our diet [†]		
Nuts & seeds	Need more in our diet [†]		
Tofu			Avoid deforestation ‡
Mycoprotein			
Insect protein			
Lab grown meat			

Key	Low impact	Medium impact	High impact	Unknown
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* There are a number of acknowledged environmental issues around fish and seafood, related to unsustainable fishing or aquaculture techniques and their impact on aquatic ecosystems. These issues have not been included in this quantitative framework, but it is important to note that these are serious challenges and some types of fish and seafood do have a significant environmental impact in areas other than GHG emissions, freshwater use, and land use. The fact that this is not comprehensively shown within this framework highlights the complexity of issues involved.

† The health and wellbeing impact from these issues is related to consuming insufficient amounts, rather than overconsumption. These ingredients all provide important elements for a healthy diet, although it should be noted that wholegrains, cereals, nuts and seeds do not suffer from the specific issues associated with fisheries. Similarly, wild-capture fishing does not involve land use change for agricultural purposes.

‡ Some soya production has a low environmental impact. However, in other circumstances the impact can be remarkably high, particularly where there is deforestation to change land use for agriculture. But as tofu currently makes up a very small part of UK diets then the direct environmental impact is assessed here as being low as demand for tofu is not driving land conversion.

The environmental impact of meat...it's not that simple

While on a global level meat has a large environmental impact, this can vary greatly depending upon local geographic conditions and the different production systems. For example, raising cattle in the UK and Ireland has much lower freshwater stress when compared to California, which has recently experienced severe water scarcity. It also has far lower impact on biodiversity loss and associated greenhouse gas emissions than Brazilian beef that is linked to deforestation in the Amazon.

There is also much more effort being put into supporting the efficient production of meat, for example through improved soil management techniques, animal diet optimisation and better fertiliser application. This can significantly reduce the environmental impact associated with meat.

Similarly, there is a large difference between red meats, such as beef and lamb, and other meats such as chicken and pork. Both red and white meats are very common protein sources in the UK diet. This means they have well established supply chains that are important for nutrition and food security. However, within the context of this quantitative assessment these have been classified together due to availability of datasets and in order to retain simplicity in understanding protein diversity.

Key findings from quantitative assessment

The typical diet in the UK currently has a high consumption of meat, specifically processed meat which is high in salt and unhealthy fats, and an undersupply of fibre and key nutrients from fish, fruit, vegetables, nuts and grains. This high consumption of meats needs to be reduced significantly for certain sections of the population and replaced with alternative healthier protein sources which also tend to have a lower environmental impact.

There is a strong case to be made that greater diversity of protein sources towards healthier, lower environmental impact proteins would have positive sustainability outcomes. Only 2% of the UK population are vegetarian or vegan, and around three-quarters of the UK population eats meat every day. This is of particular relevance, as increased diversity would involve replacing meat with other protein-rich ingredients more frequently. This replacement is where some of the most demonstrably positive improvements in sustainability can be achieved.

In particular, replacing some consumption of red meat with other protein sources and eating less red and processed meat tends to show the most beneficial impacts. This would also help to keep red meat intakes within guideline levels recommended by the Scientific Advisory Committee on Nutrition (SACN).¹⁸ Cattle and sheep produce far greater amounts of greenhouse gases, and use substantially more land and water than other types of livestock. In addition animal feed production can result in excessive use of fertilisers which in turn leads to reactive nitrogen compounds and phosphates causing the eutrophication of waterways.

