Proceedings of the Nutrition Society, Page 1 of 9 doi:10.1017/S0029665123004858

The Nutrition Society Scottish Section Conference 2023 was held at Glasgow's iconic Royal College of Physicians and Surgeons on 28–29 March 2023

Conference on 'Diet and health inequalities'
Symposium one: Food insecurity and human health

How (not) to talk about plant-based foods: using language to support the transition to sustainable diets

Esther K. Papies[1]*, Tess Davis[1], Stephanie Farrar[1], Maddie Sinclair[1] and Lara H. Wehbe[2]
[1]*Social and Public Health Sciences Unit, School of Health and Wellbeing, University of Glasgow, Glasgow, UK*
[2]*School of Psychology and Neuroscience, University of Glasgow, Glasgow, UK*

Reducing meat consumption is essential to curb further climate change and limit the catastrophic environmental degradation resulting from the current global food system. However, consumers in industrialised countries are hesitant to reduce their meat intake, often because they find plant-based foods less appealing. Despite the climate emergency, eating meat is still perceived as the norm, and recommended in most national dietary guidelines. To support the transition to more sustainable diets by providing insights for increasing the appeal of plant-based foods to mainstream consumers, this review presents recent research findings on how people think and communicate about meat-based and plant-based foods. The key findings we review include: (1) while vegans think about plant-based foods in terms of enjoyable eating experiences, omnivores think about plant-based foods in terms of health, vegan identity and other abstract information that does not motivate consumption in the moment. (2) Packages of ready-meals and social media posts on Instagram present plant-based foods with fewer references to enjoyable eating experiences than meat-based foods. (3) Presenting plant-based foods with language that references enjoyable eating experiences increases their appeal, especially for habitual meat eaters. This language includes words about sensory features of the food (e.g., crunchy, creamy), eating context (e.g. pub; with family) and immediate positive consequences of eating (e.g. comforting, delicious). In contrast, the term 'vegan' is strongly associated with negative stereotypes. Hence, rather than referring to being vegan, meat-free or healthy, the language used for plant-based foods should refer to sensory appeal, attractive eating situations and enjoyment.

Keywords: Sustainable diets: Plant-based food: Behaviour change: Climate change

Food systems are responsible for about 34 % of global greenhouse gas (GHG) emissions and are the largest cause of global environmental change, particularly from the production of meat[1–3]. Omnivorous diets, which include meat and dairy, are associated with much higher GHG emissions than pescetarian, vegetarian and vegan diets[2–5]. Particularly, red meat is associated with GHG emissions orders of magnitude larger than white meat, fish and plant-based foods, accounting for approximately 60 % of all GHG emissions from food production[2,6]. Agriculture is also the main source of deforestation and forest degradation, which leads to dramatic reductions in biodiversity, and turns environments that previously captured CO_2 naturally into carbon-emitting areas[7,8]. Most

Abbreviation: GHG, greenhouse gas.
***Corresponding author:** Esther K. Papies, email Esther.Papies@glasgow.ac.uk

deforestation happens to provide land for cattle and to grow soya for animal feed and biofuels[9]. In addition to lower GHG emissions than meat, the consumption of plant-based foods such as vegetables, legumes and whole grains is associated with a variety of health benefits[10], such as playing a protective role against cancer, cataracts, hypertension and heart disease[11,12]. Overall, reducing the demand for animal-based foods, and shifting demand towards more plant-based diets, is essential to curb further climate change and limit the catastrophic environmental degradation and negative health implications of the current food system[3,3,13,14].

Climate change is overwhelmingly caused by industrialised societies in the so-called Global North, while its impacts are most strongly felt in already disadvantaged communities, such as people in the Global South, those with lower levels of wealth and income, people of colour, women and children, reflecting ongoing and historical injustices[15–17]. In fact, the richest 10 % of the world population are responsible for about 34 % of global household-related carbon emissions[18], with 48–70 % of these household-related impacts resulting from dietary practices[19]. Within the food domain, these inequalities will likely result in intensifying food insecurity, food scarcity and food system failure that will have the strongest impact on already vulnerable and often undernourished groups[3,20]. Thus, global food system changes are urgently needed to reduce undernourishment and hunger in low-income countries, and to shift the diets of citizens in high-income nations towards more plant-based diets[13,21].

Most food-based dietary guidelines in high-income countries, however, do not support this change, and are in fact incompatible with the targets of the Paris Agreement to keep global warming to 1·5°C and with other environmental targets. This is largely because they do not recommend the reduction of animal-based food consumption, especially beef and dairy[22]. Indeed, most food-based dietary guidelines recommend the consumption of meat and dairy, and only a small number of national guidelines recommend reducing the intake of these foods for reasons of environmental sustainability[23,24]. Although most dietary patterns exceed the recommendations of food-based dietary guidelines and result in higher negative health and environmental impacts[22,25,26], these guidelines do represent what is deemed 'acceptable' eating behaviour, and they shape social norms that favour omnivorous diets over plant-based or vegetarian diets. In other words, the fact that most dietary guidelines include meat and dairy and do not explicitly recommend reducing their intake for environmental reasons communicates that eating animal-based foods is a norm supported by public health or other official authorities, and hence impedes a shift towards plant-based diets.

