A rapid review of the evidence on the factors underpinning the consumption of meat and dairy among the general public.

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Executive summary

Willingness to reduce meat and dairy consumption across the population is relatively low (12.8%-25.5%), albeit increasing. While women and higher socio-economic groups tend to show greater awareness of an environmental rationale and subsequent willingness for change, this difference does not emerge strongly in studies reporting behavioural outcomes.

Drivers for reducing consumption

The strongest consumer motives for reducing meat and dairy consumption are to improve health and to benefit animal welfare. Health reasons are a weaker driver for reduction of dairy products than for meat, in part due to conflicting messaging regarding the necessity of dairy within a healthy diet.

Only a small minority of consumers report a primary goal of protecting the environment in reducing their consumption of meat and dairy. This is due to both low consumer awareness of how, and how much, the production of meat and dairy impacts the environment, and the belief that other actions they could take are more important. In addition, while people recognise the benefits to society of reducing their meat and dairy consumption, they perceive this to be at a personal cost rather than benefit. People struggle to make a lasting change to their diet for solely altruistic motives in the face of perceived costs and sacrifices.

Barriers to reducing consumption

Many more people express willingness to reduce their meat and dairy consumption than who go on to actually change their behaviour.

Barriers to change include ‘pull’ factors towards meat and dairy, including taste, enjoyment, and seeing these foods as natural, necessary and normal parts of a balanced diet. People see few ‘push’ factors towards plant-based alternatives, and report barriers including low cooking confidence, fear of social rejection, and perceptions of inferior taste, price and freshness.

Even among those accepting of one or more rationale to reduce meat and dairy in their diet, people’s engagement in ‘off-setting’ activities can result in a switch of food types rather than overall reduction. For example, changing the type of meat they eat (to white, or free-range meat) or intending to fly less to reduce environmental impact rather than change diet.

Interventions with potential to increase the reduction of meat and dairy consumption

Increasing motivation

- **Target personal benefits** (health, enjoyment, price) rather than societal benefits (environmental), as the former predominantly drive habitual food choices
- **Avoid identifying products as vegan** (or vegetarian) to dissipate fears of social rejection
- **Reduce conflicting messaging** to reduce, or help direct, offsetting

Increasing opportunity

- **Reduce cost and food literacy barriers** to support lower socio-economic groups
- **Use nudging techniques** to prompt positive dairy- and meat-free choices by default
- **Increase availability of meat and dairy alternatives** to increase familiarity and create new social norms

Increasing capability

- **Build consumer confidence** that people's individual action will lead to the desired result
- **Avoid information overload** to maintain consumer engagement.

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Introduction

This report presents a review of the evidence on barriers and facilitators to the reduction of meat and dairy consumption among the general public. While we used a broad set of search terms to identify the literature in this area (see Appendix 1), our primary focus was on;

1) Evidence of the potential for behaviour change in response to **sustainability, environmental and climate change agendas**. This is in the light of a recent heightening of awareness of climate change, including protests (for example, climate strikes of 2019/20) and multiple recent global natural disasters attributed to climate change.
2) The **reduction of meat or dairy consumption, rather than stopping** altogether. Motives and barriers to reduction rather than stopping could differ considerably. Similarly, although we explored the factors that predict increased consumption of meat and dairy alternatives and substitutes, this was through the lens of the impact this on reducing meat and/or dairy consumption.

We also specifically searched for research exploring the impact of socio-demographic characteristics on willingness to reduce meat and dairy consumption.

In our previous report on the Psychology of Food Choice we reported on the key factors that we can use to predict what people eat and how we can influence these factors. We grouped into three processes; conscious and planned decisions (for example, selecting a food as we believe it is good for our health), unconscious choices (for example, responding somewhat automatically to product placement, or buying through old habits), and the indirect effects of the communities and society we live in (for example, basing choices on cost or availability). These same mechanisms are in operation in relation to the consumption of meat and dairy, but the underpinning attitudes, motives and levers that operate these mechanisms may be very specific to these types of food. We focus on these specific factors in the present review.

1. Evidence search

Data were extracted from 22 systematic reviews dated from 2017 to 2021 (see Appendix 1). There were sufficient systematic reviews to provide responses to each of the questions posed in the brief in relation to the reduction of meat consumption, but not for dairy. We therefore repeated the search of the literature for studies looking at dairy choices, excluding the requirement for studies to be systematic reviews; this resulted in an additional 12 papers reporting original empirical research (see Appendix 2 for data tables).

Public perceptions and attitudes are changing fast, which can sometimes result in a lag between shifts in public opinion and publication of peer reviewed research. Therefore, we also ran a search of the most recent grey literature (past 2 years) obtained from government, and government commissioned household surveys (including: YouGov, Ipsos and Eating Better surveys; see Appendix 3). We have reported these findings alongside the academic evidence base to provide an indication of where public attitudes may be shifting, but our primary emphasis remains on the academic evidence which is drawn from multiple peer-reviewed studies. We refer to this grey literature as “household survey” data from this point.

1.1 Quality of the literature / confidence in findings:

There are a wide range of studies using different designs relating to the determinants of decisions to reduce meat consumption; of the 22 systematic reviews we included, 9 assessed the quality of research studies included of which the majority were considered moderate or high quality. In general, the findings were consistent between reviews. These two factors provide confidence in the findings reported in this report. However, few measured objective outcomes of behaviour change, relying instead of self-reported behaviour, attitudes or intentions.

There was considerably less data available on dairy, so confidence in these findings is necessarily weaker. In addition, 3 of the 12 papers reporting on dairy consumption were funded by the dairy industry, framed as the reduction of dairy consumption being a problem rather than a goal.

For both meat and dairy consumption, there is little UK-specific information available in academic research papers. Data from household surveys is therefore presented where this is not available from published research.

We note that no study we retrieved reported on consumer switches to fish instead of meat or dairy as a protein source. Different search terms may be needed to retrieve this evidence.

2. Headline findings

2.1 Reducing meat consumption:

Willingness to reduce meat consumption is relatively low (12.8%-25.5%)[13] although both academic research and household surveys suggest this is increasing. Data from 2019-2020 suggest that 65% of British people said they were willing to reduce their meat intake when asked, and 21% have already done so.[37]

The strongest motives for reducing meat consumption are for benefit to health and animal welfare (Figure 1); this finding is consistent across both systematic reviews[1,13] and household surveys [38,42] The motivation for reducing meat consumption as a result of environmental and sustainability concerns appears to be weak; awareness is relatively low, albeit increasing, but ultimately people believe other pro-environmental behaviours are more important in reaching personal sustainability goals than what they eat.[13,16]

As in other contexts, there is a considerable gap between intentions, or willingness to change behaviour and actually doing so. One reason for the gap between intentions and behaviour change in relation to reducing meat consumption is reported to be the **perceived lack of personal benefit to come from changing our diet for pro-environmental reasons, as opposed to societal benefit**.[11,19] The gap in relation to meat reduction is also likely to be influenced by factors common to other behaviours but which are were less well researched in this setting, including lack of knowledge about alternatives, existing dietary habits, social or cultural influences, and conflicting priorities. These warrant further research.

Health and animal welfare rationales for change sometimes operate as reasons to switch to different types of meat, such as healthier (typically white) meat, or that reared with higher welfare standards, rather than reducing overall consumption.[1,3] This also aligns with household survey data that suggests that reduction in meat consumption conflicts with the desire to support local farmers and to 'buy local'. For example, 72% of people responding to the 2019 YouGov survey stated they had taken action in support of UK farmers in 2020[37], 62% of consumers

think that a locally sourced diet is more environmentally friendly than following a vegetarian diet[36], and plant-based foods are not considered local produce[33].

Overall, conscious intention to reduce meat consumption is typically **greater in people with a higher socio-economic status, and in women**[10,13].