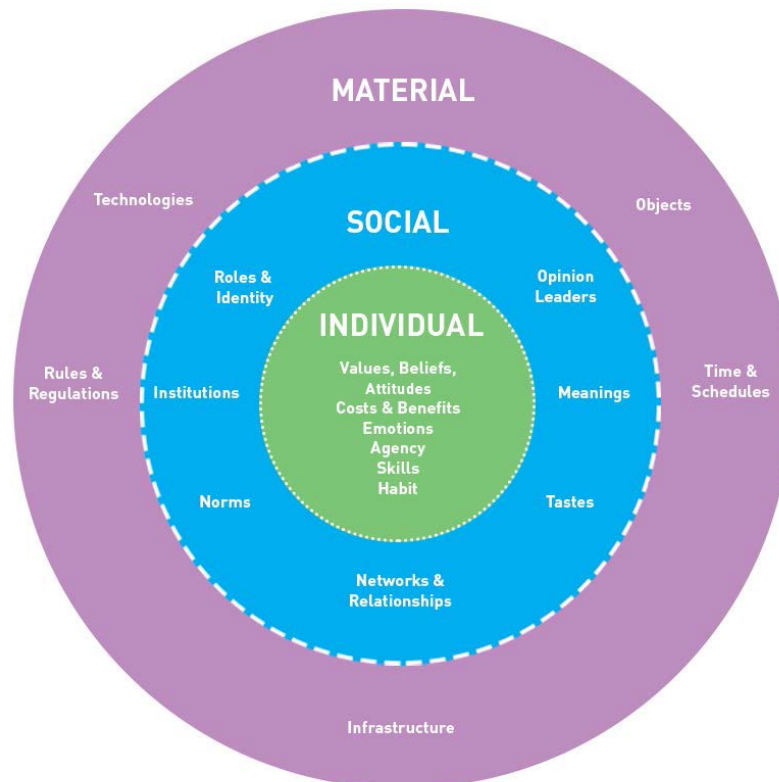
Whilst in terms of health, excessive consumption of red and processed meat can increase saturated fat and salt intake associated with increased blood cholesterol, high blood pressure, heart disease, and some cancers. There was little apparent impact from a move towards greater protein diversity on the total cost of food as part of a household income. Greater protein diversity in diets could also be particularly beneficial in helping to mitigate risks around the potential consequences from spikes in food prices. While changes in prices to specific agricultural products can have a knock-on effect across food types, a greater protein diversity will increase resilience to future impacts.

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SACN members are independent scientific experts which provide advice to Public Health England and the Department of Health. Guidelines are that adults should consume a balanced diet and ideally eat no more than 70g of lean cooked red meat per day or 500g per week.

Understanding approaches to changing consumption

In order to encourage people to change their eating patterns and promote diversity, it is necessary to consider why people eat what they do. Studies of food choices have shown that they are not simple, and that a number of factors come into play in decision making. These include individual factors such as taste and habit, social factors such as tradition and cultural meaning, and material factors such as availability and cost. These are illustrated in the below ISM model.



Source: Adapted from Darnton, A. & Evans, D. (2013) *Influencing Behaviours: a technical guide to the ISM Tool*. Edinburgh.

Different factors have varying levels of influence depending on circumstances, with noticeable distinctions depending on gender and income levels. But typically within the UK price, taste, quality and health impacts have substantially greater influence than sustainability concerns.¹⁹

Understanding this complexity that goes into dietary decision making, further qualitative assessments of different dietary choices were undertaken. This involved desk research taking an in depth look into a variety of the potential barriers to greater protein diversity. This was done primarily through a literature review of a wide range of sources including: academic research; consumer research; government nutritional data; media coverage; and public campaigns. This was supplemented by interviews with relevant experts undertaken by the Carbon Trust's team.

Following this research and some preliminary analysis a matrix was developed for assessing the potential for promoting protein diversity in eating choices. Within this matrix the qualitative issues considered were grouped into four broad categories of potential barriers, which if overcome could provide the opportunity for meaningful behaviour change:

- **Socio-cultural issues:** looking at taste, enjoyment, dietary expectations, habit and willingness to eat foods.
- **Skills & availability issues:** looking at education, knowledge and practical skills related to food production, use and preparation, including the relevance to consumers and the wider agri-food industry.²⁰
- **Ethical issues:** considering concern around issues such as animal welfare and fair trade.
- **Ecological issues:** considering concern for issues such as biodiversity, as well as impact on landscape and ecosystems.

Based on insights from desk research and interviews, a preliminary evaluation was then made on each protein source against the four categories of potential barriers. Assessments were made based on the issues that limit their more widespread acceptance.