Most people are reluctant to reduce meat and dairy intake

In line with such norms, most people are hesitant to reduce their meat and dairy intake. Barriers such as perceiving meat consumption as commonplace, being unfamiliar with plant-based foods, and lacking skills and knowledge to prepare them in tasty and nutritionally adequate ways have been identified as hindering Swedish consumers in reducing their meat intake[27]. Similarly, participants in a recent UK-based qualitative survey pointed to perceptions of low availability, affordability and health benefits of plant-based foods as important barriers when trying to reduce meat and dairy intake[28]. Habits, and the self-control needed for behaviour change, further challenge the transition away from meat-heavy diets, which is also impeded by cultural norms about meat eating and media discourse that cater to meat eating as the acceptable status quo[28–30]. Synthesising research on the barriers and enablers for transitioning to a plant-based diet, Graça *et al.*[31] identified skills and information, enjoyment motives and social norms and prejudice as key barriers, whereas positive taste expectancies and positive views of plant-based lifestyles were seen as enablers.

To address these barriers, significant 'upstream' and 'midstream' interventions in the food system are required[32]. This includes, for example, incentivising the production of plant-based over animal-based foods, updating dietary guidelines and making plant-based foods the default in public settings. Such concerted changes would increase exposure towards plant-based foods, shift social norms in favour of consuming plant-based foods, and hence support attitude and habit change. We discuss such food system interventions in more detail at the end of this review. An important complementary strategy to increase the acceptability and likely success of such measures, however, is to increase taste expectations of plant-based foods among mainstream consumers. Indeed, taste expectations and enjoyment in particular are a key obstacle to shifting towards more sustainable diets. Although vegetarian and vegan foods are expected to be healthier and more environmentally friendly, most omnivores expect these foods to be less enjoyable to eat compared to meat-based foods (e.g.[33–36]). Similarly, meat and dairy reducers reported that liking animal-based foods, and finding plant-based foods less appealing hindered their dietary change[28]. Indeed, they indicated to be willing to try more plant-based foods if they tasted better. In order to examine the psychological processes underlying these taste expectations and related motivational processes in the consumption of meat- and plant-based foods, we recently examined how people cognitively represent these foods.

A grounded cognition approach to understanding food motivation

Cognitive representations may be important as they can motivate and shape behaviour, often outside of conscious awareness. When examining the cognitive representations of meat- and plant-based foods, we adopted the theoretical framework of the grounded cognition theory of desire and motivated behaviour[37–39], which proposes that during each eating or drinking episode, people store

https://doi.org/10.1017/S0029665123004858 Published online by Cambridge University Press

rich representations of the experience in memory. These representations can include, for example, information about the smell, taste and the texture of the food, information about the motor actions of eating it, information about the physical location, time, occasion and other people present, as well as internal states such as bodily feelings, emotions, thoughts and experiences of (dis)pleasure or enjoyment.

When one later encounters a part of such a cognitive representation one has formed of eating a food (e.g. the place where one has eaten a specific food; seeing the food), this can activate remaining features of the representation, which can then be simulated, or re-experienced, in response to this cue. As an example, if one frequently eats a burger on a Friday night in the local gastro pub, later entering the pub, or hearing mention of a burger, may trigger a re-experience of what it is like to eat the burger, including picking it up, what it feels and tastes like, who else is around, the sounds of the pub and what the experience feels like. Indeed, neuro-imaging research has shown that simply viewing food pictures in an functional MRI scanner activates those areas of the brain that are also involved when actually eating, including primary taste areas, motor areas and reward areas (see[40], for a review). This suggests that people simulate, or re-experience, eating the food when they see a picture of it. Critically, the degree that these simulations include reward experiences, such as liking the taste of the food, or feeling good from eating it, can create desire, and can lead to motivated behaviour, such as choosing a food, preparing it or leaving the house to purchase it.

In line with this theory, research on the cognitive representations of foods and drinks has confirmed that people hold rich, multifaceted representations of these stimuli that seem to be shaped by their consumption experiences. When participants were asked to 'simply describe' a variety of beverages, such as Coca-Cola and water[41], they listed hundreds of unique features for each drink, pointing to highly idiosyncratic consumption experiences informing their cognitive representations (e.g. 'sweet', 'sticky', 'tangy', 'on a hot day', 'at the gym', 'satisfying', 'nice', 'awake', 'guilt', 'energy'). Related research on alcoholic drinks showed that features referring to the social drinking context were especially salient for alcoholic drinks that participants consumed frequently[42]. Similarly, when asked to describe twenty different dishes either without further instructions, or with instructions to focus specifically on sensory features, eating context or hedonic experiences, participants listed between 1237 and 1479 unique features per dish. These frequencies suggest large variability in individual representations that likely results from a wide array of individual eating experiences with a food[43].

Preferred foods are cognitively represented through rewarding eating experiences

Across experiments and domains, we have found that foods and drinks that are rated as more appealing by participants are represented more in terms of what it is like to consume them than foods and drinks seen as less appealing. Specifically, the proportion of consumption and reward features, which reflect sensory, context or reward aspects of the consumption experience, is typically higher for more appealing foods and drinks e.g. for sugar-sweetened beverages compared to water, and for unhealthy snacks compared to fresh vegetables[41,44]. Less appealing foods and drinks are more represented in terms of what they look like, in terms of food and drink categories, or with reference to ingredients or health implications. In other words, people think about foods and drinks that they enjoy consuming in terms of what they taste and feel like, and in terms of the situations where they would eat or drink them, more than for less preferred foods and drinks.

Critically, findings across experiments and domains also show that representing a food or drink in terms of consumption and reward experiences predicts appeal ratings, desire to consume, as well as consumption intentions and behaviour[41–44]. In a recent large experiment[43], we asked 720 participants to describe twenty foods, indicate their intentions to eat them over the next 30 days, and then contacted them again to assess their actual consumption 30 days later. We found that describing a food more in terms of rewarding eating experiences (i.e. with consumption and reward features) predicted intentions to consume, which in turn predicted actual intake over the follow-up period. In sum, cognitively representing a food in terms of consumption and reward experiences reflects the motivation to eat it.

