

Critical questions for alternative protein in the climate crisis



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SUMMARY

From the still-elusive cultivated meat to the mycoprotein mince that has long been on our supermarket shelves, recent years have seen much discussion of alternative proteins and the role they could play in changing diets to include far more plants and far fewer animal source foods. Investment, product ranges, and availability have all increased exponentially in the past five to ten years, though recent months have suggested a lull in sales, with several products being withdrawn from the market¹. It seems this investment has paid dividends: the Good Food Institute reports that in Europe in 2022², sales growth of plant-based products by value increased by 7% for milk and 3% for meat replacements³.

Increasingly, alternative proteins are seen by some as a 'silver bullet' to mitigating the environmental impact of the food system and supporting the 'protein transition' – a shift in Global North countries towards diets much lower in meat and dairy. On the other side of the spectrum of opinion, alternative proteins are seen as another unjust and ultimately ineffectual 'tech solution' to a set of food system problems that are fundamentally social and political, extending beyond the environmental impacts of meat and dairy production.

Alternative proteins could have a role to play in a food system that delivers far better against a range of priorities and act as a steppingstone on the path to decarbonising the food system. But just like other foods, the ways in which alternative proteins are produced, sold, and consumed affect how effectively these products might enhance our health, protect the environment, and contribute to a fairer, more diverse, and more just food system. Alternative proteins have emerged on supermarket shelves in Europe and other Global North markets within the dominant food system, which is one based on corporate extraction and the externalising of environmental and social harms. It is important that they are considered in this context, alongside exploring their potential as a tool for supporting a transition to diets low in animal source foods in Europe.

To get a clearer picture of what these products could mean for current and future food systems, Feedback commissioned a comprehensive study to research the environmental, health and food sovereignty impacts of alternative proteins, conducted by Dr Brian Cooke. In this discussion brief, we draw on this research to put forth five critical questions for policymakers, producers, and retailers to consider on the role of alternative proteins in the dietary transition in Europe:

- 1. Can alternative proteins displace, not supplement, animal proteins?**
- 2. Can alternative proteins be produced in ways which prioritise the greatest nutritional value for the least environmental impact?**
- 3. Can alternative proteins support human health through nutritious diets?**
- 4. Will alternative proteins contribute to a more diverse food economy?**
- 5. Can alternative proteins accelerate a just transition and further food justice goals?**

A SHORT NOTE ON DEFINITIONS

Non-animal sources of protein vary from the simple bean to the most technologically advanced cultivated meat. For the purpose of this brief, we define 'alternative proteins' as any functional analogues of animal source foods seeking to mimic the appearance, taste, and texture of animal source products. This definition therefore includes a wide range of processed products, from those made from ingredients we might all recognise, such as peas or wheat, to those made using highly technical processes from ingredients with which few people would be familiar.

The Good Food Institute (GFI), an alternative proteins advocacy group, divides the alternative protein sector into three categories:

1. Plant-based substitutes (includes both highly processed options made from plant protein, like pea protein, and more traditional plant-based options like bean burgers; our commentary in this report focuses on the former due to their dramatic rise in popularity)
2. Cultivated meat (also called cultured or lab meat) produced via cell-culture technologies
3. Alternative proteins produced by fermentation, including "precision fermentation" (i.e., synthetic biology)³.

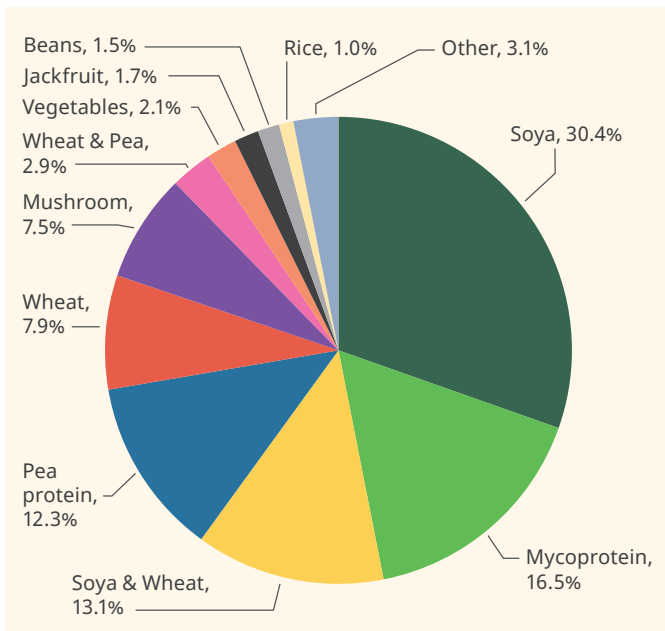
We do not include unprocessed pulses or other forms of unprocessed plant proteins in the category of 'alternative proteins', as they are generally not marketed in this way. Moreover, pulses and other unprocessed plant proteins have historically and continue to play a key role in many cultures around the world: that is to say, these are not new or 'alternative' forms of protein, and it would be inappropriate to group them with the alternative proteins mentioned above.

a This research also showed falls in unit sales of dairy milk and meat in 2022, of -4% for each category. Note that it is difficult to evidence a direct link between growth in plant-based substitutes and falls in animal source foods, as many other factors, not least inflation and the cost-of-living crisis, are at play.



Image source: Shutterstock

FIGURE 1: MEAT ALTERNATIVES AVAILABLE IN UK SUPERMARKETS, BY MAIN INGREDIENT (N=480)



Notes: Data reflect information displayed on online supermarkets of Tesco, Morrisons and Sainsbury in October 2021

BOX 1: WHOLEFOODS AND PULSES ARE IMPORTANT IN DIETS.