Barriers to protein diversity

	Socio-cultural	Skills & availability	Ethical	Ecological
Livestock products	Low	Low	Medium	High
Fish and seafood	Low	Low	Medium	High
Plant-based foods	Low	Medium	Low	Medium
Meat alternatives*	Medium	Medium	Low	Medium
Future foods [†]	High	High	Unknown	Unknown
Key	Low impact	Medium impact	High impact	Unknown

* Meat alternatives include generally available protein-rich products that simulate the texture and flavour of meat, such as tofu and mycoprotein.

† Future foods include novel protein sources that are under development but not generally available for sale, such as insect protein and lab-grown meat.

Key findings from qualitative assessment

A review of available literature found that awareness of ecological issues in the UK around livestock products is increasing across various groups. This has resulted in increased industry, government and media attention around the role these play in contributing to climate change and biodiversity loss.²¹ Levels of industry action and the scale of civil society campaigns appear to have been growing since the launch of the influential report from the UN FAO, *Livestock's long shadow*, in 2006.²² Awareness amongst the general public remains surprisingly low when compared with other environmental sustainability issues, although it does appear to be increasing.²³

20 This incorporates a range of relevant actors, such as farmers, food manufacturers, caterers, retailers, restaurants, and celebrity chefs.

21 For example, the founding of the *Global Roundtable for Sustainable Beef* in 2012, or the *Eating Better* campaign.

22 Steinfeld, H. et al. (2006) *Livestock's long shadow*. UN FAO. Rome.

23 Bailey, R. et al. (2014) *Livestock - Climate Change's Forgotten Sector*. Chatham House. London.

This may be playing a role in the continuing downward trend of red meat consumption in the UK, which has been taking place for over 30 years.²⁴ However the levels of concern for environmental sustainability are significantly lower than for animal welfare or food safety issues, particularly following the European horse meat scandal of 2013. These factors are contributing to a noticeable trend of encouraging the consumption of less but better quality meat.

This suggests that increasing diversity by a shift away from lower quality, or higher impact meat may be one of the more promising areas for improving health and environmental outcomes through diversity (although some of the environmental implications are more complex).

Following high profile campaigns around the sustainability of fish and other seafood, as well as a notable response from the retail and food service industries, there has been an observable shift in consumption patterns. In particular there has been a real uplift in the variety of fish species purchased. This has taken place as a result of the risks to biodiversity and marine ecosystems from unsustainable fishing, coupled with the risks of commercially valuable fish stocks becoming depleted.

As an example, pollock is now being substituted for less sustainable alternatives, such as cod, in common products such as fish fingers. This has been successful because it provides a similar taste experience for the consumer and a cost advantage for manufacturers, making use of a more abundant food resource. This suggests that it is certainly possible to increase diversity within a particular category in a comparatively short time, where acceptable cheaper alternatives are readily available.

There are also apparent socio-cultural or skills gaps which are acting as a serious barrier to changing certain common meal combinations. There is clearly a need for more work to be done to improve education around how to prepare interesting and enjoyable meals using more efficient livestock²⁵ or plant-based foods as the protein-rich main ingredient. Increased education will not change behaviour by itself, but providing this knowledge is a fundamental part of helping increase diversity.

There has been greater success in overcoming skills issues where there has been direct replacement of traditional protein ingredients. This is a particular strength for meat alternatives that are prepared in similar ways to meat. Adding tofu to a stir fry, or using Quorn mince for a bolognese sauce, is not particularly different to preparing those dishes with meat. But in general, knowledge of how to prepare meat alternatives would appear to remain significantly lower than for meat.²⁶

There are also issues around availability and convenience, where consumers do not have ready access to a diverse range of options. For example, looking at the sandwich – one of Britain’s most popular lunches – more than 97 percent of the 3.5 billion sold every year contain a meat, fish, seafood, egg or cheese filling.²⁷ This does raise an interesting question about how change could occur: are food businesses at fault for not providing sufficient alternatives, or are they just meeting consumer demand?