Figure 1: Relative strength of reasons why people consider reducing meat/dairy consumption:

Driver	Meat	Dairy
Health	Strong	Medium
Animal welfare	Strong	Strong
Environment	Medium	Medium
Food intolerance/to aid digestion	-	Strong
Taste preference	-	Weak
Curiosity (to try alternatives)	-	Weak
Disgust/shame	Medium	-
Social influence	Weak	Weak
Increased availability of alternatives	Weak	Weak

Notes: Strong/medium/weak indicates strength of motive for consumers;
- indicates a lack of evidence in the literature from which to draw a conclusion

2.2 Reducing dairy intake

The findings for reducing meat consumption were largely replicated for diary, although the research base for this is less strong. Environmental concerns are evident but appear weaker than other motives (Figure 1).[25,33] And as is the case for meat, some consumers prefer not to reduce dairy intake in order to support local farmers, and plant-based alternatives are not considered as a local product.[33]

There were also some key differences: Willingness to reduce dairy intake was less strongly related to health than was meat, in large part due to **contrasting messages around the healthiness of milk and dairy products**.[25,33] Whereas messaging about the health impacts of meat are primarily aligned with the environmental argument (i.e., less is better), messaging about the health impacts of milk has tended to convey the positive role milk can play in our diet (for example, calcium for bone health, source of protein for vegetarians etc). This is particularly the case for children's health, and conflicts with an agenda to reduce consumption.[29,33]

Consumers may also have strong preferences for diary within frequently consumed drinks (for example, cups of coffee), which they retain regardless of attempts to reduce dairy elsewhere.[32,33]

2.3 Value conflict in reducing meat and dairy consumption

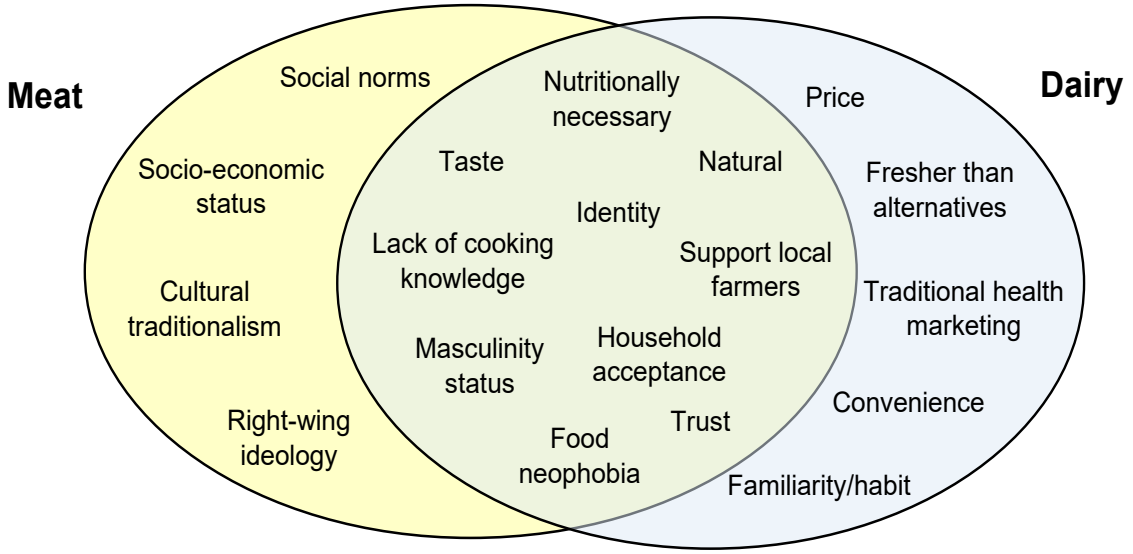
People feel their **food choice can reflect** their **identity**, so reducing consumption or switching to plant-based alternatives is highly value laden; choices seen as "vegetarian" are far more acceptable now than in recent years, but "vegan" choices are still a deterrent for those not identifying as vegan.[13]

Meat consumption is associated with a strong male identity and men get more social disapproval/teasing than women from making non-meat choices.[17]

People may have strong values towards protecting animal welfare, promoting environmental sustainability and/or health, and recognise the contribution of meat and dairy to this agenda - yet continue to eat meat and dairy due to other stronger motives and priorities. These alternative motives can include social or cultural pressures and norms, habits, enjoyment, and cost saving. Acting at odds to one's values (i.e., feeling you should do one thing, while knowingly doing another) can create a psychologically uncomfortable experience termed **cognitive dissonance**. When this happens, we are motivated to reduce this discomfort through approaches such as;[1]

- **Discounting evidence** that conflicts with our behaviour, and looking for reasons to disbelieve it. This is easier when there is mixed or conflicting evidence (for example, the reported impact on deforestation or biodiversity of some dairy alternatives), or we have low trust in the source of the information (doubting the motives of a government or food producer).[1]
- **Off-setting,** or switching instead of reducing intake. For example, eating only meat or dairy produced with high welfare standards, focusing on food-miles, donating to animal welfare charities, or cutting down other carbon-generating activities.[1]
- Allowing oneself **exceptions** to the rule in certain situations (for example, a 'special occasion')[1].

Figure 2: Reported barriers to reducing meat/dairy consumption[1,8,10,13,17,26,27,33]



Note: Where barriers are described as for either meat or dairy only, this is based on what is specifically reported in the literature, thus may relate to the absence of evidence as well as absence of a link. With more evidence, some of these barriers may actually sit in the 'both' section.

2.4 Increasing consumption of meat and dairy alternatives

Different factors may drive the consumption of replacement products to those that drive reduction in meat and dairy consumption. In the case of both meat and dairy, taste preference is a strong barrier, as well as concern that alternative foods are less natural, and therefore considered to be less healthy.[8,10,11,33] Not all consumers want the same thing in terms of taste; while some people are looking for a swap with an imperceptible taste difference, others will accept and expect a different flavour to reflect the plant-based origins of a different product, albeit a flavour they may need to learn to get used to.[8]

Recent household survey data suggests that willingness to try plant-based alternatives among people living in the UK is high; 49% of British people would eat a plant-based substitute for meat, compared with 42% worldwide.[39] Their preference is for unprocessed alternatives (pulses, nuts, seeds) rather than products mimicking meat.[38]

In the same way that people saw limited personal benefit to reducing meat and dairy consumption, consumers perceive the costs – and risks - of consuming meat and dairy alternatives to be borne by them individually, while the benefits to be primarily to the rest of society. Cultured meat in particular is considered risky.[11,19] Some perceptions about replacement products are included in the barriers to reducing meat and dairy consumption overall set out in Figure 2.

Willingness to eat both meat and dairy alternatives is associated with being younger, female, more educated and living in an urban area[10,28,30,32]. Other associations are shown in Table 1.

2.5 Sub-group differences

Table 2 sets out the trends reported in willingness to reduce meat and dairy consumption and to consume plant-based alternatives across different groups. Overall, this shows a propensity for women and people of higher socio-economic status to be more willing to reduce their consumption.

Table 2: Sociodemographic factors influencing awareness/intention/behaviour to reduce meat and dairy consumption

Factor	Findings
Gender	Women are: • More likely to be aware of the environmental[13], health[9] and animal welfare[3] impacts of meat. • More willing to reduce their meat[13] and dairy[24] intake and pay for alternative products that align with their values.[2] • More accepting of plant-based alternatives[10,30], but less accepting of cultured meats.[11]
Age	• No link found between age and awareness of environmental impacts[13] or animal welfare[3] rationales for reducing meat consumption. • Small increase in the awareness of the health benefits of meat and dairy reduction with increasing age[9]. • Younger consumers are more willing to reduce meat[13] (less so dairy[24]) and adopt alternatives[10,30], potentially as older consumers are more likely to experience food neophobia[27].
Education	Consumers with higher education are: • More aware of the health[9,18] and animal welfare[3] impacts of meat and dairy consumption. • More likely to be willing to pay for healthier or higher welfare products[2] or try plant-based alternatives[10,30]. • No more likely to reduce meat intake[13]. • No more likely to be aware of the environmental impact of meat and dairy consumption[3].
Income	Consumers with higher incomes are; • More likely to be aware of the health[18] and animal welfare[3] impacts of meat and dairy consumption • More willing to pay for healthier and higher welfare alternatives[2]. • Less likely to experience food neophobia, and hence more likely to try plant based alternatives[27]. No link found between income and; • Awareness of environmental impact of meat[13]. • Reduction in meat or dairy consumption[13,24].
Geography	• Europeans have a high concern for animal welfare issues[3], yet lower willingness to pay for higher welfare alternatives than Asian consumers[4]. • Urban dwellers are more likely to reduce meat or dairy intake[24] and accept plant based alternatives[10,30], partially due to their lower trust in farmers[11].
Existing diet	Consumers who *already* eat a low amount of meat and dairy are: • More likely to be aware of the health[33] and environmental impacts[13] of meat and dairy.

Factor	Findings
	• More accepting of plant-based alternatives[10.] • Less accepting of cultured alternatives[11,26].
Politics	Right wing consumers; • Have a higher meat consumption[1]. Are less likely to accept plant based alternatives[10,32].
Ethnicity	No clear correlations are found between ethnicity and meat or dairy awareness or consumption[18].
Religion	• Little research on the impact of religion on meat and dairy consumption. Non-religious individuals are more likely to report concern for animal welfare as a rationale for reducing consumption (excluding specific traditions)[3].

3. Mapping determinants of reduced consumption and potential for intervention to the COM-B model

The COM-B framework of behaviour change can help to integrate and interpret the implications of complex findings, particularly when combining multiple sources and paradigms. The framework stipulates that for a behaviour to take place, a person must have the **capability, opportunity** and **motivation**.[42] We have clustered the findings from our review into these three categories, noting that there is no single correct way to do this as there are many ways in which the categories overlap/interact. We have chosen the allocations that best reflect the theories prevalent within each category, and that provide the most logical account.