Wholefoods and unprocessed plant proteins and pulses are an important and nutritionally beneficial ingredient in many people’s diets, and the EAT Lancet report and other scientific papers recommend we all eat 75g of pulses per day, considerably more than the current average. In the UK, per person consumption is only around 14g per day on average⁴. Pulse consumption can and should be incentivised: in Canada, where consumption is on average 27g⁵ per day, a state-sponsored programme in the 1970s and 1980s saw Canada become the leading exporter of many different legumes, primarily high-quality produce marketed for human consumption⁶. Currently, the Dutch Ministry of Agriculture, Nature, and Food Quality, alongside others, are developing proposals – with both production- and consumption-side measures – to double consumption of legumes in the Netherlands⁷. Finding regulatory and commercial routes to incentivise the production and consumption of pulses, as well as other plant-based wholefoods that should play a bigger role in our diets, could potentially be the most environmentally sound and healthy way to chart a course through the protein transition.

1. CAN ALTERNATIVE PROTEINS DISPLACE, NOT SUPPLEMENT, ANIMAL PROTEINS?

In a February 2023 article, George Monbiot argued that meat alternatives ('alternative proteins' in the parlance of this report) are essential to facilitate the dietary transition, because more traditional vegetarian protein replacements, such as pulses and tofu, are not sufficiently appealing or easy to prepare to tempt meat eaters in the Global North (in the context of this brief, the UK and EU). This argument is based on a common assumption that the availability and promotion of alternative proteins that mimic meat and dairy will allow them to displace animal source foods from shopping baskets, leading to an overall drop in production and consumption. There is also an implied assumption behind corporate targets on sustainable diets which focus on alternative protein sales, such as Tesco's target to increase alternative protein sales by 300%⁸.

The evidence to test these assumptions paints a mixed picture: one study found that the vast majority of consumers of plant-based meat alternatives (83%) in the UK still eat red meat or poultry⁹, although we do not know in what quantities compared to those who do not buy any alternative proteins at all. In April 2023, the Good Food Institute reported that sales of plant-based foods across 13 European nations, including the UK, increased, whilst some animal protein categories experienced reduced sales figures¹⁰. However, at the same time, sausage company Heck made the decision to shelve most of its vegan range of sausages and burgers, citing 'lack of consumer appetite'¹¹, and several other brands' vegan products have also been discontinued.

A study of the promotion of plant-based products in Veganuary found that, whilst sales of alternative proteins increased by 57% during the study period, there was no significant change in meat sales. The study concludes that interventions to promote plant-based products are not enough on their own to reduce meat sales. The authors recommend that supermarkets should "implement changes that meaningfully reduce purchasing of meat products", despite the constraints of achieving this within business models designed solely to maximise profits¹². Indeed, whilst it is easy for retailers to focus on increasing availability and sales of alternative proteins as a niche market segment, in addition to their existing meat range, these companies should be enacting more meaningful policies to incentivise the rapid reduction of animal source foods in diets, as well as their substitution with affordable, accessible, and culturally appropriate plant-based alternatives.

On the other hand, whilst the evidence is mixed, there are signs that meat consumption is beginning to fall significantly in some countries. In Germany, meat production, imports, and consumption are down overall, though significant falls in pork consumption were

responsible for the majority of this decrease, whilst poultry consumption has increased¹³. In the UK, between 2008/9 and 2019/20, researchers drawing on self-reported food consumption data found a 16.7% decrease in UK meat consumption; however, household budget surveys – in which fewer meat purchases imply less consumption – show only a 3% decline in the same period. Food balance sheets, which measure how much food is available to buy, and where a rise in supply implies greater consumption, show a 5% increase in UK supply in the same period¹⁴.

BOX 2: WHY A DIETARY TRANSITION TO LESS MEAT AND DAIRY IS NECESSARY TO MITIGATE CLIMATE CHANGE.

Very significant reductions in meat and dairy production and consumption in Europe are necessary to meet climate goals. Residents of EU member states currently eat twice as much meat as the global average, and almost three times as much dairy¹⁵, and Greenpeace argues they would need to reduce meat consumption by 71% by 2030 to make a proportionate contribution to tackling food systems emissions¹⁵. Figures are similar in the UK, where beef consumption would need to drop by 89% by 2050 to remain within planetary boundaries¹⁶, and Compassion in World Farming reports that countries like Denmark and Finland needed around a 70% reduction in calories from animal source foods to bring national diets in line with the EAT Lancet recommendations¹⁷. Every route to the UK meeting net zero modelled by the Committee on Climate Change (CCC) includes 20-50% lower meat consumption, with the CCC calling it "particularly important"¹⁸. The National Food Strategy recommended a 30% reduction in UK meat and dairy consumption by 2032¹⁹. And to ensure the UK meets its fair share of international emissions reductions – reflecting its current high per capita emissions, high historical responsibility, and ability to pay – faster reductions to virtually net zero emissions by 2030 or earlier are required²⁰⁻²². More in line with this, the Eating Better alliance of over 50 UK organisations calls for a 50% reduction in UK meat and dairy consumption by 2030²³, and aligning the UK with the EAT-Lancet 'Planetary Health Diet' would require further cuts still²⁴.