Novel sources of protein that may be used in the future, such as insects, lab grown meat, and other synthesised proteins, may have substantial longer term potential. However the impact they will have on UK diets by 2030 is expected to be very low due to the high socio-cultural and skills and availability issues. There are significant supply chain issues that mean that these options are unlikely to be available at scale, or reasonable cost, within that time frame.

24 Kearney, J. (2010) *Food consumption trends and drivers*. Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences, 365(1554), 2793–807.

25 It should be noted that there can in some cases be a trade-off between farming efficiency and ethical acceptability, but in most cases it is possible to substantially improve efficiency without excessively intensive rearing.

26 Worsley, A., & Crawford, D. (2005) *Australian adult consumers’ beliefs about plant foods: a qualitative study*. *Health Education & Behavior*, 32(6), 795–808.

27 Eating Better (2015) *Sandwiches Unwrapped*. Available at: <http://www.eating-better.org/blog/78/Meat-filled-sandwiches-leave-consumers-hamstrung-for-a-healthy-planet-friendly-lunch.html>.

As discussed above, significant socio-cultural barriers would need to be overcome by effective marketing and campaigning in order to convince the general public to adopt these protein choices. Nevertheless there is a far greater potential for insects and other synthesised proteins to provide a valuable input for animal feeds in the near future, which could allow them to improve overall food sustainability without requiring direct human consumption.

Pathways to improving diversity by 2030

With a greater understanding of how dietary choices are made, as well as where barriers exist, it is helpful to consider some of the ways that might be effective in encouraging the adoption of a greater diversity of protein-rich main ingredients within the short to medium term. This is a serious challenge for the UK and an area of considerable complexity.

When considering how change might take place, it is possible to group the relevant actors into five broad categories, each with different motivations and roles to play.

- **Consumers** can have a direct impact through demand by making active decisions on their own diets.
- **Influencers**, including academics, NGOs, and other key opinion formers such as celebrity chefs, food and recipe writers can effectively communicate messages that promote protein diversity and sustainability.
- **Industry**, particularly business sectors that directly provide food to consumers – such as food manufacturers, retailers, caterers and restaurants – can develop a choice architecture with greater diversity of interesting main ingredients. In addition, farmers and growers should take advantage of an increased range of diversification options and efficiency measures.
- **Government** can influence or mandate change through regulation, taxation and other policy levers.
- **Investors** can support and finance the development of innovative food technologies, scale up production of existing options, or support new businesses that could help alternative create successful markets for diverse sources of protein.

What follows below are a series of recommended approaches, based on the Carbon Trust's preliminary findings. These could each be effective ways to increase the diversity of protein-rich main ingredient choices in the UK.²⁸

Flexitarianism

Consumers should be encouraged to experiment in meal choices, such as to try one new dish each week that does not use meat as the main protein source.

Although vegetarian and vegan diets have lower environmental impacts than those containing meat,²⁹ only 2% of the population in the UK are vegetarian, with teenagers making up the highest proportion, and fewer than 1% are vegans.³⁰ These numbers would need to be multiplied many times over to have a similar impact to encouraging a reasonable proportion of meat eaters to consume fewer meals containing meat.³¹

28 Although each of these levers can in principle help improve protein diversity, when reviewing comparable examples in practice the levels of effectiveness vary considerably. For a more comprehensive discussion of what has proven to be effective then see the Chatham House paper, *Policies and actions to shift eating patterns: What works?*, produced by the Food and Climate Research Network.

29 Berners-Lee, M. et al., 2012. *The relative greenhouse gas impacts of realistic dietary choices*. Energy Policy, 43, pp.184–190.

30 Bates B. et al. (2012) *National diet and nutrition survey. Headline results from years 1, 2 and 3 (combined) of the rolling programme (2008/2009–2010/11)*. Department of Health. London.

31 Scarborough, P. et al. (2014) *Dietary greenhouse gas emissions of meat-eaters, fish-eaters, vegetarians and vegans in the UK*. *Climatic Change*, 125(2), pp.179–192.

