Plant-forward diets and the social cultural milieu

A DISSERTATION

By

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Declaration

I declare that this thesis is entirely my own work completed under the supervision of Dr. Jared Piazza and Dr. Heather Shaw with previous supervision from Dr. Ryan Boyd.

I declare that no parts of this thesis have been submitted in support of application for the award of a higher degree elsewhere.

The parts of this thesis that have been submitted for publication or published in academic journal throughout the duration of this doctoral degree, have been indicated in the statement of author contributions section.

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Statement of Author Contributions

The following authorship contribution outline the contributions of all co-authors to each chapter. The PhD candidate, Rebecca Gregson, was the principal author of each chapter. Dr. Jared Piazza was the primary supervisor for all of the PhD. Dr. Ryan Boyd was the secondary supervisor for the majority of the PhD, followed by Dr. Heather Shaw who took over as secondary supervisor in the final year of the PhD.

Study 1: Testing the potential benefits of adhering to a meat-reduction pledge with and without social support

The first author, Rebecca Gregson, conceptualised the research topic, hypotheses, and design, collected the data, conducted the analysis and wrote the manuscript. The second author, Jared Piazza, helped conceptualise the research topic and design, and contributed to the editing of the manuscript. Both authors read and approved the final version of the manuscript.

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Study 3: Family climates and plant-forward diets: A 14-day experience-sampling study

The first author, Rebecca Gregson, conceptualised the research topic, hypotheses, and design, collected the data, conducted the analysis and wrote the manuscript. The second author, Jared Piazza, contributed to the conceptualisation of the research, writing, and editing of the manuscript. Both authors read and approved the final version of the manuscript.

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Abstract

Humanity's window for climate action is closing rapidly (Tollefson, 2022). Given the ecological footprint associated with animal husbandry, scholars and non-governmental organisations have called for a transition to a more sustainable food system: an increased focused on plant-derived proteins (Clark et al., 2022; Willett et al., 2019). Such a transformation will require the collaboration of many actors both in- and outside of academia (e.g., social scientists, food technologists, businesspeople, and advocates). The field of Psychology has a unique role to play in studying human behaviour and cognition as it pertains to societal eating norms and the acceptance of plant-forward diets. Research of this kind has demonstrated that decisions to forgo animal-derived foods constitute a social eating norm *violation* and as such ought to be understood against the wider context in which they exist. Indeed, food-related decision-making occurs at various levels of society and food systems – including at the micro- (e.g., an individual's own attitudes, motivations, and capabilities), meso- (e.g., family roles, relational dynamics) and distal-level (e.g., societal, and cultural norms around food; Boulet et al., 2021). Yet, to the authors knowledge, there is limited psychological literature that has considered these processes as they relate to plant-forward diets, specifically. Accordingly, the current thesis presents a rich exploration into the influence that one's social-cultural milieu has on their food-related cognitions and decision making as they pertain to plant-forward eating.

Study 1 employed smartphone-based experience sampling methodology and engaged in a micro-level analysis, investigating an individual's commitment to reducing their meat consumption as influences by the experience of social support. In summary, we were unable to demonstrate the facilitative effects of social support in study 1. The results of this study highlighted the need to differentiate between *types* of social support (incl. *structural*, *functional,* and *enacted* means of support) and prompted a progression of our research focus:

a move from studying food decision-making at the micro- to the meso-level. Study 2 and 3 employed a mix of survey and experience-sampling methodology with an elevated focus on the meso-level (i.e., the household), where we considered the influence of one's primary social units (i.e., family members and romantic partners) on decisions pertaining to plant-forward diets. Here we demonstrated that micro-level food decision-making takes place within the broader context of intra-family negotiations and is subject to the established leadership style and emotional connection of the relationship. Finally, study 4 and 5 considered the intergroup and social-cultural context of plant-forward diets at the distal-level. Specifically, we employed a mix of survey methodology, text, and behaviour analytics to investigate the collective identity and ideological motivations of individuals actively engaged in overt antagonism or opposition towards vegan ideology. Together, this body of research advances current knowledge of the social and cultural milieu of plant-forward by demonstrating how decisions around plant-forward diets depend upon the relational climate of cohabiting units and highlighting the importance of identity and inter-group processes in the wider societal debate about sustainable diets.