Of the three determinants, **lack of motivation** appears to be the greatest barrier to the reduction of meat and dairy consumption at this point in time. Although people may recognise health, animal welfare or environmental sustainability rationales to change, this motivation is not strong and is often disrupted by conflicting beliefs and motives.[1,13,22,29]

3.1 Motivation

3.1.1 The pro-environmental rationale for reducing meat and dairy consumption is largely considered by the public to produce **benefits to society, at a cost to the individual**.[11,19] People find it hard to make altruistically-driven choices on a routine basis, especially when these conflict with other priorities (for example, saving money, enjoyment).[6,29,33]

3.1.2 **Immediate rewards/reinforcements from food**, and perceived personal benefits from following a particular type of diet are stronger drivers than more altruistic motives, often at a more unconscious, or habitual level. These include taste, enjoyment, mood management, and can override more thoughtful value-driven choices at the point of sale and consumption.[11,19]

3.1.3 Planned and intentional food choice is driven by many different **value-driven motives**, some of which **operate in different directions**. As the motives most closely associated with choosing to eat meat and dairy do not map exactly to a rationale for reducing intake, this can result in **switching or**

offsetting rather than reducing consumption. For example, while people may believe red meat to be less healthy they may perceive chicken and white meat to still meet their health goals, or people may believe they can off-set some environmental and animal welfare impacts by choosing organic products.[13,34]

3.1.4 Motivation is strongly underpinned by our need to feel that we belong, and that the actions we take move us closer to the people important to us rather than causing conflict. Until reducing meat and dairy consumption is seen as normal, or mainstream, **fear of social rejection is likely to be prioritised above personal values**. This social effect is stronger when with other people.[1,10,17,22]

3.2 Opportunity

3.2.1 **Lower awareness of rationales to reduce meat and dairy consumption, and less willingness to try alternatives in lower SES groups** are likely to result from lesser opportunities – be it as a result of education, visibility or availability of alternatives in lower income neighbourhoods, cost, or other factors.[4,10,13,24,29] Interventions that work through persuasion or appealing to people's values are therefore less likely to be effective in these populations.

3.3 Capability

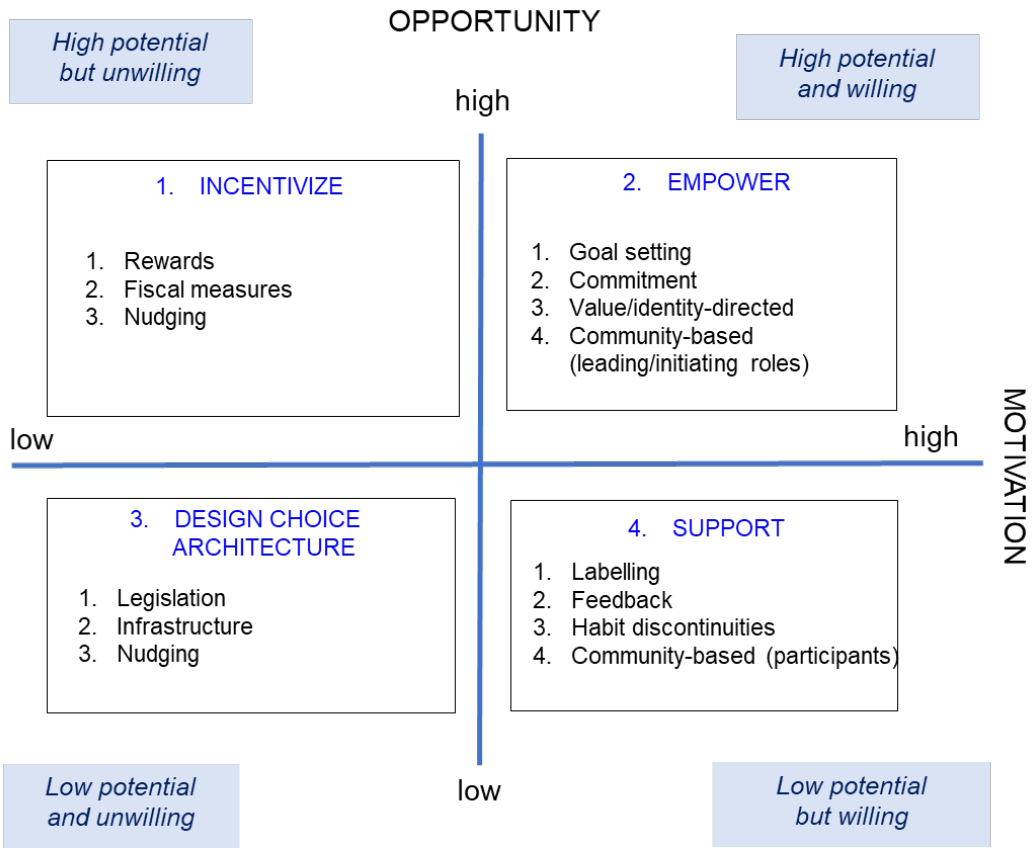
3.3.1 **Conflicting or unclear messaging** about what food is the most healthy/sustainable can reduce willingness to change; if people don't feel confident that the change will result in the outcome they want they will be less willing to try. This may include challenges of negotiating conflicting health vs environmental costs and benefits.[19,22]

3.3.2 **Too much information** can make people feel overwhelmed by the task of deciding what to do; including 'carbon labelling' in addition to nutritional information may lead to information overload. People may consider fewer factors in making their decision when a label has more information, than when it has less.[6,10,22]

3.4 A segmentation approach to targeting interventions

Figure 3 presents ideas of the types of intervention that are likely to work for different segments of the population based on their level of motivation and opportunity to change, and the text that follows sets out the evidence of specific examples in relation to the reduction of meat and dairy foods.

Figure 3: Population segmentation model of household behaviour change



Adapted from: Verplanken, B. (2018). Promoting sustainability: Towards a segmentation model of individual and household behaviour and behaviour change. Sustainable Development, 26, 193-205.

Segment 1: Low motivation but high opportunity

Interventions that do not rely on positive attitudes and motivation such as **rewards, incentives, and nudges** are likely to be effective for this population segment.

Many studies show that nudge techniques (including increasing the visibility and availability of non-meat or dairy foods while reducing the visibility and availability meat and dairy) are effective in influencing consumer purchasing.[15,16,20,22] Reducing

portion sizes could also help to reduce intake without endorsing an unintended message to cease consumption completely (which could trigger 'reactance'). Similarly, changing default options in cafeterias and cafés to vegetarian rather than meat-based meals has been found to increase the number of meat-free meals selected.

Increasing the visibility of alternative choices can also help these to become familiar and mainstream, which in turn may help to reduce barriers to consumption stemming from conflicts with **identity, familiarity, or social norms**. Dissociating plant-based or other alternatives to meat and dairy from a vegan or other minority identities (including people with food intolerances) could reduce barriers for people willing to try, but afraid of social rejection.[10,20] For example, this could be improved by including meat and dairy alternatives in mainstream supermarket isles rather than specialist sections.

Given the evidence suggesting that an environmental rationale for reducing consumption does not strongly relate to change - and that people struggle to prioritise perceived societal benefits above personal costs - there may be a **greater chance of impact from nudges aimed at the point of sale if these endorse personal benefits** (taste, cost savings, health, enjoyment) rather than long-term pro-environmental reasons.[11] Reducing the emphasis on persuading people to make changes from an environmental perspective **could also help to avoid negative reactions** (i.e., when a policy backfires by people acting in the opposite direction to that which is intended). This negative effect is typically seen when people feel that their choice or autonomy to decide on important parts of their lives is threatened (for example, if it is seen as the government trying to 'dictate' what they eat), especially when they perceive the change they're being asked to make as difficult.

While increasing the cost of products usually reduces rates of consumption, this may not be the case for meat as a **higher cost of meat is often believed to indicate better quality, which can increase desirability**.[10,15] However, this may only be relevant among higher socio-economic groups who can afford to make that choice.

Segment 2: High motivation and high opportunity

It is important to support and empower those who are already motivated and able to make changes in addition to other population segments; these people may become

early adopters, driving consumer demand, visibility and social norms. They may also need support to know how to make the most beneficial changes, and to remain committed to this agenda.

Examples of techniques that can help this segment include **goal setting** to help people to overcome the gap between intentions and behaviour and **endorsing commitment** to overcome barriers to establish longer term habits. This could be supported by providing people with examples of what some small but meaningful first steps in reducing meat and dairy consumption would look like, to boost confidence that the challenge is do-able. This may also help to emphasise that people are not being asked to cut out meat or dairy altogether, just to reduce. This approach is not only likely to be more effective in the short term but may bolster people's self-belief and confidence to take further steps in the future.[1,7]

Segment 3: Low motivation and low opportunity

This segment is likely to be the most difficult to influence. While choice architecture such as nudging (as detailed above) may be effective in some cases where motivation is low, **legislation and reducing costs** are likely to be needed to reduce meat and dairy consumption among those who have little opportunity to do so. However, changes in norms, availability and so on achieved through targeting other segments will also benefit this group in the longer term as part of population shift.

Segment 4: High motivation but low opportunity

This segment of the population will be likely to take up opportunities to reduce consumption when prompted and facilitated to do so. Support can be provided by **labelling, providing feedback, community-based interventions** (which can foster greater opportunity through access to social support), as well as helping people to establish new, more **positive habits** when old habits are disrupted. This disruption takes place during life course transitions in individuals' lives (for example, school-work, relocation, retirement), but may also take place through shared disruptions to the way we shop and live such as the COVID-19 pandemic.