This shift in dietary habits to encourage less consumption of meat has become known as “flexitarianism”, where meat is frequently displaced by other main ingredient choices. This is not as prescriptive or prohibitive as a vegetarian diet, allowing meat eaters to continue to enjoy their consumption of meat. If individuals choose to purchase meat with better taste, quality and values it may even increase levels of enjoyment.

There is an apparent generational divide on the frequency of meat consumption which suggests that efforts to promote flexitarianism may be best targeted at the young. A 2013 survey by YouGov for the Eating Better campaign found that one in six young people aged 18-24 claimed that they didn’t eat any meat, which was three times the survey average.³² Although it should be noted that this self-reported statistic is a substantially higher percentage than is found in official dietary data, it does show an identification and engagement with eating less meat amongst a younger demographic.

This shift away from meat amongst the young is being seen elsewhere in the world as well. A 2015 Mintel survey in Germany suggests that one in five 16 to 24 year olds purchase meat alternative products, compared with an average of one in ten consumers across all age groups. It also found that 15% identified themselves as vegetarian, which was twice the national average.³³

Regulation and voluntary schemes

Policy makers and industry should create or promote schemes that integrate health and environmental issues by changing consumer pricing, or improving nutritional information.

There are a number of government policies and initiatives that can help increase preference for different dietary ingredients, through influencing factors such as price, availability, and the provision of information. These include: the provision of information through publicly funded campaigns; food education through schools; public sector food procurement, such as setting standards for meals in schools; voluntary or co-regulatory mechanisms with the food industry, such as the Department of Health’s Responsibility Deal; price mechanisms to encourage better diets through taxation or subsidy; or specifying that particular information needs to be included on product labels.

Regulation can be difficult to impose in the face of opposition from industry, as was seen when the French Senate in 2012 unsuccessfully attempted to introduce a ‘Nutella tax’ on products containing palm oil, in order to improve environmental and health outcomes. This challenge has also been seen in the UK recently, where the government has indicated that it is unwilling to introduce a sugar tax following recommendations by Public Health England. Voluntary or collaborative programmes seem to produce better outcomes, such as the Courtauld Commitment, delivered by WRAP, which has been running since 2005 and has made significant progress in reducing food waste and improving sustainability in the UK. Similarly, Consensus Action on Salt and Health (CASH), since 1996 has worked with the food industry to reduce salt content in key foods such as bread.

Government can also use its influence to promote better behaviour. There is also a suggestion of including health and environmental considerations within Defra’s Plan for Public Procurement, in order to improve the sustainability and healthiness of food procured through public funds.³⁴ Around the world the governments of other developed countries, such as the USA and Sweden, have begun to experiment with including sustainability information within their nutritional guidance.³⁵

32 Eating Better (2013) *New survey shows support for Eating Better messages*. Available at: <http://www.eating-better.org/blog/23/New-survey-shows-support-for-Eating-Better-messages.html>. It is worth noting that this result is significantly higher than national nutritional survey data, so it could in fact suggest a great proportion of self-identified flexitarians rather than fully vegetarian diets.

33 Mintel (2015) *Young consumers are hungry for meat alternatives in Germany*. Available at: <http://www.mintel.com/press-centre/food-and-drink/young-consumers-are-hungry-for-meat-alternatives-in-germany>

34 Defra (2014) *A Plan for Public Procurement*. Department for Environment, Food and Rural Affairs. London.

35 Proposals are currently being considered by the Swedish NFA and USDA’s Dietary Guidelines Advisory Committee.

There is also a role here for industry bodies and other stakeholders to develop voluntary schemes without the intervention of government, which could shift common industry practice. For example initiatives such as the Fairtrade and the Marine Stewardship Council labels have influenced and changed consumer and business behaviour, by highlighting important sustainability issues to consumers through labelling. But despite evidence of the positive influence ecolabels can have on the behaviour of certain consumer groups when implemented effectively,³⁶ more research would be needed into the characteristics of a scheme that could promote increased protein diversity.

Food campaigns

As part of the change process, credible campaigns should use increased diversity of main ingredients as a key message to improve consumer behaviour.