Cognitive representations of meat-based and plant-based foods

Similar to the findings described earlier, we recently studied the representations that people hold of meat- and plant-based foods, to understand whether they could provide insights into the reluctance of mainstream consumers to switch to more plant-based diets[45]. In two large-scale experiments (N 220 and N 843), we asked omnivores and vegans to describe a number of meat- and plant-based foods (e.g. beef burger, falafel burger; pork ramen, tofu ramen). The listed features were then coded as consumption and reward features (i.e., referring to sensory aspects, eating context, or immediate positive effects of consuming the food), or as situation-independent features (i.e. referring to visual aspects, categories, health implications, ingredients, etc.). Across the two experiments, we also assessed food attractiveness, how often participants typically consumed each food, likelihood of ordering each food in a restaurant, intentions to consume it and actual intake over a 30-d period.

Again, we found high numbers of unique features for all twenty dishes (Experiment 1 = 3910; Experiment 2 = 7346), pointing to the large variability in how people cognitively represent the foods. Analysing the categories of the features listed showed that omnivores described meat-based foods more with consumption and reward

https://doi.org/10.1017/S0029665123004858 Published online by Cambridge University Press

features than plant-based foods, using words such as tasty, spicy, delicious, filling, meaty, hot and juicy. Notably, we found exactly the opposite pattern for vegans: they described plant-based foods more with consumption and reward features than meat-based foods, using words such as tasty, spicy and filling. In other words, each group described foods that are compatible with their diet and thus frequently consumed more in terms of rewarding eating experiences than foods that are incompatible with their diet or infrequently consumed. Indeed, higher typical consumption frequency was associated with describing a food more in terms of consumption and reward features, which is consistent with related studies on foods and drinks[41,43].

These findings suggest that omnivores simulate rewarding eating experiences when thinking about meat-based foods, but not when thinking about plant-based foods. In contrast, vegans simulate rewarding eating experiences when thinking about plant-based foods, but not meat-based foods. When thinking about plant-based foods, omnivores were more likely to list features related to health (e.g. healthy), ingredients (e.g. chickpeas) or categories (e.g. vegetarian, vegan), whereas vegans were more likely to list features about meat-based foods related to the social political context of consuming meat (e.g. cruel, carcass, bad for the environment). While these features are often accurate, they do not reflect or create desire for a food, and do not motivate consumption in the moment.

Furthermore, as we had hypothesised, representing a dish in terms of rewarding eating experiences was systematically associated with eating motivation. Specifically, we found that consumption and reward features predicted how attractive participants rated a dish, how likely they would be to order it in a restaurant, their intentions to eat it, and their actual consumption over 30 days. However, this association with actual consumption disappeared when controlling for typical consumption, suggesting that consumption habits are strongly aligned with behaviour, and both are reflected in consumption and reward descriptions. In other words, past consumption frequency, or habitual consumption, was a strong predictor of consumption, and participants represented these habitual foods in terms of eating and enjoying them.

Overall, these findings show that people are more likely to simulate eating and enjoying food that is compatible with their dietary pattern and that they consume frequently, and that these simulations motivate future consumption. This could provide insights into why omnivores are hesitant to shift towards plant-based foods: they do not represent them in rewarding ways that motivate consumption.

Plant-based foods are presented to others in less appealing ways

In line with these findings, we found that plant-based foods are also described to others in less appealing ways than meat-based foods, for example on food packages[46]. In an observational UK study examining the labels of 240 meat-based, vegetarian and plant-based ready-meals available in four supermarkets, we coded the language used in the food descriptions according to the same categories as in the experiments described earlier (i.e. as consumption and reward features or other features). Here, we found that meat-based foods tended to be labelled with a higher proportion of consumption-related words than vegetarian and plant-based foods, which in turn had a higher proportion of more abstract, distal features (e.g. ingredients, health implications, food categories). This suggests that in a retail context, plant-based foods may be presented in a disadvantageous way, with fewer references to the rewarding consumption experiences that motivate desire for food, and that could entice omnivores to try out plant-based foods (see also[47]).

We found the same pattern of language in food posts on the social media platform Instagram[48]. In two observational studies, we coded the words used as hashtags for posts (N 852 and N 3104) about meat- or plant-based foods. As we had predicted, and analogous to the language about supermarket ready-meals, posts about meat-based foods contained more consumption and reward features than posts about plant-based foods, which instead contained more words related to ingredients, health and food categories. This suggests that even those who post about plant-based foods on this social media platform do this in a way that may not create motivation to eat them.

Notably, posts about plant-based foods contained a high proportion of words reflecting vegan identity (#veganfood, #whatveganseat, #govegan, #veganlife) as well as words that may help other users identify useful dishes or recipes (#healthy, #recipes, #breakfast, #dinner). This may reflect vegans' motivation to create a positive social identity and provide support to other vegans, rather than a motivation to make specific foods appealing in a way that signals immediate reward from an enjoyable consumption experience. While this may be an important function of social media communication about plant-based foods, it is not likely to create desire for these foods among mainstream consumers, i.e. omnivores.