It is important to consider this mixed picture on consumption of alternative proteins and meat/dairy in the wider market context: alternative proteins are currently competing against meat in a food system that is strongly biased towards the status quo of high-meat diets. In the EU, livestock production receives €30 billion in EU subsidies (equivalent to 69-79% of CAP direct payments going directly to livestock or to animal feed)²⁵ and 32% of the EU promotional budget is spent on meat and dairy, with only 19% focused on promoting horticultural products²⁶. Meanwhile, meat and dairy corporations exert considerable lobbying influence to deter the transition



Image source: Shutterstock

away from high-meat diets^{27,28}. A new website by Feedback, IATP, and DeSmog explores some of the greenwash narratives used by this industry to obstruct and obscure the climate science on meat production, and to argue against a dietary transition^b.

On the side of public policy, little has, so far, been tried at scale in Europe to reduce meat and dairy consumption and promote the consumption of the various alternatives. Policy options include changes to dietary guidance to emphasise the desirability of large reductions in meat and dairy consumption, accompanied by a strong public information campaign; changes to public procurement policies^{29,30}; changes to dietary guidelines^{31,32}; bans on meat advertising in public spaces³³; and policies in support of a just transition that incentivise the reduction of meat and dairy farming. In Denmark, funds for the National Action Plan for Plant-Based Foods, enacted in 2021, were taken directly from sources that mostly support animal products¹⁷.

On the corporate side, no company has yet adopted a target to drastically reduce meat and dairy sales alongside targets to increase alternative protein sales. However, moves in this direction include Lidl's aim of reducing meat sales, IKEA's plans to make 50% of its main meals plant-based by 2025, and Burger King's target to offer a 50% meat-free menu by 2030^{34,35,36}. Experiments trialling different interventions are necessary to identify whether and how alternative proteins can replace meat and dairy foods at sufficient scale. Given the current lack of detail on how national- and industry-level targets to reach net zero will be implemented, this action is urgent.

Alongside these broader market and policy considerations, there is much still to be discovered regarding which

alternative protein products will be most successful at displacing meat and dairy products. In seeking a rapid dietary transition, it makes sense that functional analogues of familiar animal source foods will be a useful tool: the growing popularity of plant-based milks demonstrates the ease with which this transition can take place, without a significant change in wider food habits. Many of these analogues are plant-based alternative proteins that use soy, peas, or wheat, or mycoprotein products which have been available for some decades.

It is more difficult to assess the potential of less familiar alternative proteins, such as cultivated meat, which is still not available on the market. Cultivated meat is regarded by some as a key piece of the dietary transition puzzle because it so closely mimics the taste and eating experience of real meat, allowing those who wish to continue to consume animal source foods to do so, albeit most likely in smaller quantities. However, these products continue to face significant barriers to scaling up, including the lack of large-scale bioreactors to achieve significant tissue volume, high capital costs of equipment with adequate microbial contamination safeguards, and the challenges of replacing animal source growth medium with plant protein hydrolysates³⁷. In 2021, Joe Fassler at The Counter alleged numerous critical problems facing the development of the technology, arguing that, to displace just 10% of the world's current meat supply, we would need a minimum of 4,000 factories, each with 600 bioreactors running simultaneously³⁸ — a scale of production currently not seen anywhere in the world and challenging for many reasons, not least food hygiene. A related article in the food industry publication Food Navigator claimed the cost of the infrastructure would reach US\$1.8 trillion³⁹.

b www.biglivestockgreenwash.com

2. CAN ALTERNATIVE PROTEINS BE PRODUCED IN WAYS WHICH PRIORITISE THE GREATEST NUTRITIONAL VALUE FOR THE LEAST ENVIRONMENTAL IMPACT?

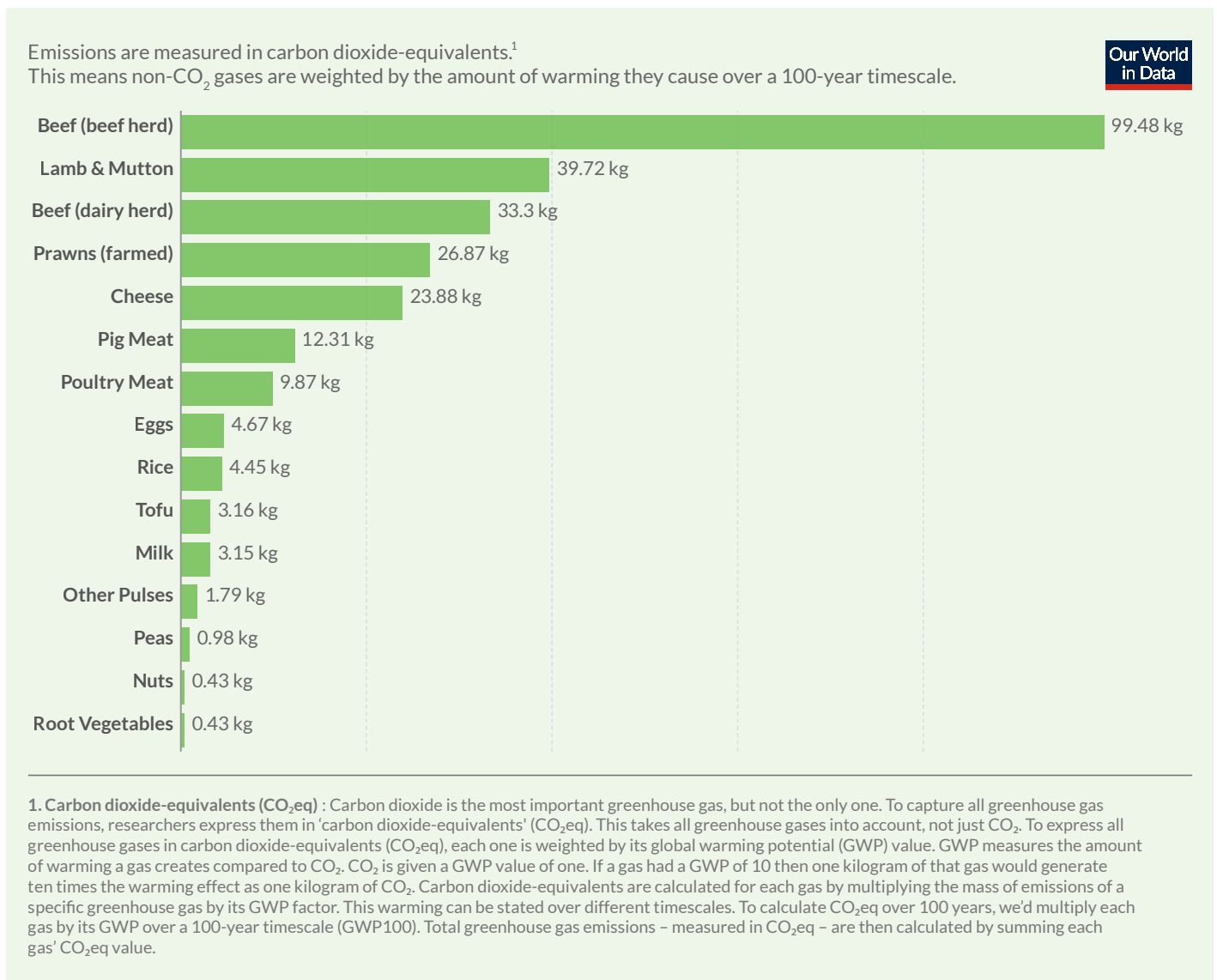
Plant proteins have a much lower environmental footprint than animal source foods. Though the research commissioned by Feedback emphasised that assessing the environmental impact of food is a complex task, it found:

“ Plant proteins are generally linked to a much lower environmental impact compared to animal proteins. Ruminants such as beef and lamb generate the highest impacts of any food categories, creating high amounts of greenhouse gas (GHG) emissions (primarily methane). They also tend to have a much higher impact on other indicators such as land use, water use, eutrophication (water pollution), and acidification (soil degradation). Dairy has a higher impact, in terms of land use and GHG emissions, than poultry but less than ruminant meat. ”

The graph below demonstrates the huge difference in GHG emissions between the most GHG-intensive animal protein, beef, and the least GHG-intensive plant proteins.

Feedback’s commissioned research goes on to say, ‘Based on this research, it is very likely that alternative proteins made from plants have a lower environmental impact than their animal source equivalents. This should still be true even with the added steps of processing involved in producing plant-based burgers, sausages and so on. The vast majority of environmental impacts occur at the food production stage’⁴⁰.

FIGURE 1: GREENHOUSE GAS EMISSIONS PER KILOGRAM OF FOOD PRODUCT



Source: Joseph Poore and Thomas Nemecek (2018). OurWorldInData.org/environmental-impacts-of-food • CC BY

It is clear there are many unknowns and debates surrounding the environmental impact of alternative proteins. One study attempting to compare the environmental (and nutritional – see section 3) impacts of different sausages (e.g. meat, vegetarian and vegan), for example, showed large differences in estimated impacts. For example, chicken and turkey sausages had a 170% higher impact than vegan and vegetarian sausages. However, in many cases, these differences were driven by the presence of one or two ingredients. The study also noted that, even within the same types of products (e.g. pork sausages), there were still large differences in environmental impacts⁴¹. This is true even within the range of alternative proteins, from the least to the most processed, due to considerable variation in production methods and associated environmental impact. For example, the precise footprint of cultivated meat is still unknown at this time. In studies assessing the GHG emissions of these products, the process of cultivating muscle cells in bioreactors is always the most emissions-intensive stage of production. Therefore, the type of energy that is used at this stage is critical to the overall environmental impact. Whilst there was recently news around cultivated meat emitting 4-25x more CO₂e than conventional beef⁴², it is prudent to note that the research backing these articles has not been peer-reviewed and has been challenged by organisations like the Good Food Institute. At the other end of the scale, mycoprotein products produced by biomass fermentation (such as Quorn), which are already a familiar staple, have been reported to have emissions as low as 1.1kg CO₂-e/kg⁴³ and up to 6.2kg CO₂-e/kg⁴⁴, with the highest estimate including emissions from production to cooking.

Precision fermentation, another form of alternative protein, has been identified as needing substantial energy inputs (though, little other inputs)⁴⁵, and is more emissions-intensive than other fermentation processes, like biomass fermentation. Industrial infrastructure has been identified as a barrier to the scale-up of this technology: precision fermentation requires large investments in concrete, steel, plastic, and energy to create the necessary environment for the microorganisms to thrive^{46,47}. However, although fermentation is more energy-intensive than conventional livestock, it has a smaller carbon footprint that can be further reduced by using low-carbon energy⁴⁸. Moreover, fermentation in general, compared to traditional agriculture, has less reliance on land, lower emissions, and uses less water⁴⁹ – but it is not yet clear what the wider environmental implications of production at scale could be. Forays into new ways of producing food, unfamiliar to consumers, raise new types

of questions, including considerations around potential contamination if microbes used in precision fermentation escape production systems into the 'wild'⁴⁷.