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General Introduction

"Dis-moi ce que tu manges, je te dirai ce que tu es"

[Tell me what you eat, I will tell you what you are]

Anthelme Brillat-Savarin (1825)

The social framework of food choice and consumption

Scientific disciplines that study eating behaviour (e.g., biology, physiology, biochemistry, and pathology) have long been preoccupied with the processes that occur *post*-consumption - the impact that food has on our physical and psychological form. Less scientific concern has been placed on understanding the processes that occur *pre*-consumption: meso- (i.e., small groups, e.g., cohabiting family units) and distal-level (i.e., wider society and culture) influence on food decision-making (Delormier et al., 2009). On the contrary, scholars from neighbouring disciplines (e.g., history, anthropology) have long acknowledged the search for, preparation and ingestion of food as fundamental to the evolution of human anatomy and psychology, and instrumental in the very organisation of our societies (Pilcher, 2006). Over the last two decades, researchers in the social sciences have come to acknowledge food choice and consumption as deeply social activities governed by wider societal eating norms, and reinforced by the individuals with whom we dine (Delormier et al., 2009; Rozin, 1996). With this, and with increasing concerns over the health and sustainability of our current food system (Willet et al., 2019), there has been a burgeoning of psychological literature that considers the societal influence on food decision-making (Rozin, 1996).

Decades of research have taught us that food choice and consumption is not a process that can be studied solely at the micro-level (Chen & Antonelli, 2020; Furst et al., 1996; Sobal, 2006). Instead, there is powerful evidence to argue that food decision-making is

influenced by one's wider social framework and the established eating norms of their in-groups (Rozin, 1996; Higgs, 2015; Higgs & Ruddock, 2020). Social norms are implicit codes of conduct that provide a guide for appropriate actions (Higgs, 2015). More specifically, social *eating* norms, are the group's perceived or materialised standards for what constitutes appropriate food consumption, both in terms of content and volume (Higgs, 2015). Eating norms may be *implied* via cultural practices, *perceived* based on what we believe most other people think and do or directly *observed* in the behaviour of others. Across their lifespan, any one individual will be exposed to and experience a variety of social eating norms, informed by and influencing their position in the wider social order (Beardsworth & Kiel, 2002). In this context, one's social group may be defined across a number of non-mutually exclusive levels, including at the meso- (e.g., one's family, or relational identity) and distal-level (e.g., national group-identity, gender-identity). At the micro-level, it is the strength of one's identification with the perceived "in-group" which mediates the extent to which eating norms are adhered to (Cruwys et al., 2012).

Importantly, adhering to eating norms is considered *socially adaptive* – and for two reasons (Higgs, 2015). First, people infer from the widescale acceptance of a particular consumption practice that there is a good justification for it. This might be that eating norms provide information about the safety and nutritional value of consuming a particular food, for example. Second, adhering to food norms helps to facilitate food sharing (Higgs, 2015). That is, eating food in the company of others is a socially *facilitative* act, which helps to define group boundaries, strengthen, and maintain relationships as well as teach and reinforce important values (Ochs & Shohet, 2006). By contrast, rejecting a social eating norm may be considered *socially maladaptive* and costly (Higgs, 2015). Abstaining from a well-established practice would be to violate a social norm - a course of action which places an individual in a vulnerable position of uncertainty over the safety and nutritional adequacy of novel foods

(Higgs, 2015). Such behaviour also threatens to derail the status quo and may lead an individual to experience negative social judgements, stigmatisation and exclusion (van Kleef et al., 2015).