In a separate experiment where we asked participants to compose hypothetical Instagram posts[49], we found that both omnivore and vegan participants used more consumption and reward features when promoting meat-based foods compared to plant-based foods. Participants used more situation-independent features for plant-based dishes, especially when appealing to a vegan audience, and especially using words related to the sociopolitical context of vegan food and to identity (e.g. #crueltyfree, #whatveganseat). This demonstrates that meat foods are typically promoted in terms of their consumption and reward features, and plant-based foods in terms of health, identity or sociopolitical features, even by vegans. Although our previous research suggests vegans spontaneously think about plant-based foods in rewarding ways[50], these findings suggest that they present these foods in less rewarding ways in public discourse on social media, even when the goal is to create appeal among omnivore audiences. Furthermore, these findings may reflect the assumption that omnivores are hedonically motivated (and hence appealed to with rewarding eating

https://doi.org/10.1017/S0029665123004858 Published online by Cambridge University Press

experiences), and vegans are politically motivated (and hence appealed to with sociopolitical and identity language). This may drive omnivore–vegan polarisation, and hence further hinder the mainstream transition to sustainable diets.

Creating desire for plant-based foods through eating simulation language

How can the appeal of plant-based foods be increased for mainstream consumers? As we have reviewed earlier, thinking about a food or drink in terms of rewarding consumption experiences, or simulating consuming and enjoying it, has been found to predict desire and intake (e.g., [41,43,50]). Similarly, experimental research on inducing consumption simulations has shown that simulations increase salivation, which can be seen as an indirect measure of desire to consume a food[51]. What are the implications of this research for increasing the appeal of plant-based foods?

In an experiment among UK omnivores, we manipulated the descriptions of twenty plant-based and twenty meat-based ready-meals available in UK supermarkets. Specifically, we created descriptions that either contained only words referring to food categories (e.g. 'stir-fry', 'burger patty'), ingredients (e.g. 'mushroom', 'vegetables') and composition of the food (e.g. 'added', 'assorted'), or that reflect rewarding consumption simulations by referring to sensory (e.g. 'aromatic', 'creamy'), context (e.g. 'Sunday lunch', 'Pub-favorite') and hedonic (e.g. 'indulgent', 'tasty') aspects of the consumption experience. Findings showed that simulation-focused labels increased the perceived attractiveness of both meat- and plant-based foods, and they increased the degree to which participants reported the descriptions made them think about what it would be like to eat the food. In other words, the simulation labels triggered spontaneous consumption simulations. This increase in simulations mediated the effect on attractiveness. Notably, the effect of simulation-focused labels on the attractiveness of plant-based foods was especially pronounced among more frequent meat-eaters. Overall, this work suggests that presenting plant-based foods in ways that evoke rewarding simulations of eating them can increase their appeal.

These findings are consistent with a number of large-scale field experiments on changing the labels of vegetable foods in food service settings. For example, Turnwald and Crum[52] found that, across four field studies, taste-focused labelling (e.g. 'Crispy veggie straws with decadent miso dip') increased and sustained plant-based and vegetarian food sales over a 2-month period, and also improved post-consumption ratings of vegetable deliciousness, in comparison to health-focused labelling (e.g. 'Fibre-packed vegetables with nutritious miso sauce'). In related research, taste-focused labels (e.g. 'Herb n' honey balsamic glazed turnips') increased vegetable selection by 29 % compared with health-focused labels (e.g. 'Healthy choice turnips'), and by 14 % compared with basic labels (e.g. 'Turnips'); this was mediated by increased expectation of positive taste experiences[53]. Similarly, Gavrieli *et al.*[54] found that appealing names for plant-rich dishes (e.g. 'Sweet velvety soup with collard greens') increased the amount of food taken per plate by 43·9 % compared to basic labels ('Collard Greens Vegetable Soup'). Bacon *et al.*[55] showed that attractive descriptions (e.g. 'Cumberland Spiced Veggie Sausages and Mash') of plant-rich dishes increased sales by up to 76 %, in comparison to their basic descriptions ('Vegetarian Sausages and Mash'). Furthermore, research by Garaus *et al.*[56] suggests that texture descriptions may be especially effective at increasing food appeal in the field. Together, this research demonstrates the real-world impact of dish labelling focused on eating experiences, which allows people to simulate the sensory and reward aspects of eating a plant-based food.

Avoiding vegan labels

Where labels focusing on eating experiences may be helpful to promote the appeal of plant-based foods, labels referring to veganism should be avoided, as they may reduce the appeal of plant-based foods. Despite the climate emergency, veganism is still a dietary pattern that deviates from mainstream diets and challenges traditional norms, beliefs and values about consuming meat and dairy, often for moral or ethical reasons. People who consume meat can feel threatened by vegans' moral stance[57] and experience cognitive dissonance[58]. Being exposed to vegans can also activate so-called 'do-gooder' derogation, a psychological phenomenon that refers to the tendency to evaluate individuals who engaged in moral behaviours negatively[59]. In addition, vegans are heavily and negatively stereotyped[60,61], and omnivores have been found to rate the label 'plant-based' more positively than the label 'vegan'[46]. In sum, words related to veganism, such as 'vegan' as a label for plant-based foods, are likely to activate a host of negative associations in most mainstream consumers, which may negatively affect the appeal of plant-based foods[62]. Hence, these should be avoided when labelling plant-based foods to create appeal for mainstream consumers.

The special role of eating context

It may be worth pointing to the special role that eating context may have in creating desire for food. According to the grounded cognition theory of desire and motivated behaviour, context cues form part of the representations of foods and drinks that people form during consumption experiences[37–39]. As a result, cueing a context where a rewarding food has previously been consumed may increase desire for that food, as it triggers simulations of eating it. Indeed, supporting that reasoning, experiments in which participants were presented with foods in a congruent or an incongruent eating context (e.g. popcorn in the cinema *v.* popcorn in the kitchen) showed that the congruent context increased desire for the presented food, mediated by eating

https://doi.org/10.1017/S0029665123004858 Published online by Cambridge University Press

simulations[63]. Social aspects of the eating context may be particularly important, as cueing foods with 'eating together' compared to 'eating alone' has been shown to increase the activation in reward areas in the brain in neuro-imaging research[64].