A low carbon transition means that producers, retailers, and policymakers must have the principle of delivering the greatest nutritional value for the least environmental impact at every stage in deploying alternative proteins. Whilst significant reduction of meat and dairy products in diets will result in emissions reductions, which is vital to mitigate the climate crisis, perverse environmental outcomes from the production of alternative proteins should be avoided. One important step would be for the alternative protein and retail industries to agree to standards of environmental disclosure: if a selling point for these products is their low environmental impact, then clear and transparent information for shoppers on their production and environmental burden is important. More information about production methods might also help mitigate public concern over what their food contains, which is increasing in light of reporting on possible associations between negative health outcomes and ultra-processed foods⁵⁰.

Whilst this brief is focused on climate mitigation, other environmental impacts warranting consideration include impacts on water use and land use, for example for the production of feedstocks for cultured meat. Little has been published, for example, on the implications for biodiversity loss of the scaling of alternative proteins. Moreover, given the growing use of different types of technology in the production of alternative proteins, resources used to create this technology – rare earth minerals, for instance – need to be considered when assessing the impacts of alternative proteins. Consideration will also need to be made on how these technologies 'impact communities already dealing with the environmental racism and colonialism inherent in mining, tech manufacturing and waste disposal'⁴⁷.

In practice, it is challenging for individual businesses to adopt policies that effectively balance environmental trade-offs, which is why it is vital that policymakers take a clear stance on food policy within the wider climate transition. Businesses can contribute by ensuring a thorough understanding of the various environmental impacts of alternative proteins that they source, ensuring that they prioritise alternative proteins with the lowest impacts per nutrition delivered, and equipping customers with an understanding of the impact of the alternative proteins on offer, alongside the impacts of meat and dairy.

3. CAN ALTERNATIVE PROTEINS SUPPORT HUMAN HEALTH THROUGH NUTRITIOUS DIETS?

Current diets in Europe contribute to both high environmental impacts and poor health outcomes⁵¹. In considering how replacing meat and dairy consumption with alternative proteins may impact on human health, it is important to distinguish between health outcomes due to reducing meat and dairy in diets, versus those owing to an increase in alternative protein consumption.

There is a significant body of research on the health impacts of diets high in plant-based foods, or those high in meat and/or dairy, but much less research on alternative protein-rich diets. The 2019 EAT-Lancet report reviewed the best available scientific evidence and concluded that a healthy diet that contributes to sustainable food systems is generally plant-based, with low amounts of animal source foods and no or small amounts of processed meat, added sugar, and refined grains⁵¹. In addition, several studies and literature reviews have found links between meat consumption and poor health outcomes, particularly between high meat consumption and increased risk for some cancers. In 2015, the World Health Organization’s International Agency for Research on Cancer classified processed meat and red meat as carcinogenic to humans because of an association with colorectal cancer⁵². In addition to the evidence on health benefits of reducing consumption of some types of meat, research has found links between meat-free diets and a range of positive health outcomes, such as lower heart disease mortality⁵³, lower incidence of total cancer⁵⁴, hypertension⁵⁵, and type 2 diabetes⁵⁶. There are also some potential drawbacks, with vegans who do not consume a sufficiently balanced diet more likely to be diagnosed with iron deficiency anaemia or B12 deficiency⁵⁷.

The impact of alternative proteins in diets is less clear: in as much as they may displace red meat or processed meats from diets, they may contribute to reducing the negative impact of excessive consumption of these foods. Otherwise, the wide variety of production methods, ingredients, and nutrient profiles of different alternative proteins means drawing conclusions about their health impacts is difficult. The evidence is sparse, but the only published intervention trial that specifically focused on the health effects of increased alternative protein (in this case plant-based meat alternatives using peas, rice, and soy as the protein source consumption) found favourable changes in participants’ gut microbiota⁵⁸. Another study attempting to compare nutritional impacts of different types of sausages found, for example, chicken and turkey sausages had a 75% higher impact (ie. less nutritious) than vegan and vegetarian sausages⁴¹. The most recent, and relevant, study on alternative protein nutritional content shows that replacing meat with alternative proteins can

be done without significant changes in nutrient intake, but only if consumers are mindful of the protein, fibre, sodium, and sugar content of these replacement products. In other words, it depends on what you eat⁵⁹.

The salt content of alternative proteins is often cited as a concern in popular debates on meat alternatives. An analysis in 2022 of meat-free products, such as burgers, sausages, and meatballs based on the UK’s front of the package (FOP) traffic light ratings showed that the majority of products fall into the medium (amber) category for salt content, and many alternative protein burgers and sausages fall into the red category for saturated fat content (see Table 1).

TABLE 1: UK FRONT OF PACKAGE NUTRITION RATINGS FOR MEAT AND DAIRY ALTERNATIVE CATEGORIES

Category	SALT		SATURATED FAT	
	Rating	# SKUs	Rating	# SKUs
Burgers	Green	0	Green	22
	Amber	50	Amber	25
	Red	3	Red	6
Sausages	Green	0	Green	24
	Amber	51	Amber	18
	Red	14	Red	23
Meatballs	Green	0	Green	14
	Amber	14	Amber	1
	Red	1	Red	0
Milk	Green	114	Green	72
	Amber	0	Amber	13
	Red	0	Red	29

Credit: Feedback, 2022.

The health effects of cultivated meat have also not been well studied, with questions arising around, for example, uptake of micronutrients (such as iron) and culture mediums used to produce cultivated meat. Some studies argue meat analogues might have insufficient essential amino acids and trace elements compared to conventional meat due to the production process and ingredients involved (i.e. over-processing, high salt content, and genetically modified organisms)⁶⁰. Others, however, contend that the nutritional content of cultivated meat can be controlled, with the ability to adjust, for instance, fat composites (e.g. the ratio between saturated fatty acids and polyunsaturated fatty acids) and increasing omega 3 content, depending on the medium of production⁶¹.