The socio-cultural value of animal-derived foods

While social eating norms differ culture-to-culture, consuming foods derived from animals (incl. meat, fish, dairy and eggs) is a particularly widespread practice, woven into the fabric of human ancestry and culture (Leroy & Praet, 2015; Smil, 2002, 2013). In the origins of our animal product consumption (200,000 YA – 10,000 YA) the killing of large animals, was a male-dominated task, requiring group co-cooperation (Leroy & Praet, 2015). Such an undertaking often produced more food than any one individual or family could consume (Zaraska, 2016). Accordingly, the surplus was often shared with others, making it a focal point for social gatherings and shared eating (Chiles & Fitzgerald, 2018). In this way, animal-derived foods were instrumental in the development of our communal living (Zaraska, 2016). However, prior to the industrialization and intensification of animal agriculture the relative scarcity of animal-derived foods meant that their consumption was oft reserved for members of the elite and upper class (Montanari, 1999). It was during this period in our history that animal-derived products, and meat in particular, garnered ascriptions of power and status (Twigg, 1983). Later, widespread industrialization in the 19th Century saw a shift in the social eating norms; animal-derived food products became increasingly available to members of the working-class, replacing bread as the primary source of protein (Grigg, 1995). Foods derived from animals thus kept their valuable status but were no longer reserved for the elite.

Today, the consumption of animal-derived foods is a prevailing eating norm across many parts of the world, though particularly in the west. It is estimated that on average approximately 86% of the global population identify as “omnivorous” that is, consuming without restriction food products derived from animals (Statista, 2023a). In some countries

this figure is much higher - 95% in South Korea, for example - the lower average attributed to anomalies found in countries like India, whereby just 53% of people report regular meat consumption (Statista, 2023a). Estimates from the Food and Agriculture Organisation suggests that globally, our average annual consumption of meat totals 357.39 million tonnes, a rate which continues to rise year-on-year (Roser, 2023). In addition, global average egg consumption totals 86.3 million tonnes (Statista, 2023b), and milk 800 million tonnes (Ritchie et al., 2019). Expressed in the number of animals slaughtered for food or through the harvesting of animal by-products, this equates to approximately 3 billion land mammals, and 78 billion birds. Add to this the annual estimates for aquatic mammals, fish and invertebrates, and the numbers become virtually uncountable (Schukraft, 2019).

In the western world, the majority of omnivores eat meat and other animal-derived foods every day of the week, and with almost every meal of the day (Statista, 2023c). In fact, the consumption of animal-derived foods has become so embedded within the daily lives and cultures of most consumers that, for many, a meal is not considered as such in the absence of meat (O'Keefe et al., 2016; Sobal, 2005). The consumption of animal-derived products is deeply intertwined with the cultures of many societies and religious groups across the globe – a cornerstone of tradition and celebratory ritual, and symbolic of affluence and group-identity (Chiles & Fitzgerald, 2018). The preparation and sharing of animal-derived foods often takes centre stage during communal gatherings and celebration - for example Turkey as quintessential to both Thanksgiving and Christmas Day dinner (Kaufman, 2004).

Who we are – both in terms of how we perceive ourselves and how others perceive us - depends in part on the food we choose to consume, which includes our decision to consume or eschew animal-products. This includes national identities, and the attachment we have to our nation (Nguyen & Platow, 2021), for example, the "*hotdog*" considered to be prototypically American (Violante et al., 2019) and the Sunday Roast prototypically English

(Leddy-Owen, 2014). Decisions to consume animal-products also govern perceptions of gender-identity, given the symbolic potency of meat as inherently masculine (e.g., see Rozin et al., 2012; Salmen & Dhont, 2022; Sobal, 2005) and social standing, given meats associations with power and status (Chan & Zlatevska, 2019; Twigg, 1983).

Global diets in transition

Though animal-derived food products bear huge socio-cultural meaning for many, concerns over the sustainability of their production and consumption have been mounting (Willett et al., 2019). For almost a decade now, scientists have been documenting the link between animal agriculture and poor planetary health including both the chronic-disease burden and climate change (Shah & Merlo, 2023). With regards to public health - industrially produced animal products have been linked to a number of non-communicable diseases including obesity (Rouhani et al., 2014), type-2 diabetes (Talaei et al., 2017) cardiovascular disease (Abete, et al., 2017) and certain cancers (Farvid et al., 2021). Moreover, because of the overcrowded conditions in which animals live, the close proximity in which animals and humans operate, and the non-therapeutic use of antibiotics, industrial animal farming operations offer the perfect breeding ground for the emergence of zoonotic diseases, such as avian flu and swine flu, that can threaten public safety (Jones et al., 2013; Slingenbergh et al., 2004). The latter especially pertinent given the recent global COVID-19 pandemic (González et al., 2020).