Building on this work, we recently instructed participants to list three to five words that relate to either the typical, sensory, context, hedonic or health aspects of twenty savoury dishes, before measuring present moment desire to consume each dish[43]. We found that participants focusing on the sensory, context or hedonic aspects of a food described the foods more in terms of overall consumption and reward experiences (i.e. sensory, context and hedonic words combined) than participants listing either the typical or health words, which in turn was associated with increased desire for the foods. The effects of the 'context-focus' manipulation were particularly pronounced. This suggests that focusing on the context aspect of the consumption experience, such as where, with whom and under which circumstances one would eat a food (e.g. at the pub, with friends, weekend, family dinner) triggers a mental simulation of all the aspects that are present during the experience (i.e. sensory, context *and* hedonic parts of the experience), which underlies food desire. Overall, these findings suggest that context cues may be an effective (and likely under-used) way of eliciting rich and vivid imagery of rewarding eating situations to create desire for a food. As little previous work has focused on this role of context cues, future research may be needed to address this in more detail. In the meantime, we encourage readers to consider the role of rewarding eating contexts when communicating about food to create desire.

Food system interventions to support sustainable diets

In addition to improving the ways that plant-based foods are described, other interventions are urgently needed in the food system to support the mainstream transition to more sustainable diets. Addressing the way plant-based foods are offered and presented, for example, research has shown that doubling the number of vegetarian options on a menu from 25 to 50 % can increase sales by 41–79 %[65]. Furthermore, in a recent meta-analysis of university cafeteria setting research[66], presenting the vegetarian option first and widely distanced from the meat option[67] was the most effective meat reduction intervention out of thirty-one studies. Other changes to the choice architecture or use of 'nudging' techniques, such as changing the default menu choice to plant-based[68], can also help reduce meat-based food choices via contextual and environmental modifications (see[69] for a scoping review). Indeed, these out-of-home meal contexts can shape the habits of a large group of consumers from varied demographic backgrounds, without having to rely on effortful strategies such as nutrition or sustainability education[70].

Interventions in school food systems are especially promising for reducing the demand for meat and dairy foods[71]. As children consume on average 30 % of their daily food intake in school[72], school food is an important area to shape children's eating behaviours and preferences, which will shape their eating behaviour as adults through the development of eating habits. In addition, increasing the consumption of plant-based foods in school may facilitate similar transitions in the home environment. Animal-based dishes contribute greatly to school food's GHG emissions and water usage, with meat dishes responsible for over half of carbon emissions in English primary schools[73]. A recent scoping review into sustainable school food interventions found that more environmentally sustainable menus, including those that were meat-free, vegetarian and followed a Nordic diet, had lower GHG emissions and water footprint than previous menus[74]. There were some instances of increased food waste; however, these interventions and accompanying qualitative research seem promising for children's acceptance and liking of more plant-based school food. Gardner *et al.*[74] conclude that further school food interventions aiming to improve both health and the environmental sustainability, including changing menus to be more plant-based, can contribute towards shaping children's norms about eating behaviours. Future research might also assess the effectiveness of consumption and reward labelling of plant-based dishes in this context, and examine whether this strategy works to increase the taste expectancies of plant-based foods among children as well. It is possible that this strategy can increase acceptance of plant-based school meals among children and parents, and reduce food waste in schools.

More generally, significant transformations are needed across food systems to increase equitable access to healthy, sustainable and affordable food, to address both malnourishment and overconsumption, and to reduce the environmental impact of food systems. This includes measures such as updating dietary guidelines to support a shift towards more plant-based diets; increasing health and sustainability standards for public food procurement; large reductions in food waste; supporting and incentivising organisations to shift away from producing, procuring and offering foods heavy in animal products; and significant changes in farming practices and re-organising land use to prioritise healthy and sustainable food production and nature restoration over industrial production of animal foods[3,75,76]. In this critical transition, organisations and individual decision makers within organisations (e.g. universities, health-care providers, food service providers) have significant power to catalyse and facilitate these transformative shifts, through acting as transformative investors, role models and courageous decision makers who prioritise planetary health over the destructive behaviours associated with the status quo[38,77–79].

Conclusion and recommendations

The research discussed here has shown that language can play a useful role in supporting the transition to more sustainable diets. Given the catastrophic effects of the

https://doi.org/10.1017/S0029665123004858 Published online by Cambridge University Press

current global food system on the earth's climate and ecosystems, a reduction in the demand for meat and dairy in high-income nations is urgently needed. Food-based dietary guidelines should be updated to reflect this, and should provide specific and well-motivated advice for citizens how to eat well in ways that supports their own physical health and planetary health more generally. In addition, food system interventions are needed to ensure global food security and equitable access to healthy food within planetary boundaries. In high-income nations with overconsumption of animal-based foods, transforming school food systems may be a particularly effective starting point with possible effects across wider local and national food systems. Within all these transitions, it is critical that plant-based foods and dietary patterns are presented and communicated about in positive ways that prioritise rewarding eating experiences, rather than referring to veganism or sustainability only.