Finding a simple labelling approach is challenging, as it may not be possible to incorporate health, animal welfare and environmental labelling at one time without overloading consumers and compromising the impact of each. Research into the most effective combinations would be valuable.[6,10] Similarly, increasing the consistency of messaging and reducing misinformation across sources (including the media) would be useful in reducing confusion (which deters action), and making it less easy for people to discount arguments that they would prefer not to hear.

3.4.1 Notes on interpreting the segmentation approach

Some interventions will be beneficial to all, particularly those aimed at changing behaviour without changing attitudes and motivation (i.e., segments 1 and 3) but are included in Figure 3 where their impact is most clearly seen. We also note that even if awareness and acceptance of rationales for reducing meat and dairy intake are not sufficient to change behaviour in themselves, increasing them is still important.[5,10,14,22] Improving these will help to move people from one segment to another (i.e., improve motivation), and help to increase the impact of policy by increasing the proportion of people who notice and are open to 'working with' policies rather than ignoring or acting against them.[14,15,20,22]

Reports from recent household surveys suggest that acceptance for government intervention to reduce meat consumption is much lower than in other domains; for example 61% support alcohol interventions, 77% support smoking interventions, 67% support obesity interventions, but only 35% support meat reduction interventions.[42] Support is greater for interventions that focus on education (particularly improved knowledge of how to plan and cook meals that reduce meat) and labelling[37]; however, past research in other domains suggest that while acceptable when posed hypothetically, educational approaches may not be the most effective in practice.[5,13,14]

4 Gaps in the evidence base and areas for future research

4.1 Understanding of the predictors of behaviour

1. **Replicating studies with an objective behavioural outcome.** Most studies stop short of measuring behaviour, tending to only measure intention or willingness. Those that do measure behaviour show that some of the predictors of willingness and awareness do not predict actual changes in consumption. Similarly, differences between socio-demographic groups that are visible in awareness and willingness to change, have not been reliably observed in studies measuring behavioural outcomes. While we note that measuring dietary intake is challenging, without this information we do not yet have a robust account of the factors reliably associated with behaviour change in relation to reducing meat and dairy consumption.

2. **Creating a UK baseline dataset**. There is currently no nationally representative data on willingness to reduce meat and dairy consumption, people's motives for this, and which motives are most appealing to the wider public. Research suggests that national differences exist, so having this available would provide a solid foundation for policy decisions and evaluation. Linking this baseline to a long-term UK representative panel would provide future benefits would require significant resources and management. Examples of gaps in our current knowledge include:

    a) What messages are people aware of in relation to reducing meat and dairy consumption?
    b) If people are aware of the messages to eat less meat and/or dairy for environmental reasons:
        i. Are they aware of a conflict between their values and behaviour?
        ii. Are there aware of this in general, at point of making the decision, etc?
        iii. How do they rationalise this?
        iv. Are people conscious of "off-setting", and if so how?
    c) Who do people trust, or not trust, when it comes to messaging about the link between meat, dairy and environmental sustainability?

d) What personal gain do people perceive to reducing meat and dairy consumption, and what personal costs?
e) How great an impact do people believe reducing their meat or dairy intake has compared with other pro-environmental behaviours, and how much more/less challenging would this be for them to achieve?
f) At the point of making a decision, what factors/drivers are people aware of at the time, and if so which are the strongest?
    i. Are people aware of competing goals (for example, health vs environment)?
    ii. Do people switch goals when convenient?
g) How do families negotiate changes in food choice in relation to sustainability?
    i. How do families accommodate differences in preference within the home?
    ii. Who has the power in deciding what is or isn't purchased and eaten?
h) Among those who do intend to reduce meat or dairy consumption, what strategies do they use, if any, to try and achieve this?
i) Do people feel they make different choices when eating with others, than they would if eating/choosing by themselves?
    i. What do people expect when eating at others' homes or out, in relation to meat and dairy? Is this different from when at home?
    ii. What substitutes for meat or dairy do people feel are normal or mainstream (if any)?
j) How do attitudes, willingness and awareness compare across different ethnic groups – and why?

3. **Unpicking differences in the meaning of food within the range of products encompassed by 'meat' and 'dairy'.** The reduction of consumption of some meat and dairy products may be easier for people to make than others. Exploring this could identify the most fruitful areas for policy focus to bring about meaningful reductions at a population at scale. For example, willingness and ease of changing behaviour may differ for high- vs low-value meat products, for milk-substitutes as opposed to cheese and butter

substitutes, and for products incorporated within a meal vs the focus of a meal (for example, people may accept substituting beef in a cottage pie or curry, but not a roast dinner).

4. **Research to explore the factors underpinning demographic differences**. While the existence of differences between groups have been explored, limited data exist that help to explain why. For example, we may expect gender differences in willingness to reduce consumption based on differences in identity and gender norms, but why do we also see differences in awareness? Similarly, why do we *not* see differences in the reduction of meat consumption in different socio-economic groups, when we *do* see differences in awareness and willingness? These, and similar investigations could provide insight into the different routes to reducing meat and dairy consumption that may be appropriate to different populations and suggest different routes of intervention.

4.2 Intervention strategies

1. **Testing the impact of increasing awareness of the environmental costs of meat and dairy on consumption over the long term**. There is not yet robust research reporting on whether increasing awareness is an efficient and effective way to approach reducing consumption. Unanswered questions generated by our literature review include;
    a. Is there greater potential from increasing awareness and acceptance of the environmental rationale for reducing meat and dairy consumption than there is for increasing awareness and acceptance of other, more personal benefits?
    b. Is there greater potential for reducing consumption of meat and dairy through endorsing this message directly, or through the positive promotion of alternatives? For example, by increasing the acceptability and normalisation of meat and dairy substitutes, and/or improving skills and knowledge relating to preparing affordable meat/dairy free meals.

2. **Testing social modelling and interventions based around social norms** to help reduce the intention-behaviour gap in relation to meat and dairy consumption. People recognise the societal, rather than individual, benefits of reducing consumption and this currently presents as a problem to interventions that require individuals to bear the costs of making a change. Instead, we could design interventions that use this perception as their starting point, focusing on fostering social movements, widespread modelling of meat- and dairy-free food choices as mainstream, and community-based initiatives fostering co-action rather than individual change.

3. **Testing alternative labelling formats** for ease of interpretation and avoiding information overload. Research into nutrition labelling suggests simple, traffic-light style labels are most widely understood and acted upon. Research would be valuable to investigate how this could be adapted to communicate environmental impact, and to explore how to provide a combined nutrition and environmental labelling system that may reduce both providing too much information and off-setting.

5. References:

Peer-reviewed literature:

1. Lin-Schilstra, L. and Fischer, A.R.H., 2020. Consumer Moral Dilemma in the Choice of Animal-Friendly Meat Products. *Sustainability,* 12(12). https://doi.org/10.3390/su12124844
2. Tobi, R.C.A., Harris, F., Rana, R., Brown, K.A., Quaife, M. and Green, R., 2019. Sustainable Diet Dimensions. Comparing Consumer Preference for Nutrition, Environmental and Social Responsibility Food Labelling: A Systematic Review. *Sustainability,* 11(23). https://doi.org/10.3390/su11236575
3. Boaitey, A. and Minegishi, K., 2020b. Who are farm animal welfare conscious consumers? *British Food Journal,* 122(12), pp. 3779-3796. https://doi.org/10.1108/BFJ-08-2019-0634
4. Yang, W. and Renwick, A., 2019. Consumer Willingness to Pay Price Premiums for Credence Attributes of Livestock Products - A Meta-

Analysis. *Journal of Agricultural Economics,* 70(3), pp. 618-639. https://doi.org/10.1111/1477-9552.12323