With regard to planetary health, animal agriculture is thought to play a seismic role in altering ecosystems and accelerating climate change (Willett et al., 2019). It is estimated that approximately half of all habitable land is currently used for agriculture, 77% of which is dedicated to the rearing of livestock (Ritchie, 2019). Such demand for land drives deforestation (Wellesley, et al., 2015), resulting in a rapidly accelerating loss of biodiversity (Machovina et al., 2015). Moreover, animal agriculture makes a significant contribution to

atmospheric pollution. Conservative estimates predict that animal agriculture contributes to at least 16.5% of all anthropogenic greenhouse gas emissions (Twine, 2021) - a quantity larger than that emitted by the transport sector (for a review of different estimates see Blaustein-Rejto & Gambino, 2023). It is also the largest sectoral source of methane (CH4), one of the most potent greenhouse gases with a global warming potential 86 times the size of carbon dioxide (Shindel et al., 2017).

Humanity's window for climate action is closing rapidly (Tollefson, 2022) and the transition to an environmentally sustainable food system is thus of urgent importance (Willett et al., 2019). Accordingly, scholars and non-governmental organisations have called for large-scale changes in the diets of modern society, a transition from meat to plant-based eating (Clark et al., 2022). For example, the EAT-Lancet commission recently prescribed a 50% decrease in the consumption of animal-derived foods, and an increased uptake of plant-based proteins (Willett et al., 2019). Indeed, plant-based diets offer a potential solution to the health and ecological challenges that we presently face. Gram-for-gram, plant-based proteins require less land, water, and energy resources than their animal-based counterparts (Clark et al., 2022). As such, it is estimated that global adherence to the EAT-Lancet diet would result in 56% decrease in greenhouse gas emissions, a 31% decrease in energy demands and a 54% decrease in land occupation (Kesse-Guyot et al., 2021). Moreover, plant-based diets are associated with a reduced risk of non-communicable disease, including obesity, cardiovascular disease, diabetes, and cancer (Afshin et al., 2019). Hence, transitioning to a food system that is increasingly dependent upon plant-derived proteins, as opposed to animal-derived proteins, would help to lessen both the chronic-disease burden and the impending climate and ecological crisis.

Given the prevailing socio-cultural value of animal-derived foods, a large-scale transformation of the global food system is likely to be one of society's greatest challenge in

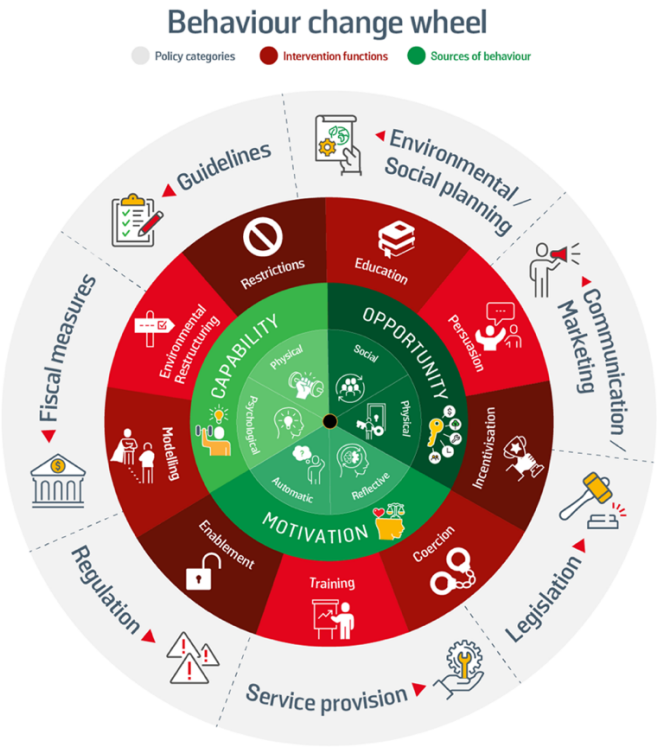
the 21st century. Such a transformation will include advances along several axes: technological, economic, and psychological. It will require the collaboration of many actors both in and outside of academia (e.g., social scientists, food technologists, businesspeople, advocates). The field of Psychology has a unique role to play in the study human behaviours and cognition as they pertain to societal eating norms and the acceptance of plant-forward diets. Psychologists are tasked with understanding *how* the relative acceptance, or reluctance to engage in plant-forward diets at the individual level may predict societal-level shifts in eating norms. Indeed, over the past few decades, there has been a blossoming of psychological research exploring plant-forward diets (e.g., for reviews see Rosenfeld, 2018; Ruby, 2012). In this time, there have been clear advancements in a diverse array of associated topics. Notable examples include research into the developmental trajectory of meat-eating behaviour (e.g., see Piazza et al., 2023; Wilks et al., 2021); the study of dietary motivations (e.g., see Kim et al., 2022; North et al., 2021) and identity research which considers the interplay between one's decision to consume animal-derive products and one's self-percept (e.g., see Rosenfeld, 2019; Rosenfeld & Burrow, 2018). Of particular relevance to the present thesis, a vast and comprehensive body of research has considered the barriers that may impede an individual from engaging with a plant-forward diet (e.g., for reviews see Bryant et al., 2022; Graça et al., 2019).