Empirical work on the way that people think and communicate about plant-based foods has shown that omnivores think about plant-based foods less in terms of eating and enjoying it than they do about meat-based foods. This is consistent with other research in this area showing that preferred and frequently consumed foods and drinks are cognitively represented in terms of consumption and reward experiences, and that this motivates future consumption. Importantly, however, presenting plant-based foods to omnivores with descriptions that evoke rewarding eating experiences increases their appeal. Given that this is not how plant-based foods are typically presented, as we have shown through analyses of ready-meal packages and social media posts, the strategy of communicating about plant-based foods in terms of enjoyment should be more central in food service and retail settings.

Based on these findings, we make the following recommendations to increase the appeal of plant-based foods to mainstream consumers: (1) describe plant-based foods with language referencing enjoyable eating experiences, including words about sensory features of the food (e.g. crunchy, creamy), eating context (e.g. pub, with family) and immediate positive consequences of eating (e.g. comforting, delicious). (2) Avoid using category labels such as vegetarian or vegan. (3) Increase the proportion of plant-based options available in food settings and in food-based dietary guidelines or make plant-based the default to shift dietary norms towards plant-based foods.

Financial Support

This work was supported by ESRC Research Grant ES/T011343/1, and by Grant ES/P000681/1. The funding source(s) was/were not involved in the study design, data collection, analysis, interpretation of the data, writing or in the decision to submit the article for publication.

Conflict of Interest

None.

Authorship

E. K. P. conceptualised the article and produced a first draft, with significant additions and revisions from T. D., S. F., M. S. and L. H. W. All authors approved the final version of the article for submission.

References

1. Crippa M, Solazzo E, Guizzardi D *et al.* (2021) Food systems are responsible for a third of global anthropogenic GHG emissions. *Nat Food* **2**, 198–209.
2. Poore J & Nemecek T (2018) Reducing food's environmental impacts through producers and consumers. *Science* **360**, 987–992.
3. Willett W, Rockström J, Loken B *et al.* (2019) Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. *Lancet* **393**, 447–492.
4. Stylianou KS, Fulgoni VL & Jolliet O (2021) Small targeted dietary changes can yield substantial gains for human health and the environment. *Nat Food* **2**, 616–627.
5. Xu X, Sharma P, Shu S *et al.* (2021) Global greenhouse gas emissions from animal-based foods are twice those of plant-based foods. *Nat Food*, 1–9.
6. Clark M, Springmann M, Rayner M *et al.* (2022) Estimating the environmental impacts of 57,000 food products. *Proc Natl Acad Sci* **119**, e2120584119.
7. Gatti LV, Basso LS, Miller JB *et al.* (2021) Amazonia as a carbon source linked to deforestation and climate change. *Nature* **595**, 388–393.
8. Tilman D, Clark M, Williams DR *et al.* (2017) Future threats to biodiversity and pathways to their prevention. *Nature* **546**, 73–81.
9. Pendrill F, Persson UM, Godar J *et al.* (2019) Agricultural and forestry trade drives large share of tropical deforestation emissions. *Glob Environ Change* **56**, 1–10.
10. Clark MA, Springmann M, Hill J *et al.* (2019) Multiple health and environmental impacts of foods. *Proc Natl Acad Sci* **116**, 23357–23362.
11. Dauchet L, Amouyel P, Hercberg S *et al.* (2006) Fruit and vegetable consumption and risk of coronary heart disease: a meta-analysis of cohort studies. *J Nutr* **136**, 2588–2593.
12. Duyn MASV & Pivonka E (2000) Overview of the health benefits of fruit and vegetable consumption for the dietetics professional: selected literature. *J Am Diet Assoc* **100**, 1511–1521.
13. Creutzig F, Niamir L, Bai X *et al.* (2021) Demand-side solutions to climate change mitigation consistent with high levels of well-being. *Nat Clim Change*, 1–11.
14. Creutzig F, Roy J, Devine-Wright P *et al.* (2022) Demand, services and social aspects of mitigation. IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, pp. 752–943.
15. Chevance G, Fresán U, Hekler E *et al.* (2022) Thinking health-related behaviors in a climate change context: a narrative review. *Ann Behav Med* **57**, 193–204.
16. IPCC (2022) Climate Change 2022: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC Geneva, The Netherlands.
17. Newell P, Srivastava S, Naess LO *et al.* (2021) Toward transformative climate justice: an emerging research agenda. *WIREs Clim Change* **12**, e733.

https://doi.org/10.1017/S0029665123004858 Published online by Cambridge University Press