Unlike cultivated meat, fermentation has existed for centuries to preserve and increase the nutritional value of food (e.g. yogurt, kimchi, cheese)⁶². Alternative protein products made from biomass fermentation, like Quorn, have been relatively well studied, but the evidence on the health impacts of ingredients made through precision fermentation is relatively limited, partly because it is highly flexible and capable of producing a wide range of chemical structures. However, one study showed that the biological value of proteins produced via precision fermentation occupied an intermediate position between traditional animal and plant proteins⁶³.

The guidelines for a balanced diet apply here. Consuming some alternative proteins alongside larger quantities of wholefoods is likely to contribute to better health outcomes than merely incentivising replacing animal source foods with alternative proteins.

To summarise, the evidence is clear that reducing excessive consumption of some animal source foods, in particular processed meat, and increasing the volume of plants in diets, is highly likely to contribute to better health outcomes. How alternative proteins are developed and deployed will make a real difference in the extent to which they contribute to strengthening public health. For example, as a direct replacement for common processed meat products, such as sausages or bacon, alternative proteins could help reduce the colorectal cancer risk associated with excessive consumption of these products. But if they displace wholefoods from diets, such as by replacing a traditional pulse-based dish with a highly processed product, their contribution may not be so wholesome. Again, it is for policymakers to clarify the standards and requirements alternative proteins should meet in order to make a positive contribution to diet-related health.



Image source: Image by Marcel Gnauka from Pixabay

4. WILL ALTERNATIVE PROTEINS CONTRIBUTE TO A MORE DIVERSE FOOD ECONOMY?

Alternative proteins are relatively new food entrants in a system marked by entrenched power discrepancies that are driving hugely damaging health and environmental outcomes. Meat and dairy production, like many aspects of our food system, are highly concentrated industries worldwide. ETC Group reports that, in Brazil (one of the world's major meat suppliers), just three companies account for well over two thirds of all beef exports⁶⁴. For a deeper exploration of the environmental and social harms that this industry creates, see Feedback's report 'Big Livestock vs The Planet' (2020). An important question when considering the future development of alternative proteins is whether their growth can support a more diverse food economy, including alternative models of ownership, or whether they will only serve to further entrench the existing market structure.

The alternative protein market is currently a mix of start-ups, supermarket brands, and powerful meat corporations. Even though meat proponents continue to downplay the value of alternative proteins⁶⁵, big meat companies are tempted by the revenue streams they potentially offer. According to ETC Group, each of the world's top 10 meat companies either has its own alternative protein line (e.g. Smithfield's Pure Farmland plant-based meat; Danish Crown's Tulip brand of alternative bacon), is collaborating with others to develop alternative protein products (e.g. Marfrig and ADM's joint venture PlantPlus Foods; NH Foods' joint venture with Japan's IntegriCulture Inc. to produce cell-cultivated beef), and/or is investing in alternative protein start-ups (e.g. BRF's investment in Aleph Farms' cell-cultivated beef)⁶⁴. These corporate players are investing big money in getting into alternative protein sales — alternative protein companies have raised almost \$11.1 billion in invested capital since 2010⁶⁶ — but they have a vested interest in simultaneously growing meat and dairy sales. ETC Group notes these corporations "aren't leaving the farm" but rather are enticed by the idea of a supply chain with "fewer animal welfare, worker safety and environmental downsides"; the ability to diversify their product offerings; and potentially earn some "green 'cred' and/or carbon credits along the way³. On Tyson Food's launch of its alternative protein line, Raised and Rooted, Noel White, the president and CEO declared:

“For us, this is about 'and' – not 'or.' We remain firmly committed to our growing traditional meat business and expect to be a market leader in alternative protein, which is experiencing double-digit growth and could someday be a billion-dollar business for our company.”⁶⁷

Many smaller brands exist in the alternative protein market (in part because companies interested in mergers and acquisitions typically look for brands valued in the £/€100m+ range, whereas many in the sector are worth

less than £/€10m), but advocates have sounded the alarm about big companies starting to gobble up their competition. For example, in 2021, the popular soy-based brand Vivera was purchased by Brazilian meat giant JBS, the largest meat processing company in the world. Although extreme consolidation is unlikely to happen in the medium term given the continued presence of smaller producers in the alternative protein market, it remains a real risk^{68,69}. Already, four companies own nearly 80% of the plant-based meat market⁷⁰. One expert worries that the alternative protein landscape will morph into something like that of the US craft beer industry: although the US has nearly 9,000 breweries, the vast majority are so small that they cannot distribute beer beyond their neighbourhood bars, and alcohol conglomerates own most of the larger craft companies⁶⁸. Another prediction is that the alternative protein market could end up mirroring the beef industry in the US, where four companies – JBS, Cargill, Tyson Foods, and National Beef Packing – control 85% of the industry⁶⁸.