Barriers to plant-forward diets

In an attempt to develop a clear picture of current knowledge on the barriers to plant-forward diets, and to provide a road map for future work, Graça et al. (2019) imposed a top-down theoretical restructuring of the literature. The authors organised their review in accordance with the COM-B model of behaviour change (Michie et al., 2011). The COM-B model conceptualizes behaviour as influencing, and being influenced by, three components: *capability*, *opportunity,* and *motivation*. Capability refers to being psychologically and

physically able to perform the desired behaviour, where opportunity refers to having a social and physical environment that affords the focal behaviour. Motivation refers to the inner reflective and automatic processes that drive behaviour. The model posits that for sustained behaviour change to occur (i.e., the successful adoption of plant-forward diets), an individual would need to feel sufficiently *motivated* to act (e.g., possessing a desire to avoid animal suffering), and have both the *opportunity* (e.g., a supportive family environment), and the *capability* to do so (e.g., having the skills to prepare a plant-based meal). The COM-B model is embedded within the Behaviour Change Wheel (BCW; Michie et al., 2011) around which are positioned nine intervention functions (aimed at addressing deficits in one or more elements of the COM-B structure) and seven policy categories (i.e., policies that could enable those interventions to occur). See Figure 1 for a visual representation of the COM-B model and BCW.

Figure 1. *Behaviour change wheel (Michie et al., 2011)*



As discussed by Graça et al. (2019), previous research has been revealing of a number of *capability*-related barriers, that may impede an individual from engaging with a plant-forward diet. These include difficulties in getting reliable information (Lea et al., 2006), and acquiring new skills and competencies (Lacroix & Gifford, 2019) as well as a high sensitivity to bitter tastes (Cliceri et al., 2018). With regards to *opportunity*-related barriers, previous research highlights the following as being particularly deleterious to the pursuit and maintenance of plant-forward diets: the social representation of meat as being the centre of the plate (O'Keefe et al., 2016), concerns over vegan-stigmatisation (e.g., see Markowski & Roxburgh, 2019), and experiencing a lack of social support (e.g., Hoek et al., 2017). Last of all, research on *motivation*-related barriers has been particularly expansive. Barriers of this nature include (but are not limited to): a perceived lack of responsibility to change (Bohm et al., 2015), a lack of environmental concern (de Boer et al., 2013), meat attachment (Graça et al., 2015), health concerns with meat reduced diets (Ensaff et al., 2015), frequent meat eating habits (de Boer et al., 2017), endorsement of traditional or conservative values (de Backer & Hudders, 2015; Hodson & Earle, 2018) and holding strong beliefs that eating meat is a natural human right, necessary for optimal health, and a normative practice (Graça et al., 2016; Piazza et al., 2015).