5. Potter, C., Bastounis, A., Hartmann-Boyce, J., Stewart, C., Frie, K., Tudor, K., Bianchi, F., Cartwright, E., Cook, B., Rayner, M. and Jebb, S.A., 2021. The Effects of Environmental Sustainability Labels on Selection, Purchase, and Consumption of Food and Drink Products: A Systematic Review. *Environment and Behavior*. https://doi.org/10.1177/0013916521995473
6. Henchion, M.M., McCarthy, M. and Resconi, V.C., 2017. Beef quality attributes: A systematic review of consumer perspectives. *Meat Science,* 128, pp. 1-7. https://doi.org/10.1016/j.meatsci.2017.01.006
7. Harguess, J.M., Crespo, N.C. and Hong, M.Y., 2020. Strategies to reduce meat consumption: A systematic literature review of experimental studies. *Appetite,* 144. https://doi.org/10.1016/j.appet.2019.104478
8. Short, E.C., Kinchla, A.J. and Nolden, A.A., 2021. Plant-Based Cheeses: A Systematic Review of Sensory Evaluation Studies and Strategies to Increase Consumer Acceptance. *Foods,* 10(4). https://doi.org/10.3390/foods10040725
9. Bimbo, F., Bonanno, A., Nocella, G., Viscecchia, R., Nardone, G., De Devitiis, B. and Carlucci, D., 2017. Consumers' acceptance and preferences for nutrition-modified and functional dairy products: A systematic review. *Appetite,* 113, pp. 141-154. https://doi.org/10.1016/j.appet.2017.02.031
10. Onwezen, M.C., Bouwman, E.P., Reinders, M.J. and Dagevos, H., 2021. A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite,* 159. https://doi.org/10.1016/j.appet.2020.105058
11. Bryant, C. and Barnett, J., 2020. Consumer Acceptance of Cultured Meat: An Updated Review (2018-2020). *Applied Sciences-Basel,* 10(15). https://doi.org/10.3390/app10155201
12. Balan, C., 2021. How Does Retail Engage Consumers in Sustainable Consumption? A Systematic Literature Review. *Sustainability,* 13(1). https://doi.org/10.3390/su13010096
13. Sanchez-Sabate, R. and Sabate, J., 2019. Consumer Attitudes Towards Environmental Concerns of Meat Consumption: A Systematic

Review. *International Journal of Environmental Research and Public Health,* 16(7). https://doi.org/10.3390/ijerph16071220

14. Bianchi, F., Dorsel, C., Garnett, E., Aveyard, P. and Jebb, S.A., 2018. Interventions targeting conscious determinants of human behaviour to reduce the demand for meat: a systematic review with qualitative comparative analysis. *International Journal of Behavioral Nutrition and Physical Activity,* 15. https://doi.org/10.1186/s12966-018-0729-6
15. Bianchi, F., Garnett, E., Dorsel, C., Aveyard, P. and Jebb, S.A., 2018. Restructuring physical micro-environments to reduce the demand for meat: a systematic review and qualitative comparative analysis. *Lancet Planetary Health,* 2(9), pp. E384-E397. https://doi.org/10.1016/S2542-5196(18)30188-8
16. Hartmann, C. and Siegrist, M., 2017. Consumer perception and behaviour regarding sustainable protein consumption: A systematic review. *Trends in Food Science & Technology,* 61, pp. 11-25. https://doi.org/10.1016/j.tifs.2016.12.006
17. Modlinska, K., Adamczyk, D., Maison, D. and Pisula, W., 2020. Gender Differences in Attitudes to Vegans/Vegetarians and Their Food Preferences, and Their Implications for Promoting Sustainable Dietary Patterns-A Systematic Review. *Sustainability,* 12(16). https://doi.org/10.3390/su12166292
18. Desbouys, L., Mejean, C., De Henauw, S. and Castetbon, K., 2020. Socio-economic and cultural disparities in diet among adolescents and young adults: a systematic review. *Public Health Nutrition,* 23(5), pp. 843-860. https://doi.org/10.1017/S1368980019002362
19. Bangsa, A.B. and Schlegelmilch, B.B., 2020. Linking sustainable product attributes and consumer decision-making: Insights from a systematic review. *Journal of Cleaner Production,* 245. https://doi.org/10.1016/j.jclepro.2019.118902
20. Taufik, D., Verain, M.C.D., Bouwman, E.P. and Reinders, M.J., 2019. Determinants of real-life behavioural interventions to stimulate more plant-based and less animal-based diets: A systematic review. *Trends in Food Science & Technology,* 93, pp. 281-303. https://doi.org/10.1016/j.tifs.2019.09.019

21. Reisch, L.A., Sunstein, C.R., Andor, M.A., Doebbe, F.C., Meier, J. and Haddaway, N.R., 2021. Mitigating climate change via food consumption and food waste: A systematic map of behavioral interventions. *Journal of Cleaner Production,* 279. https://doi.org/10.1016/j.jclepro.2020.123717
22. Sullivan, V.S., Smeltzer, M.E., Cox, G.R. and MacKenzie-Shalders, K.L., 2021. Consumer expectation and responses to environmental sustainability initiatives and their impact in foodservice operations: A systematic review. *Journal of human nutrition and dietetics : the official journal of the British Dietetic Association*.
23. Canavari, M. and Coderoni, S., 2019. Green marketing strategies in the dairy sector: Consumer-stated preferences for carbon footprint labels. *Strategic Change-Briefings in Entrepreneurial Finance,* 28(4), pp. 233-240. https://doi.org/10.1002/jsc.2264
24. Allen, S., Goddard, E. and Farmer, A., 2018. How knowledge, attitudes, and beliefs impact dairy anti-consumption. *British Food Journal,* 120(10), pp. 2304-2316. https://doi.org/10.1108/BFJ-12-2017-0733
25. McCarthy, K.S., Parker, M., Ameerally, A., Drake, S.L. and Drake, M.A., 2017. Drivers of choice for fluid milk versus plant-based alternatives: What are consumer perceptions of fluid milk? *Journal of Dairy Science,* 100(8), pp. 6125-6138. https://doi.org/10.3168/jds.2016-12519
26. Thomas, O.Z. and Bryant, C., 2021. Don't Have a Cow, Man: Consumer Acceptance of Animal-Free Dairy Products in Five Countries. *Frontiers in Sustainable Food Systems,* 5. https://doi.org/10.3389/fsufs.2021.678491
27. Jaeger, S.R. and Giacalone, D., 2021. Barriers to consumption of plant-based beverages: A comparison of product users and non-users on emotional, conceptual, situational, conative and psychographic variables. *Food research international (Ottawa, Ont.),* 144, pp. 110363-110363. https://doi.org/10.1016/j.foodres.2021.110363
28. Pandey, S., Ritz, C. and Perez-Cueto, F.J.A., 2021. An Application of the Theory of Planned Behaviour to Predict Intention to Consume Plant-Based Yogurt Alternatives. *Foods,* 10(1). https://doi.org/10.3390/foods10010148
29. Morelli, N. and Vitale, T., 2020. Take politics off the table: A study of Italian youth's self-managed dairy restriction and healthy consumerism. *Social*

Science Information Sur Les Sciences Sociales, 59(4), pp. 679-703. https://doi.org/10.1177/0539018420973596

30. Boaitey, A. and Minegishi, K., 2020a. Determinants of Household Choice of Dairy and Plant-based Milk Alternatives: Evidence from a Field Survey. *Journal of Food Products Marketing,* 26(9), pp. 639-653. https://doi.org/10.1080/10454446.2020.1857318
31. Laila, A., Darlington, G., Duncan, A.M., Haines, J., Ma, D.W.L., Von Massow, M., Wallace, A., Newton, G. and Buchholz, A.C., 2020. Dairy and Plant-Based Dairy Alternatives Purchasing Habits of Guelph-Based Families with Preschool-Aged Children. *Canadian Journal of Dietetic Practice and Research,* 81(4), pp. 215-217. https://doi.org/10.3148/cjdpr-2020-018
32. Wolf, C.A., Malone, T. and McFadden, B.R., 2020. Beverage milk consumption patterns in the United States: Who is substituting from dairy to plant-based beverages? *Journal of Dairy Science,* 103(12), pp. 11209-11217. https://doi.org/10.3168/jds.2020-18741
33. Haas, R., Schnepps, A., Pichler, A. and Meixner, O., 2019. Cow Milk versus Plant-Based Milk Substitutes: A Comparison of Product Image and Motivational Structure of Consumption. *Sustainability,* 11(18). https://doi.org/10.3390/su11185046
34. Laassal, M. and Kallas, Z., 2019. Consumers Preferences for Dairy-Alternative Beverage Using Home-Scan Data in Catalonia. *Beverages,* 5(3). https://doi.org/10.3390/beverages5030055

Non-peer-reviewed literature:

35. Ipsos, 2021. Perils of Perception, Environmental Perils, GB findings. Game Changers
36. Eating Better, 2020. Growing public support for less and better meat. Public attitude survey.
37. Eating Better, 2019. Public attitudes to meat consumption. YouGov Survey quick analysis
38. Ipsos, 2019. Global views on food; What are the world's food habits?
39. YouGov, 2020. WWF survey results – meat
40. YouGov, 2020. Diet and animal welfare survey results.
41. YouGov, 2018. Internal red meat survey results.