Alongside the hand of the Big Livestock industry, researchers have identified alternative protein production as bearing the hallmarks of the Silicone Valley narratives and model of disruption and secrecy:

“Silicon Valley food tech entrepreneurs aspire to bring a new food system into being and convince their audiences that this food future is both better and achievable. Nevertheless, their representational practices make it difficult, if not impossible, for the public—or anyone really—to meaningfully assess the promises and their potential consequences, much less hold their proponents accountable to anything but pecuniary concerns.”⁷¹

A more inclusive approach to innovation in the alternative protein sector could be achieved by promoting appropriate ownership and participatory models. Alternative protein production could be owned by cooperatives, funded through social financing (including participatory impact investing or blended finance), fed by open-source licensing, and supported by participation frameworks (such as digital platforms offering tools, data, and software for innovators, similar to support for independent app developers). And, as identified by iPES-Food, technologies and innovation pathways must be aligned with the public good⁷². Policymakers, keen to support innovation in a growing market, could use anti-trust laws or restraints on intellectual property rights to ensure aspects of alternative protein technology are open source, and in working with academic institutions, should ensure their knowledge is shared with community organisations rather than limited access behind a paywall. For example, the UK's government's proposed land use strategy should include measures to reduce pressure on land to produce animal feed and pasture and take into account the role homegrown plant proteins could play in UK

diets, including through the use of UK crops in alternative protein production⁷³. An 'Alternative Proteins Roadmap' from UK Research and Innovation, a non-departmental public body, made several recommendations, including the development of an innovation network to support incubator and accelerator programmes. Ensuring that these programmes are regionally embedded and allocate a certain percentage of financial and technical support to alternative ownership models would help seed the beginning of a diverse alternative protein sector in the UK.

Retailers can help by supporting new entrants to the market by stocking a range of alternative protein brands, rather than concentrating on just one or two. But policymakers must make the greatest contribution by constructing a vision of how alternative proteins fit within a wider food system shift: without regulatory support, it is questionable whether the current alternative protein business model will be able to disturb existing economic or power structures within the agri-food system⁷⁴.

5. CAN ALTERNATIVE PROTEINS ACCELERATE A JUST TRANSITION AND FURTHER FOOD JUSTICE GOALS?

This section touches on two important and complex issues. The first is how accessible alternative proteins are to all groups of people within the current food system paradigm, one characterised by low food prices, high levels of poverty and high environmental impacts from food production. The second is around the role of alternative proteins in a transition to a more just food system, and in a food system which meets the goals of the food sovereignty movement. Neither of these questions have simple answers, and it is not the goal of this paper to provide them, but to point out some important tensions around the growing role of alternative proteins in food systems in our diets.

To tackle the first issue, currently alternative proteins are not universally accessible to everyone who might want to eat them. This is partly a piece of a wider trend in the divergence between incomes, wider household costs such as housing, and being able to afford a healthy and sustainable diet. In 2021/2022, around 14.4 million people were living in poverty in the UK, and 9.3 million adults experienced food insecurity in January 2023⁷⁵. This situation has been made worse by recent increase in global food prices: in December 2022, food prices increased by a record 16% in the eurozone and 16.8% in the UK — the highest readings since at least 1977 — over the same month in the previous year^{76,77}. The situation is similar in the EU, where more than one in five people at risk of poverty were unable to afford a meal with meat, fish, or a vegetarian alternative every second day⁷⁸. Workers in the food system, including retail, are particularly vulnerable to in-work poverty and food insecurity: in January 2023, food insecurity was experienced by 26% of households in which food sector workers live, compared to 17.9% of households in which no one works in the food sector⁷⁹.

When it comes to affording alternative proteins, an analysis for Feedback of the most popular alternative proteins available in three of the largest UK supermarkets (Tesco, Sainsbury, and Morrisons) shows that almost all meat and fish alternative products are more expensive (per 100g) than their lowest priced animal source food equivalents. Meanwhile, a 2021 study on UK consumer spending found that milk alternatives cost consumers 2-3 times more than dairy milk (though it also noted that conventional dairy milk is often deployed as a loss leader^c by retailers, contributing to a crisis for dairy farmers)⁸⁰. These issues should be seen in the wider context of historically low prices for groceries, accompanied by a squeeze on incomes and an increase in other costs, such as housing and energy. There have been some simple moves to increase affordability: in 2021, the Co-op announced that they would price match their plant-based food range to their meat and dairy counterparts⁸¹.

Alongside affordability sit questions around access. A study in 2018 found that 1.2 million people in the UK were living in 'food deserts'⁸²: one area in which Feedback operates, Knowsley in Merseyside, was recently found to have half the UK average number of large supermarkets, with 96% of local neighbourhoods unable to easily access affordable and healthy food shops⁸³. It is likely that, alongside poor access to more conventional foods, people living in these areas will be less able to access alternative proteins, amid a basket of diverse, healthy, and sustainable food options. As the food system adapts to the impacts of climate change, it is important to consider who is being offered – or pushed towards – which foods. Alternative proteins should not become a cheap staple at the expense of communities having access to a wide range of healthy and sustainable wholefoods, and the community infrastructure and skills to make use of them in their diets.

^c A loss leader is a product priced at a loss in order to sell additional products and services to customers: milk is a frequently purchased item and retailers see it as a useful way to draw customers into stores, where they are likely to be tempted to buy other products.

Whilst affordability and physical accessibility of alternative proteins are key considerations within the paradigm of the current food system, there are further questions about the role alternative proteins can play in furthering food justice and food sovereignty goals. See Box 3 for definitions.

BOX 3: DEFINING FOOD JUSTICE AND FOOD SOVEREIGNTY⁸⁴

Food justice is a multidisciplinary and grassroots perspective of the food system that views healthy, nutritious, and culturally competent foods as a human right while addressing the structural barriers and food insecurities to that right.

Food sovereignty is a food system where the people who produce the food are also in charge of the processes and policies involving its production, distribution, and consumption.