The review by Graça et al. (2019) showcases the clear advancements in the psychological inquiry of barriers to plant-forward diets. Specifically, in its utilisation of self-report methodology, the field of Psychology has generated a wealth of descriptive research outlining the multitude of factors that may impede an individual from pursuing or maintaining a plant-forward diet (~76% of all papers reviewed by Graça et al., 2019). These advancements are particularly useful in advancing interventions for promoting plant-forward diets. Furthermore, because the COM-B model feeds into the BCW, Graça et al.'s (2019) restructuring has helped to illuminate the practical applications of the literature for informing

intervention and policy around sustainable eating. In equal measure, the review also reveals key limitations of this body of work, and areas in need of further study. Particularly scarce are studies investigating *capability* (e.g., competencies for preparing plant-based meals) and *opportunity* (e.g., the influence of one's social environment) variables, as well as those that consider, holistically, all three domains of the COM-B model.

At the broadest level, the aim of the present thesis was to conduct further psychological inquiry into the factors that impede individuals from pursuing or maintaining plant-forward diets, specifically, those which fall under the *opportunity* domain of the COM-B model. *Opportunity*-related barriers to plant-forward diets encompass both aspects of the physical environment (e.g., the availability of plant-based alternatives) and the social factors operating within a person's socio-cultural milieu (e.g., the leadership style and emotional closeness of one's family as it governs food-related decision-making; culture-bound stigmatisation of particular eating habits). My particular focus was on the latter – the influence of one's socio-cultural milieu on a person's receptivity to, pursuit and maintenance of plant-forward dietary transitions. To the authors knowledge, there is limited psychological literature that has engaged in a rich exploration of how a person's social environment, both at the meso- (e.g., households) and distal-level (e.g., culture), modulates the thoughts, feelings, *and* behaviours one expresses towards plant-forward diets. Yet, as intimated above, the social-cultural significance of animal products points to its critical importance for such dietary transitions. Thus, having a better understanding how social-cultural factors impact on food related decision-making is an essential step in knowing how to effectively transform our current food system.

Here, I first present a targeted review of the psychological literature that has focused on the social barriers to plant-based eating. I identify several avenues for advancing

knowledge on this topic – research directions which constituted the basis for my thesis. I conclude by providing an overview of the programme of studies contained in my thesis.

Plant-forward diets and the social cultural milieu

To achieve a global shift toward more plant-based eating would be to overhaul the dominant ideological belief system of *'carnism'* (Joy, 2020) – from which our norms and beliefs about animal treatment stem. This would entail altering the social representations of animal-derived food products as definitive of a meal, and beholden of one's self- and group-identity. For the last eight decades, such an attempt to revolutionise our societal eating norms has been underway, from a small, but growing segment of society who reject the normative position (Wrenn, 2019). Though the rejection of animal-derived foods is a practice with ancient roots (Zaraska, 2016), the past two decades have seen an increased interest in- and uptake of- plant-forward diets (e.g., see Asano & Biermann, 2019). This is true for diets characterised by the exclusion of *all* animal-derived products (i.e., veganism; Gheihman, 2021) and those by the exclusion or active reduction of *some* animal-derived products (i.e., vegetarian- and flexitarianism; Duckett et al., 2021). Moreover, forecasted predictions suggest that we will continue to see absolute growth in the plant-based food market for years to come (Statista, 2023d).