18. Hubacek K, Baiocchi G, Feng K *et al.* (2017) Global carbon inequality. *Energy Ecol Environ* **2**, 361–369.
19. Ivanova D, Stadler K, Steen-Olsen K *et al.* (2016) Environmental impact assessment of household consumption. *J Ind Ecol* **20**, 526–536.
20. Duro JA, Lauk C, Kastner T *et al.* (2020) Global inequalities in food consumption, cropland demand and land-use efficiency: a decomposition analysis. *Glob Environ Change* **64**, 102124.
21. Romanello M, Napoli CD, Drummond P *et al.* (2022) The 2022 report of the Lancet countdown on health and climate change: health at the mercy of fossil fuels. *Lancet* **400**, 1619–1654.
22. Springmann M, Spajic L, Clark MA *et al.* (2020) The healthiness and sustainability of national and global food based dietary guidelines: modelling study. *Br Med J* **370**, m2322.
23. James-Martin G, Baird DL, Hendrie GA *et al.* (2022) Environmental sustainability in national food-based dietary guidelines: a global review. *Lancet Planet Health* **6**, e977–e986.
24. Sinclair M, Combet E, Davis T *et al.* (2023) Sustainability in food-based dietary guidelines: a review of recommendations around meat and dairy consumption and their visual representation. Preprint at https://doi.org/10.31234/osf.io/xgq46.
25. Culliford AE, Bradbury J & Medici EB (2023) Improving communication of the UK sustainable healthy dietary guidelines the Eatwell guide: a rapid review. *Sustainability* **15**, 6149.
26. Scheelbeek P, Green R, Papier K *et al.* (2020) Health impacts and environmental footprints of diets that meet the Eatwell guide recommendations: analyses of multiple UK studies. *BMJ Open* **10**, e037554.
27. Collier ES, Oberrauter L-M, Normann A *et al.* (2021) Identifying barriers to decreasing meat consumption and increasing acceptance of meat substitutes among Swedish consumers. *Appetite* **167**, 105643.
28. Wehbe LH, Banas K & Papies EK (2022) It's easy to maintain when the changes are small: exploring environmentally motivated dietary changes from a self-control perspective. *Collabra Psychol* **8**, 38823.
29. Bryant CJ, Prosser AMB & Barnett J (2021) Going veggie: identifying and overcoming the social and psychological barriers to veganism. *Appetite*, 105812.
30. Macdiarmid JI, Douglas F & Campbell J (2016) Eating like there's no tomorrow: public awareness of the environmental impact of food and reluctance to eat less meat as part of a sustainable diet. *Appetite* **96**, 487–493.
31. Graça J, Godinho CA & Truninger M (2019) Reducing meat consumption and following plant-based diets: current evidence and future directions to inform integrated transitions. *Trends Food Sci Technol* **91**, 380–390.
32. Hampton S & Whitmarsh L (2023) Choices for climate action: a review of the multiple roles individuals play. *One Earth* **6**, 1157–1172.
33. Bryant CJ (2019) We can't keep meating like this: attitudes towards vegetarian and vegan diets in the United Kingdom. *Sustainability* **11**, 6844.
34. Caputo V, Sogari G & Van Loo EJ (2023) Do plant-based and blend meat alternatives taste like meat? A combined sensory and choice experiment study. *Appl Econ Perspect Policy* **45**, 86–105.
35. Michel F, Knaapila A, Hartmann C *et al.* (2021) A multinational comparison of meat eaters' attitudes and expectations for burgers containing beef, pea or algae protein. *Food Qual Prefer* **91**, 104195.
36. Vural Y, Ferriday D & Rogers PJ (2023) Consumers' attitudes towards alternatives to conventional meat products: expectations about taste and satisfaction, and the role of disgust. *Appetite* **181**, 106394.
37. Papies EK, Barsalou LW & Rusz D (2020) Understanding desire for food and drink: a grounded-cognition approach. *Curr Dir Psychol Sci* **29**, 193–198.
38. Papies EK, Barsalou LW, Claassen MA *et al.* (2022) Grounding motivation for behavior change. In *Advances in Experimental Social Psychology*, pp. 107–189 [B Gawronski, editor]. Cambridge, Massachusetts: Academic Press.
39. Papies EK & Barsalou LW (2015) Grounding desire and motivated behavior: a theoretical framework and review of empirical evidence. In *The Psychology of Desire*, pp. 36–60 [W Hofmann and LF Nordgren, editors]. New York, NY, USA: Guilford Press.
40. Chen J, Papies EK & Barsalou LW (2016) A core eating network and its modulations underlie diverse eating phenomena. *Brain Cogn* **110**, 20–42.
41. Papies EK, Claassen MA, Rusz D *et al.* (2022) Flavors of desire: cognitive representations of appetitive stimuli and their motivational implications. *J Exp Psychol Gen* **151**, 1919–1941.
42. Keesman M, Aarts H, Ostafin BD *et al.* (2018) Alcohol representations are socially situated: an investigation of beverage representations by using a property generation task. *Appetite* **120**, 654–665.
43. Farrar S & Papies EK (2023) How consumption and reward features affect desire for food, consumption intentions, and behaviour. Preprint at doi: 10.31234/osf.io/ugvnb.
44. Papies EK (2013) Tempting food words activate eating simulations. *Front Psychol* **4**, 838.
45. Davis T, Harkins L & Papies EK (2023) Polarizing plates: both omnivores and vegans represent in-group foods with eating simulations. *Pers Soc Psychol Bull*, 01461672231202276.
46. Papies EK, Johannes N, Daneva T *et al.* (2020) Using consumption and reward simulations to increase the appeal of plant-based foods. *Appetite* **155**, 104812.
47. Turnwald BP, Jurafsky D, Conner A *et al.* (2017) Reading between the menu lines: are restaurants' descriptions of 'healthy' foods unappealing? *Health Psychol* **36**, 1034–1037.
48. Davis T & Papies EK (2022) Pleasure vs. identity: more eating simulation language in meat posts than plant-based posts on social media #foodtalk. *Appetite* **175**, 106024.
49. Davis T, Silberhorn L & Papies EK (2023) 'Who says a salad can't taste good?': More appealing language used to promote foods to mainstream than to vegan consumers. Preprint at https://doi.org/10.31219/osf.io/p8g53.
50. Davis T, Harkins L & Papies EK (2023) Polarising plates: Both omnivores and vegans represent in-group foods with eating simulations. *Pers Soc Psychol Bull*, 01461672231202276.
51. Keesman M, Aarts H, Vermeent S *et al.* (2016) Consumption simulations induce salivation to food cues. *PLoS ONE* **11**, e0165449.
52. Turnwald BP & Crum AJ (2019) Smart food policy for healthy food labeling: leading with taste, not healthiness, to shift consumption and enjoyment of healthy foods. *Prev Med* **119**, 7–13.
53. Turnwald BP, Bertoldo JD, Perry MA *et al.* (2019) Increasing vegetable intake by emphasizing tasty and enjoyable attributes: a randomized controlled multisite intervention for taste-focused labeling. *Psychol Sci* **30**, 1603–1615.
54. Gavrieli A, Attwood S, Wise J *et al.* (2022) Appealing dish names to nudge diners to more sustainable food choices: a quasi-experimental study. *BMC Public Health* **22**, 2229.