Additional sources

42. Michie, S., Van Stralen, M. M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implementation science*, *6*(1), 1-12. https://doi.org/10.1186/1748-5908-6-42

Appendix 1: Search detail

Table 1: Initial search incorporating meat and dairy systematic reviews

Number	Search aim	Food component	Search Focus	Psychology component	Consumer component	Date inclusion	Number of hits
1	Consumer attitudes towards meat and dairy	Meat OR dairy OR milk	consum* OR substit* OR alternat* OR reduc*	attitude* OR motiv* OR intention* OR habit* OR behav* OR choice OR norm* OR self-efficacy OR nudg* OR emot* OR willing* OR belie* OR perception* OR accept*	consumer* OR people* OR social* OR population* OR participants	Last 10 years	215
2	Consumer attitudes towards sustainable food	food OR diet OR eating	sustainab*	attitude* OR motiv* OR intention* OR habit* OR behav* OR choice OR norm* OR self-efficacy OR nudg* OR emot* OR willing* OR belie* OR perception* OR accept*	consumer* OR people* OR social* OR population* OR participants	Last 10 years	129
3	Consumer attitudes towards reduced meat diets	Meat OR dairy OR milk	Flexitarian* OR "conscientious omnivores" OR "plant based" OR vegetarian OR vegan*	attitude* OR motiv* OR intention* OR habit* OR behav* OR choice OR norm* OR self-efficacy OR nudg* OR emot* OR willing* OR belie* OR perception* OR accept*	consumer* OR people* OR social* OR population* OR participants	Last 10 years	24

Number	Search aim	Food component	Search Focus	Psychology component	Consumer component	Date inclusion	Number of hits
4	Consumer attitudes towards ethical/local meat	Meat OR dairy OR milk	local OR welfare OR quality OR food miles OR better OR free-range	attitude* OR motiv* OR intention* OR habit* OR behav* OR choice OR norm* OR self-efficacy OR nudg* OR emot* OR willing* OR belie* OR perception* OR accept*	consumer* OR people* OR social* OR participants	Last 10 years	147
5	Impact of specialist diets on meat/dairy consumption e(iv)	Meat OR dairy OR milk	Atkins OR "blood group diet*" OR "cabbage soup diet*" OR "Carnivore diet*" OR "dukan diet*" OR "paleo diet*" OR "DASH diet*" OR "Mediterranean diet*" OR "ketogenic diet*" OR "kosher diet*" OR "5:2 diet*" OR "low carb* diet*" OR "intermittent fasting diet*" OR "special* diet*" OR "fad diet*" OR "weight loss diet*"	attitude* OR motiv* OR intention* OR habit* OR behav* OR choice OR norm* OR self-efficacy OR nudg* OR emot* OR willing* OR belie* OR perception* OR accept*	consum* OR substit* OR alternat* OR reduc*	Last 10 years	26

* All searches were run with AND “systematic review”

Table 2: Search of individual empirical dairy studies

Search	Key words	Filters	Inclusions	Exclusions	Remaining
-	consumer	Date Last 5 years	Only papers that focus on dairy	Dairy reformulation with no discussion on reduction	-
AND	dairy OR milk OR yoghurt OR cheese	Platform Web of Science	Focus on consumer attitudes or behaviours	Experiments to improve the acceptance of alternatives	-
AND	alternative* OR plant-based OR substitut*	**Results** **374**	Western high-income countries	-	**13**
AND	attitude* OR motiv* OR behav* OR choice*OR belie* OR perception*	-	-	-	-

Appendix 2: Detail of Evidence underpinning report

Table 1: Factors associated with meat and dairy consumption, and substitutions

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
Awareness of the environmental impact of meat and dairy	18-38% of consumers are aware of the adverse impacts of meat/dairy on the environment (16) The impact is underestimated versus other behaviours such as transport choice and packaging (13) Awareness is gradually increasing over time (13)	Sociodemographic factors associated with higher awareness: • Female • Limited meat eaters No evidence to suggest a correlation for age or education (13) 4-19% of meat reducers report environment as their main driver for reducing meat – health is more prominent (13) Willingness to choose sustainability products varies significantly between product types. Sustainability is a higher priority for building/automobile purchases than food (19) Important driver for acceptance of cultured meats (10)
Awareness of health impact of meat/dairy	Health is the main driver for meat reduction (13)	Factors correlating to healthier diets among adolescents: (18) • Higher parental education • Higher parental occupation status

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	Also a main driver of plant based meat alternative consumption (10)	• Higher family affluence • Stable household income • Ethnicity – highly varied • Smaller families Demographics most likely to consume nutrition-modified/functional dairy products: (9) • Female • Older – more familiar with products, more interested in disease risk reduction • Individuals with specific health conditions/previous health scares eg need for low cholesterol • Higher educated • Individuals with more nutrition knowledge • Wellness oriented (sporty, take supplements)
Awareness of animal welfare	62-73% of UK consumers are willing to eat less meat but of a certified origin (European average = 80%) (13)	Demographics more likely to be concerned/ WTP for animal welfare: (3 & 17) • Female – linked to role of nurturer, higher levels of compassion/ less aggression

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	Many consumers experience a moral dilemma of eating meat – can resolve through: (1) • Reducing meat consumption • Buying 'better' meat • Altering mind-set /denial (eg identifying meat as just food) – this is the most common strategy Consumers often think that higher animal welfare products are healthier, higher quality and more environmentally friendly. (3)	• Higher education • Higher income – ability to pay • European (versus rest of world) • Non-religious • Naturalist (versus utilitarian) Age is ambiguous/context dependent (3) Only 50% of vegetarians consider themselves as animal activists. Vegetarians driven by ethical reasons tend to make more sudden diet changes (1) Triggers of ethical awareness: (1) • Meat-related media/reading • Presence of living animals at time of meat consumption • Exposure to animal death/carcasses • Limited meat processing (whole chicken rather than mincemeat)
Attitudes towards meat	Social norms around meat act as a barrier to diet shift. (10)	Meat consumption is associated with: (1 & 17) • Masculinity

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	Common rationalisations for meat consumption: (1 & 17) • Nice • Natural - evolutionary • Necessary - nutritional • Normal – social norms • Counter-value behaviours (donating to animal welfare organisations) Common challenges of meat consumption: (1) • Shame, guilt • Empathy • Disgust, repulsion – often occurs later in a meat reduction journey	• Wealth • Social status • Right-wing ideology • Cultural traditionalism • Human dominance over animals Vegetarian/vegan men encounter more hostility/questioning than women. But gradually reducing over time (17)

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
Attitudes towards dairy	There is very little literature on consumer perceptions or interventions for dairy (21) Drinks (milk) plays a very different role in consumer's lives to solid foods (meat) - cannot assume same attitudes/behaviours (27) Perceptions of dairy milk versus non-diary alternatives: (34) • Tastes better – perception of taste not impacted by socio-demographics • Fresher • Healthier - Better for bones/ richer in minerals (consumer perceptions do not align to evidence supporting plant-based diets for health)	Dairy intake (Few and inconsistent findings) tends to be higher for individuals with: • Higher education • Higher income • Higher overall socio-economic status. Little evidence to suggest correlation to occupation, income stability or ethnicity (18). **Health:** Mixed perceptions regarding health. (34) • Good health – bones and calcium • Bad health – high cholesterol, fat, calorie Consumers of diary or non-dairy alternatives tend to think their choice in milk is healthier. (34) Traditionally milk was marketed by governments as an essential component of a healthy diet. Over time – milk is seen as a less necessary/ staple food group. Increasingly associated with unhealthy, fatty foods. (29)

Factor	Nature of association	Context for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	• More natural (potentially a misconception given many supermarket milks are treated. Consumers do not understand the meaning of pasteurisation) • Higher fat/calorie • More allergenic • More masculine Important attributes of dairy milk (ranked); (29 & 34) 1. Taste 2. Price 3. Fat content / ingredients 4. Packaging size 5. Label claims/ origin – eg local 6. Natural Organic	

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	Vitamin fortified (No significant variations based on gender or age) Some consumers discussed choosing a milk that their family also likes (38)	
Attitudes towards vegetarian/vegan diets	Becoming a vegetarian/vegan involves adopting an identity. 'Meat reducer'/'flexitarian' is an easier adoption (13) Vegetarians increasingly accepted, 'vegans' are still considered a external group to mainstream society (17) Attitudes towards environmental initiatives are generally positive, but don't always translate into behaviour change (22)	1/3 of teenage vegetarian/vegans say its hard to avoid meat at home – due to low support for diet from family (17) Men are more sceptical of veggie foods – based on lack of taste, appeal and nutritional value (17) Vegetarians and vegans reflect much more on the reasons behind their diet choice than omnivores (29)

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
Attitudes towards meat alternatives	Overall, low levels of acceptance Plant based alternatives are generally favoured over artificial/cultured meats (10) Attitude is consistently found to be relevant for acceptance of meat alternatives (10) Potential benefits: (11) • Artificial/processed alternatives are often confused with adverse environmental impacts • Health benefits vary with alternative. Cultured meat perceived as the least healthy or safe.	Cultured meats are more accepted by: (11) • Non-meat reducers (versus vegetarians) • Men • Left-wing politically oriented • Urban dwellers • Higher educated Plant based alternatives are more accepted by consumers with healthier/ eco lifestyles (10)

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	• Consumers rarely mention food safety as a benefit Barriers: (11) • Unnaturalness – doesn't always lead to rejection (not everyone values naturalness)	
Attitudes towards dairy alternatives	Dairy alternatives initially marketed to allergies/intolerances/vegan diets. (8) US sample – 32% thought vegan cheese was just as good as dairy. 34% disagreed. 34% were indifferent. (8) Drivers/barriers to purchase: (8 & 34) • Taste (most significant) – difficult with plants to achieve flavour, aroma,	Some consumers expect a product that embraces plant flavours, others want something that resembles conventional dairy. Can result in strong consumer segmentation. (8) Very limited literature – doesn't reflect diverse/growing array of options available (8 & 21) Consumers unwilling to try plant-based drinks are also unwilling to try other less traditional drinks (energy drinks, kombucha) (27) Perception of animal free dairy cheese versus normal cheese: (39)