A number of campaigns from government, NGOs, media and high profile individuals have focused on promoting the environmental and health benefits from dietary changes. These include Paul McCartney's Meat Free Monday campaign, the Eating Better campaign and WWF's Livewell Plate. There has also been advocacy from celebrity chefs such as Hugh Fearnley-Whittingstall, promoting dietary change for sustainability reasons through his television series, or Jamie Oliver promoting healthier school meals.

There is a correlation between increased awareness and improved behaviour, although in most cases awareness does not change behaviour by itself.³⁷ An obvious first step would include ensuring that school children are educated about the impacts of their food at the same time as being fed nutritious meals, with a diverse range of protein-rich main ingredients. These actions would help both address the burden of poor health on the NHS, and contribute towards the UK's greenhouse gas emissions targets.

Different campaigns and campaign messages are required to cut through to different parts of the population, depending on values and attitudes. For example messages regarding personal health and wellbeing tend to be more effective than environmental ones, although ethical and ecological campaigns also reach certain smaller audience sectors.³⁸

There appears to be a clear opportunity to link messages around reducing the oversupply of protein at the same time as and promoting increased protein diversity in our diets. However, while most people eat too much protein, there are certain groups in society (such as the elderly) that would gain a health benefit from eating more protein, which should be considered in the development of campaign messages.

Education and skills

There is a need to promote knowledge and capability to use a greater variety of main protein ingredients.

Much can be done to promote the interesting and enjoyable use of diverse main protein choices, through ensuring that people know how to prepare them well. Dietary choices are frequently constrained by a limited repertoire of common dishes that are cooked at home, or brought ready prepared.

Organisations and individuals involved in setting food trends – such as restaurants, supermarkets, celebrity chefs and food writers – have a role to play in changing public tastes and understanding of how to cook underutilised protein sources. This could be done through marketing, promoting new recipe designs through the media, or changing the formulation of ready meals and ready-to-cook meals. The public sector also has a role to play, both within schools at an early years setting, within the curriculum and within the broader community using collaboration between local government and health institutions.

36 Thøgersen, J. et al. (2010) *Consumer responses to ecolabels*. European Journal of Marketing, 44(11/12), pp.1787–1810.

37 Young, W. et al., 2009. *Sustainable consumption: green consumer behaviour when purchasing products*. Sustainable Development, 18(1), pp. 20-31.

38 Defra (2011) *Attitudes and Behaviours around Sustainable Food Purchasing*. Department for Environment, Food and Rural Affairs. London.

Choices that can be directly substituted for meat in common dishes, such as pulses, nuts and seeds, soya and mycoprotein would appear to provide the most viable options for increasing protein diversity in the short to medium term. Novel sources of protein – such as algae, insects and lab-grown meat – will have a longer adoption curve within the UK. But these options may have significantly lower environmental impacts than current choices, so could prove to be an important dietary element in a sustainable future. There is therefore also a case to explore how these proteins could be used, which would include the demonstration of these ingredients by pioneering early adopters. This will help to normalise consumption over time, through finding ways that less common proteins can be incorporated within diets in appealing ways.

Diversity of production and supply

UK farmers and food manufacturers and retailers should be engaged and encouraged to produce more diverse protein choices.

In order to ensure a resilient supply of diverse main proteins over the long term, it is necessary to provide UK farmers and food manufacturers with information, case studies and sales opportunities that support diversification. Food manufacturers and retailers should work together to develop the market for more diversified protein sources.

Some early examples of diversification can be seen in Germany, where recent trade shows have seen growing numbers of meat companies launching vegetarian products into the market in order to grow their businesses in response to changing consumer habits.³⁹ These should recognise that a broader, more efficient, approach to producing protein sources will be crucial over the coming decades, as we meet the challenges of population growth and the impacts of climate change.

Improving choice architecture

Retailers and food service businesses should consider how they can encourage greater diversity in main protein choices using a combination of replacement, reformulation, marketing, and pricing.