https://doi.org/10.1017/S0029665123004858 Published online by Cambridge University Press

55. Bacon L, Wise J, Attwood S *et al*. (2018) The language of sustainable diets: A field study exploring the impact of renaming vegetarian dishes on U.K. café menus. Washington, DC, USA: World Resources Institute. https://www.wri.org/research/language-sustainable-diets-field-study-exploring-impact-renaming-vegetarian-dishes-uk-cafe
56. Garaus M, Weismayer C & Steiner E (2023) Is texture the new taste? The effect of sensory food descriptors on restaurant menus on visit intentions. *Br Food J* **125**(10), 3817–3831.
57. O'Connor K & Monin B (2016) When principled deviance becomes moral threat: testing alternative mechanisms for the rejection of moral rebels. *Group Process Intergroup Relat* **19**, 676–693.
58. Rothgerber H (2020) Meat-related cognitive dissonance: a conceptual framework for understanding how meat eaters reduce negative arousal from eating animals. *Appetite* **146**, 104511.
59. Minson JA & Monin B (2012) Do-gooder derogation: disparaging morally motivated minorities to defuse anticipated reproach. *Soc Psychol Personal Sci* **3**, 200–207.
60. De Groeve B, Rosenfeld DL, Bleys B *et al*. (2022) Moralistic stereotyping of vegans: the role of dietary motivation and advocacy status. *Appetite* **174**, 106006.
61. Wehbe LH, Duncan S, Banas K *et al*. (2023) Meta-stereotypes and their associations with eating motivation and identity among vegans and meat and/or dairy reducers. Preprint at doi: 10.31234/osf.io/s54hg.
62. Krpan D & Houtsma N (2020) To veg or not to veg? The impact of framing on vegetarian food choice. *J Environ Psychol* **67**, 101391.
63. Papies EK, van Stekelenburg A, Smeets MAM *et al*. (2022) Situating desire: situational cues affect desire for food through eating simulations. *Appetite* **168**, 105679.
64. Huang J, Wang C & Wan X (2022) Influence of eating together on brain activation and hedonic evaluation in response to foods. *Cogn Affect Behav Neurosci* **22**, 1145–1156.
65. Garnett EE, Balmford A, Sandbrook C *et al*. (2019) Impact of increasing vegetarian availability on meal selection and sales in cafeterias. *Proc Natl Acad Sci* **116**, 20923–20929.
66. Chang KB, Wooden A, Rosman L *et al*. (2023) Strategies for reducing meat consumption within college and university settings: a systematic review and meta-analysis. *Front Sustain Food Syst* **7**. https://www.frontiersin.org/articles/103.389/fsufs.20231.103060 [cited 16 July 2023].
67. Garnett EE, Marteau TM, Sandbrook C *et al*. (2020) Order of meals at the counter and distance between options affect student cafeteria vegetarian sales. *Nat Food* **1**, 485–488.
68. de Vaan JM, van Steen T & Müller BCN (2019) Meat on the menu? How the menu structure can stimulate vegetarian choices in restaurants. *J Appl Soc Psychol* **49**, 755–766.
69. Graça J, Campos L, Guedes D *et al*. (2023) How to enable healthier and more sustainable food practices in collective meal contexts: a scoping review. *Appetite* **187**, 106597.
70. Pfeiffer C, Speck M & Strassner C (2017) What leads to lunch – how social practices impact (non-)sustainable food consumption/eating habits. *Sustainability* **9**, 1437.
71. Roque L, Graça J, Truninger M *et al*. (2022) Plant-based school meals as levers of sustainable food transitions: a narrative review and conceptual framework. *J Agric Food Res* **10**, 100429.
72. Nathan N, Janssen L, Sutherland R *et al*. (2019) The effectiveness of lunchbox interventions on improving the foods and beverages packed and consumed by children at centre-based care or school: a systematic review and meta-analysis. *Int J Behav Nutr Phys Act* **16**, 38.
73. De Laurentiis V, Hunt DVL & Rogers CDF (2017) Contribution of school meals to climate change and water use in England. *Energy Procedia* **123**, 204–211.
74. Gardner G, Burton W, Sinclair M *et al*. (2023) Interventions to strengthen environmental sustainability of school food systems: narrative scoping review. *Int J Environ Res Public Health* **20**, 5916.
75. Dimbleby H (2021) The national food strategy – part two. https://www.nationalfoodstrategy.org/ [cited 23 January 2023].
76. WWF (2023) Eating for net zero. https://www.wwf.org.uk/sites/default/files/2023-05/Eating_For_Net_Zero_Full_Report.pdf
77. Garnett EE & Balmford A (2022) The vital role of organizations in protecting climate and nature. *Nat Hum Behav* **6**, 1–3.
78. Nielsen KS, Nicholas KA, Creutzig F *et al*. (2021) The role of high-socioeconomic-status people in locking in or rapidly reducing energy-driven greenhouse gas emissions. *Nat Energy* **6**, 1–6.
79. Papies EK, Nielsen KS & Soares VA (2023) Health psychology and climate change: Time to address humanity's most existential crisis. Preprint at doi: 10.31234/osf.io/ujwk4.

https://doi.org/10.1017/S0029665123004858 Published online by Cambridge University Press