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	mouthfeel and meltability. Soy products often have a undesirable beany flavour and gritty mouthfeel. • Price • Convenience • Health – nutritional differences: protein quality, calcium content • Longer shelf life is beneficial for stockpiling/flexibility/smaller households Perceptions of plant-based alternatives for non-consumers: (27) • More… boring, irritating, modern, pretentious, unique • Less… carefree, comforting, confident, easy-going, friendly,	• Slightly less tasty • More ethical and environmental • Less natural and safe • Similar health/nutrition

Factor	Nature of association	Context for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	happy, genuine, simple, traditional, trustworthy Common criticisms: - varies with product and consumption frequency (8 & 34) • Yeasty • Unpleasant onion/garlic flavours • Oily • Rubbery • processed • Sour /salty aftertaste • Poor/rancid odour • Soy – perception of bad for environment • Unsure how to prepare/use product	

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	Important attributes of dairy milk (ranked); (34 & 38) 1. Sugar level (naturally sweetened/ unsweetened – some confusion around what counts as natural) 2. Plant source 3. Packaging size	
Willingness to reduce meat consumption	Very few people are willing to reduce their meat consumption (12.8%-25.5% if unprompted) (13) 29-49% of UK consumers are willing to replace most meat with vegetables (European average – 50%) (13) Need to prevent consumers simply switching to other stores/hospitality to get meat (23)	Demographics most willing to reduce meat: • Female • Young No evidence to suggest a correlation for education (13) Ethnicity and culture have a strong, varied influence (13) Women also more likely to try out different diets (low-fat or carb) (17) Awareness of the environmental impact of meat consumption significantly increases the willingness to reduce (10)

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
Willingness to reduce dairy consumption	In US, since 1975: (32) • Total dairy consumption increased 20% • Milk consumption per capita declined 41% (driven by reduced frequency in younger generations and decline in whole milk) • Cheese consumption per capita increased 177% • Butter consumption increased 23% **Drivers** for reducing dairy consumption (ranked): (34 & 38) 1. Animal welfare concerns – leads to feelings of accomplishment/ relieved guilt	Demographics most willing to reduce dairy: (29 & 37) • No significance to age • High income • Female • Urban dwellers (38) found no significant differences between socio-demographics Knowledge and attitudes are more significant predictors of dairy consumption than socio-demographics (37) Consumers are more likely to have abandoned dairy consumption rather than never have consumed it. (29) Some consumers are unwilling to reduce dairy consumption in support of local economy and farmers. Whereas plant-based milk is not seen as a domestic product (34)

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	2. Digestion problems. Although some consumers are willing to sacrifice digestion comfort for the taste of dairy 3. Environmental concerns Unhealthy Inferior taste Consumers are not significantly influenced by vegan/anti-dairy campaigns. Behaviour is more driven by personal gains in wellbeing than political/ethical movements. (29) Milk is the most likely dairy group to be reduced – versus cheese/butter (29) Possibly due to the higher popularity/availability of milk alternatives (37)	Expressing concern for animal welfare and environment does not significantly increase likelihood of actually changing behaviour. Concern for health does impact behaviour. (29) Parental milk consumption is associated with child's willingness to reduce dairy intake/ accept alternatives (30)

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	Barriers to reducing diary consumption: (34) • Better taste than alternatives = biggest barrier • Staple food • Habit/ familiar – 'grew up with it' • Cheaper than alternatives • More available/ convenient than alternatives • Need it for nutrients	
Willingness to accept meat alternatives	48.5-55.2% would eat cultured meat instead of meat (11)	More willing to accept alternative proteins if: (10) • Young • Highly educated • Not politically conservative • Live in urban areas • Female • Already reduce meat intake

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
Willingness to accept dairy alternatives	Drivers for **accepting** dairy alternatives: (ranked) (34) 1. Switching diet Reduced tolerance for cow milk – lactose intolerance/ allergies Curiosity 2. Change to healthier lifestyle 3. Knowledge about animal welfare Knowledge of environmental impacts 4. Recommendation from friends Greater supply in supermarkets Drivers for not accepting dairy alternatives: (ranked): (34) 1. Inferior taste 2. No interest 3. Less natural	More willing to accept dairy alternative if: (28, 30 & 32) • Young (some conflicting findings) • Higher educated • Live in urban areas • Females • Less exposure to farming • More liberal • Following a diet 50% of non-dairy consumers still consume dairy milk occasionally, mostly due to the preferred taste in coffee (34, supported by 32) Willing to accept animal free dairy cheese (cheese equivalent of cultivated meat – not yet on market) (39) • 67.6% of UK would try • 58.5% of UK would buy • 34.6% of UK would buy regularly Willingness increased with: (39)

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	Not habitual Significant factors influencing acceptance: (28) • Perceived behavioural control • Attitudes • Perceived sensory attributes (especially taste)	• Higher current consumption of normal cheese • Following a flexitarian diet (versus following a omnivore or vegan diet) • Younger • More liberal • More urban No/little correlation to gender, income, education or religiosity. Few consumers are willing to substitute dairy for their pets (32)
Willingness to pay	Attributes ranked by consumer preference: (6) (this was specifically for beef) 1. Origin (study: when local food was marginally more expensive, more consumers chose local food than when it was sold at the same price (22)) 2. Price	Willingness to pay for environment/ health/ animal welfare benefits higher for: (4 & 26) • Higher affluence • Higher education • Female • Preference for naturalness • Health/environment conscious • Beef/dairy versus lamb/chicken • Type of attribute (ranked: organic, hormone/antibiotic free, high animal welfare, food safety, geographic origin, environmental benefits)

Factor	Nature of association	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	3. Certification/labels/brands/information 4. Visible fat 5. Flavour 6. Animal welfare 7. Production system/feeding 8. Freshness/wholesomeness/ shelf life 9. Natural (GM feed, hormones)/organic 10. Tenderness 11. Health, nutrition, body weight 12. Meat colour 13. Convenience 14. Safety (residues, health risk etc) 15. Environmental issues 16. Appearance 17. Juiciness	Asian markets are the most willing to pay, followed by Europe then North America (4) WTP is increasing over time. (4)

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	18. Process technologies (aging, irradiation, halal/kosher) 19. Place of purchase 20. Packaging 21. Breed Expected that health, welfare and environment will go up the priority list (6) Consumers have good intentions to pay a price premium but don't always follow through (4 & 6) Consumers may primarily purchase sustainable products to satisfy personal benefits rather than societal eg organic for health (19) Drivers: (4)	

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	• Self-interest (confidence in safety) • Social responsibility (sustainability) Associated with perceived attributes rather than labelled/actual. (4)	
Food neophobia	Reluctance to try new foods is a significant barrier for the adoption of novel meat and dairy alternatives (10 & 27) Strategies to overcome neophobia: (27) • Use familiar flavours (chocolate milk • Use locally grown plants • Reduce price	Food neophobia more likely for: (11 & 27) • Older • Less educated • Less likely to work • Lower income • Smaller household • European

Factor	**Nature of association**	**Context** for example, whether different effects for different subgroups, whether and how the effect related to broader values or a stand-alone motivation, eating in the home/out of the home etc
	• Emphasising environmental/health benefits unlikely to be significant.	
Trust	Based on limited evidence, trust is positively associated with adoption of meat alternatives (10) Consumers report distrust with food companies and labelling (11) Independent promotors/public health institutions play a key role in increasing trust (10)	Rural dwellers place more trust in farmers – hence more loyal to meat (11)

Table 2: Interventions to reduce meat and dairy consumption

Factor	**Mechanism of action** Link to mechanisms in previous report	**What works** Intervention details (for example, substitution or reduction, rather than abstinence etc) Context (as per table above)
Awareness	Providing information	Strong support that non-tailored information can reduce **intention** to eat meat (14) Tailoring information to consumer has little effect (14 & 20) No evidence to suggest information leads to actual long term **behaviour change** (13 &14) Specific information more effective than general (10 & 20) **Extra information** not always effective eg possible negative health impacts (10) Extra information is not always used – consumers use only a few characteristics to make decisions (6)

Factor	**Mechanism of action** Link to mechanisms in previous report	**What works** Intervention details (for example, substitution or reduction, rather than abstinence etc) Context (as per table above)
		Consumers make trade-offs between different attributes. More likely to trade off hedonic values than utilitarian values for sustainability. (19) Too many choices can sap cognitive resource – decreasing participation and satisfaction (22) Information could be used to support more structural interventions (14) Information about animal welfare most significant for reducing meat consumption intension (14) Also important for increasing perceived safety of alternatives (11) Providing information about the social antecedents/consequences of meat had limited impact (14)