Unless there is a greater availability of more diverse main ingredient options in supermarkets, food-to-go outlets, restaurants and cafeterias, it will be very difficult for people to make more diverse choices. Therefore these businesses have key roles to play in ensuring that there are diverse and appealing options for the consumer that are attractively priced. Marketing, branding and communications are all important elements in ensuring that options are appealing. However the relative capacity to act differs depending on the type of business and customer expectations.

Contract caterers would appear to have the greatest capacity to control menu design and promote a greater diversity of options. This is because their main client is not the end consumer of food, it is the organisation contracting their services. As organisations become increasingly aware of health and environmental concerns, and acting in a more responsible manner, then they will demand caterers that provide healthy, nutritious, and sustainable meal choices. This is particularly the case in places operated by clients with mandates to act for the good of the public, such as hospitals and schools. However, moving too far ahead of consumer demand may not be effective, with negative outcomes such as additional food waste.

Supermarkets have a greater need to meet demand as it exists today, and therefore less flexibility to experiment and change quickly. With food retail being a highly competitive sector, there are strong drivers to deliver on current consumer expectations and provide competitive pricing.

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Addy, R. (2015) *German meat firms swell meat free presence*. Available at: <http://www.globalmeatnews.com/Industry-Markets/German-meat-companies-interest-in-vegan-products-grows>.

Despite this there are a number of more subtle arts that retailers can use to create change, through innovation, category management and the reformulation of products to create real commercial opportunities in diversification of main ingredient choices. There are also positive reputational and brand benefits to be obtained by demonstrating to customers how they are promoting health and sustainability. Some restaurants will find it especially difficult to change. For example, it is unlikely that a restaurant or chain based on selling steak, hamburgers or chicken can readily shift its menu design away from this main ingredient and still be successful, although they could start to provide meat-free alternatives alongside their core products whilst working with their suppliers to promote environmental efficiency. This is particularly true for restaurants that are seen as occasional treats by their customers. However there is a greater role to be played in casual or informal everyday dining sector, such as food-to-go chains and cafes, where a similar innovation and reformulation approach could be taken to the one described above for the supermarkets sector.

Conclusion

Our analysis has found that in most instances increasing the diversity of protein-rich main ingredient choices in the UK today would result in overall positive outcomes: for the health and wellbeing of the individual; for society at large; and for the wider environment. It appears that the case is strong for increasing the diversity of protein-rich main ingredients.

But for most British people today food choices are deeply embedded within habit, culture and tradition, which do not change easily. Similarly there is a considerable amount of practical and commercial inertia which means that it is not easy to change the supply and sale of food.

We know that change is possible over time. But now there is a need for various stakeholders from across government and the agri-food industry to come together to ensure change occurs much more quickly. This is going to be necessary to help create a secure, healthy and resilient food supply for the UK by 2030, which helps to meet the challenges of feeding a growing population, at the same time as addressing issues from global climate change and resource scarcity.

It is important that before action is taken, this is considered with a broad systemic perspective, in order to avoid antagonistic or counterproductive measures being taken. This needs to look at the economic, socio-cultural, health and sustainability contexts for the consumption and production of food. Some guidelines on how best to do this should appear in the initial framework due to be published by UNEP and the UN FAO as part of the Sustainable Food Systems Programme (SFSP) later in 2015, which has been created as part of the Ten-Year Framework of Programmes on Sustainable Consumption and Production Patterns agreed to by global leaders at the Rio+20 United Nations Conference on Sustainable Development in 2012.

There is a lot more work to be done in understanding and solving the sustainability and health issues arising from the food system in the UK. Fortunately, there is a large and growing body of knowledge and understanding of what can be done today. This report has identified one promising solution to create positive change and further action will be required to demonstrate whether it can be effective in practice.

But now is the time for taking action to support the transition to healthier and more sustainable diets, in order to address some very real and urgent global challenges. We therefore recommend that a message of promoting the greater diversity of protein-rich main ingredients is more widely disseminated, as there is a strong case to suggest it can be an effective tool to change consumption patterns and deliver positive outcomes.

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