When talking about the links between food justice and food sovereignty with alternative proteins, there is considerable controversy. On the one hand, La Via Campesina have openly stated that they see lab-grown proteins as a direct threat to food sovereignty: cultivated meat is energy-intensive, there are many unknown variables around the impacts of cultivated meat on human health or new diseases, and the sector is controlled by the same agri-business corporations dominating the existing meat and dairy industry⁸⁵. Similarly, the ETC Group cautions against what they call 'petri-proteins', arguing this industry would enclose land, genetics, and knowledge of food production to protect its monopoly, rather than opening these up (i.e. rights to the commons). Additionally, they state 'many food companies are using petri-protein as a steppingstone to a whole world of industrialised applications of genetic engineering. In other words, the enclosures won't stop at meat, milk and egg production'⁸⁶.

Moreover, and regarding market structures discussed previously, one paper questions whether the existing alternative protein business model will be able to disturb existing economic or power structures within the agri-food system⁷⁴, echoing La Via Campesina's main argument. Drawing on the research commissioned by Feedback, then, this means food justice advocates engaging in the alternative protein debate are unlikely to find "big meat" partners receptive to alternative models of AP innovation and production, and so they will need to work with governments, funders, and other allies to promote these alternative ownership and participatory models to foster greater diversity, transparency, open-source innovation, and lower barriers to entry to the sector. Errol Schweizer, the ex-VP of Grocery for Whole Foods, points out that there are high levels of private venture capital available for high-risk food tech investments, including in forms of alternative proteins, and proposes some interesting hypotheticals:

“For every high-risk food-tech investment dollar deployed, a matching amount is either invested, donated, or gifted to organizations who are building soil, increasing nutrient density and enabling greater food and land access.... And maybe the carried interest of successful food-tech ventures should be taxed to fund a just transition for the farm and processing workers who will be laid off and displaced by the growth of precision fermentation ventures.”

Errol Schweizer, *Forbes Magazine*⁴⁷

On the other hand, the UKRI contends alternative methods of producing protein are required that can address the UN's predicted global protein deficiency of 60 million tonnes a year by 2050, whilst also reducing environmental impact through more sustainable production systems and practices⁸⁷. Organisations like the Good Food Institute argue that alternative proteins have much potential to reduce food insecurity, enhance national security, and strengthen climate action⁸⁸. Moreover, some institutions are seeking to address some of the criticisms mentioned above (e.g. corporate control): New Harvest, a non-profit research institute, is one such organisation, which is working to create a world where cellular agriculture is accessible, applicable, and accountable⁸⁹. In a similar vein, as identified in the research commissioned by Feedback, one researcher is calling for a new approach called 'food tech justice', with the aim of creating systemic change that overcomes the free market conservatism of food system reform, whilst (as some would argue) being more pragmatic than the food sovereignty approach in terms of influencing the scaling of progressive food system changes and harnessing new technology for beneficial outcomes⁹⁰.

Clearly, alternative proteins should not be treated simplistically as a cure-all for some of the problems bedevilling the food system, and there is a risk that with a focus on climate mitigation comes a marginalisation of other priorities, whether those are environmental or social.

iPES-Food's 2022 report 'The Politics of Protein' is a useful place to begin grappling with questions and considerations around these issues⁷². Important for this discussion brief are the report's three recommendations focused on reframing and transforming the discussion around meat, dairy, and alternative proteins:

1. Shift the focus from a 'protein transition' to sustainable food system transition and sustainable food policies;
2. Prioritise reform pathways that deliver on all aspects of sustainability, starting at the territorial level (measure what matters, where it matters);
3. Reclaim public resources from 'big protein', realign innovation pathways with the public good, and reset the debate.

Alternative proteins, in their modern incarnation (as opposed to lightly processed plant-based proteins like tofu and tempeh, which have been consumed for hundreds if not thousands of years), are largely a phenomenon stemming from and responding to the Global North's overproduction and overconsumption of meat and dairy. In as much as the world's emerging economies are shifting towards diets high in animal source foods⁹¹, alternative protein producers will see opportunities to

expand their sales to these markets. There is a risk here that multinational food corporations look to market a solution to a problem of their own creation: after disseminating high meat diets to global customers by framing 'Western' diets as the ideal, they then propose to 'solve' the environmental crisis this shift represents by marketing alternative proteins instead – potentially causing enormous damage to local and Indigenous forms of protein production.

CONCLUSION

Whilst alternative proteins are widely available in the UK and EU, and a growing market – a 2022 estimate projects the global plant-based meat market will reach \$24.8 billion by 2030 – the market is still very small compared with the global meat and seafood industry, projected to reach \$7.3 trillion by 2025. There is considerable scope to shape this industry, and to explore the effects of concerted efforts by producers, retailers, and policymakers to both accelerate the transition, and – crucially – ensure that it addresses power imbalances in the food system, promotes human health, supports fair livelihoods and equal access to good food, and maximises the environmental benefits of reducing the volume of meat and dairy in diets.

This discussion paper has considered some of the questions around the emergence of the alternative protein market. None of these questions are separate to wider

food systems tensions on justice, environmental impact, and health outcomes, but alternative proteins offer a specific – and controversial – lens through which to view these debates. As relatively new products, they have the advantage of offering food system actors, from businesses to campaigners, an opportunity to question their assumptions, their targets, and their routes for achieving a dietary transition in line with the Paris Agreement goal of limiting global warming to 1.5C degrees – as well as deeper questions about why we eat what we eat, how it is produced, and how the food system could function differently. Importantly, in seeking climate goals, it is vital not to forget the parallel and intertwined goals of greater food justice, less food insecurity, and ultimately of developing a food system paradigm which delivers for both people and planet.

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