Factor	**Mechanism of action** Link to mechanisms in previous report	**What works** Intervention details (for example, substitution or reduction, rather than abstinence etc) Context (as per table above)
		More effective to focus on the personal benefits of meat reduction / adoption of meat alternatives (11) Adding emotion to messages enhances influence – as seen for smoking campaigns (24)
Awareness	Message framing	Describing cultured meat in a non-technical manner, focusing on the final product (10) Focusing on the problems of conventional meat (animal welfare) is more persuasive than focusing on the benefits of meat alternatives (11)
Awareness	Labelling For example, text, logos, claims	Consistently effective for increasing sustainable food choices (25) Efficacy increases with: (25 & 26) • Varies with type of claim (ranked: organic, animal welfare, environmental impact, Fairtrade) • Combined labelling of environment and nutritional claims most effective

Factor	**Mechanism of action** Link to mechanisms in previous report	**What works** Intervention details (for example, substitution or reduction, rather than abstinence etc) Context (as per table above)
		• Varies with type of food (Organic preferred for dairy, animal welfare/nutrition preferred for meat, nutrition/quality preferred for luxury items – chocolate, smoked salmon) • Accessibility (Increased by providing a total score or colour coding) • Certification backing – increases trust • Positive messaging – reinforcing consumer choice • Understandable with current knowledge – carbon labels are consistently poorly understood and received, organic labels are incorrectly associated with improved health Efficacy does not depend on label format (25) Consumers are more respondent to labels if: (25) • Female • Wealthier

Factor	**Mechanism of action** Link to mechanisms in previous report	**What works** Intervention details (for example, substitution or reduction, rather than abstinence etc) Context (as per table above)
		No correlation for age or education level Challenges: • Corporate green washing • Lack of demand (reason for Tesco's carbon labelling withdrawal 2012) • Encouraging a further price premium
Attitude	Adjusting social norms eg providing information on other people's diets Social modelling	Norms can act as barriers to change, but can also steer behaviour – particularly for consumers who rarely eat meat alternatives (10) About 50% of experiments were effective (20) Dynamic norm messages (reporting people's change in behaviour) is more effective than static norms (20)

Factor	**Mechanism of action** Link to mechanisms in previous report	**What works** Intervention details (for example, substitution or reduction, rather than abstinence etc) Context (as per table above)
		Social modelling found to produce significant behaviour change – highlights importance of leadership and emergent change (22)
Attitude	Social acceptance – opinion of family and friends	Limited research (10) Adding positive consumer reviews to meat-free foods increases acceptance (15) Social support groups can be effective in supporting positive dietary changes (20)
Attitude	Individual lifestyle counselling (health professional 1-1 sessions)	Strong support for efficacy, but limited by high resource demand (14)
Attitude	Self-monitoring (to stay within recommended meat intake) For example daily journaling, goal setting, reminder text messages	Increased intention to reduce meat intake (14)

Factor	**Mechanism of action** Link to mechanisms in previous report	**What works** Intervention details (for example, substitution or reduction, rather than abstinence etc) Context (as per table above)
Attitude	Altering the visual/ hedonic appeal of meat and alternatives for example, Including pictures of the animal's head/limbs, including photos of cute animals	Reduces meat consumption via (24): • Increasing empathy towards animals • Inducing higher cognitive dissonance • Decreasing state dissociation • Increasing disgust Unnaturalness perceptions of meat alternatives are more effectively resolved through calling out the unnaturalness of conventional agriculture (versus promoting the naturalness of meat alternatives or dismissing the importance of naturalness) (11)
Attitude	Adjusting product naming	Calling out meat dishes for including meat – rather than allowing them to become the standard (15) Conflicting evidence regarding how to label meat-free dishes for maximum uptake (15)
Nudging – behaviour change needs to	Reduce meat portion sizes	Strong support that it reduces consumption of meat, but may also decrease consumer satisfaction (15)

Factor	**Mechanism of action** Link to mechanisms in previous report	**What works** Intervention details (for example, substitution or reduction, rather than abstinence etc) Context (as per table above)
be easy, convenient, appealing or default (22)		Providing options for smaller portions reduces total meat sales - allowing others to choose larger for satisfaction (20)
Nudging	Increasing availability of meat alternatives	When combined with educational components, significantly reduce long term meat consumption (15) Studies looking at product placement and outlet density were less effective (20)
Nudging	Default meat-free options / meat free days	Default vegetarian options increase probability of a meat-free choice (16) Meat free days encouraged trial – increasing positivity towards vegetarian food (22)
Nudging	Repositioning meat and meat-free options on menus/ point of sale/ buffets	Positive results in reducing meat consumption – extent varies with context (15)

Factor	**Mechanism of action** Link to mechanisms in previous report	**What works** Intervention details (for example, substitution or reduction, rather than abstinence etc) Context (as per table above)
Nudging	Creating atmosphere	Some retailers have explored using natural sounds/colours to encourage sustainable choices (23)
Willingness to reduce meat / adopt meat alternatives	Increase familiarity – with tastings	Specifically important for novel meat alternatives such as cultured meat (10) Disguise novel ingredients into recognisable foods eg burgers Free samples/ portions of meat-free options significantly improve diet choices (20)
Willingness	Pricing	Price is an important determinant of food choice. Economic interventions can be the most effective for food behaviour change (15) Conflict – hence needs further research: Higher priced meat alternatives can increase perceived quality (10) Cheaper meat alternatives appeal to price sensitive consumers – otherwise at risk of only for the elite (20)

Appendix 3: Findings from the grey literature and commissioned surveys

Survey data provide information on UK-only populations, and some indication of trends, although the number of years that studies look back is limited. The data largely corroborates the demographic factors associated with willingness to change, and awareness, as set out in Section 2 – except where identified in the specific examples set out below.

3.1 Awareness and changes over time

The grey literature from the most recent 2 years supports the findings that meat reduction is predominantly driven by health and animal welfare, even though people report that the environmental impact is becoming increasingly important to them.[3]

People's knowledge of the environmental impact of livestock is low and largely underestimated, although they are able to rank it appropriately; consumers correctly rank eating a plant-based diet below having fewer children, not having a car, avoiding long haul flights, renewable energy for reducing carbon emissions. However, they incorrectly rank recycling more to be the most important.[1,6]

However, 62% of consumers think that a locally sources diet is more environmentally friendly than following a vegetarian diet[1], and support for farmers was raised by a large proportion of of people as a reason why not to reduce meat and dairy intake. For example;

- 69% want to support UK farmers, particularly those with high animal welfare and environmental standards.[2]
- 72% have taken action in support of UK farmers in 2020. 44% selected UK-produced food ahead of imported.
- 35% have bought directly from farmers.
- 11% have signed petitions in support of UK farming.[2]

3.2 Intentions and behaviour to reduce consumption

Willingness to reduce consumption aligns with awareness,[3] but this does not strongly link to behaviour.

The majority of British people in samples recruited intend to reduce their meat intake; in 2019-2020 65% of people (71% of women) reported being willing to reduce their

meat taken, although only 21% had done so.[2] In actually, the majority of people in the UK report eating meat a few days a week, and (55%) eat meat 3-5 days per week[2] and the UK has fewer vegetarians than the global average (9% never eat meat).[2]

Older consumers are reducing meat consumption more than younger consumers.[3]

3.3 Attitudes towards meat and dairy alternatives

Surveys suggest that willingness to try plant-based alternatives is high (for example, 49% of British people would eat a plant based substitute for meat, compared with 42% worldwide). Their preference is for unprocessed alternatives (pulses, nuts, seeds) to products mimicking meat.[3]

This is consistent across socio-economic backgrounds and ages, but fewer nuts/seed are consumed in the North of the UK.[3]

3.4 Support for policy approaches

In reporting these findings, we note up-front that consumers' views on what would help them to make a change in many behavioural domains includes education, but this rarely has an impact on its own. Similarly, we note that people are not always good judges in hypothetical situations of how they would react when posed with a real policy that might pose a real cost, financial or otherwise.

Consumer acceptance for government intervention to reduce meat consumption is much lower than for other dietary changes; 61% support alcohol interventions, 77% support smoking interventions, 67% support obesity interventions, but only 35% support meat reduction interventions.[6]

Nonetheless, in responding to consumer surveys;

- Consumers supported a greater emphasis on education, for example 35% would welcome improved knowledge of how to plan and cook meals that reduce meat.[2]
- People rank improved labelling as the best approach to influencing food choice, followed by education/information, and more meat free options in supermarkets/catering.[2]
- 55% would support labels on meat indicating how the animal was raised and slaughtered; 14% would oppose these.[6]

References

1. Ipsos, 2021. Perils of Perception, GB findings, April
2. Eating Better, 2020. Public attitude survey – sample size = 2095.
3. Eating Better, 2019. YouGov Survey quick analysis, April
4. Ipsos, 2019. Global views on food. UK sample size = 1,000
5. YouGov Survey, WWF 2020. Sample size = 905
6. YouGov Survey, 2020. Sample size = 1652 GB adults.
7. YouGov Red Meat Survey, 2018. Sample size = 1073 adults.