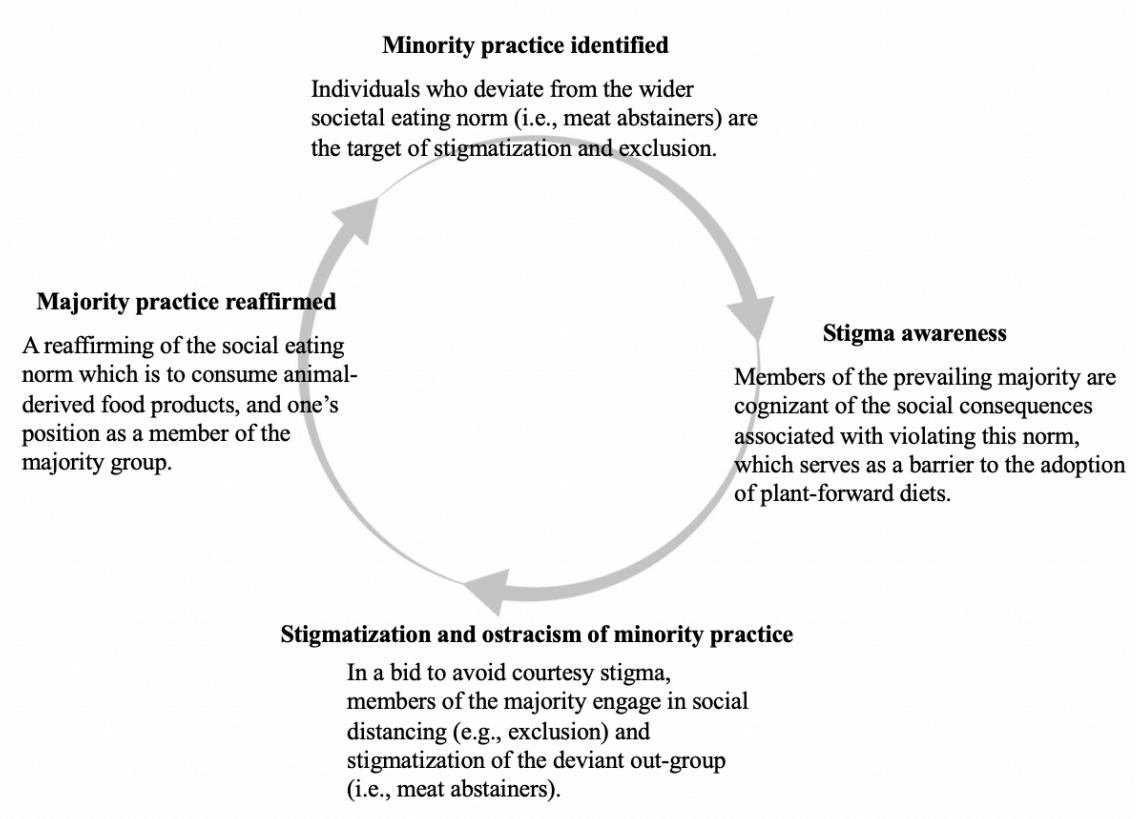
For many, and particularly for vegans, choosing not to consume animal-derived foods is more than a mere dietary preference, but central to their identity (de Boer et al., 2017; Rosenfeld, 2018), and underpinned by a deep-rooted philosophy which is to put an end to all forms of animal exploitation and cruelty (The Vegan Society, 2021). As such, the transition toward a plant-forward food system has gained significant traction, in part, because actors have become increasingly professional in their calls for collective action (i.e., actively promoting plant-forward lifestyles; Judge et al., 2022; Wrenn, 2019).

Yet, despite the absolute growth in recent years, when compared to the normative majority, plant-forward diets remain a relatively unpopular practice. Certainly, only small minorities of the population identify as vegetarian (~5%) and vegan (3%), with slightly elevated rates for flexitarians (~15%; IPSOS Mori, 2018; YouGov, 2023). As such, individuals who abstain from the consumption of animal-derived food products represent a minority group who pose a challenge or threat to the majority view (Kurz et al., 2020). From an inter-group perspective, threats from a perceived outgroup are fundamental antecedents to prejudicial outgroup attitudes (Stephan & Stephan, 2000). Hence, as deviant-members of society who push the boundaries of our social eating norms, meat-abstainers are perceived to pose both *symbolic* threats to shared cultural values and tradition and *realistic* threats to the public health, environmental conditions, and economic functioning of a society (Dhont & Hodson, 2014; Judge & Wilson, 2015; Stanley, 2022).

Prejudicial views toward meat-abstainers have prevailed for many decades (Iacobbo & Iacobbo, 2004) and appear often in popular media (Cole & Morgan, 2011; Ragusa & Crampton, 2015). Meat-abstainers, and particularly vegans, are often met with resentment and can elicit irritation in those who consume animal products (de Groeve et al., 2021; Dhont & Hodson, 2014; Rothgerber, 2014). Impressions of meat-abstainers as moralistic (e.g., self-righteous, opinionated, judgmental) and extreme (e.g., militant, overbearing) account for much of antipathy and discrimination against them (de Groeve & Rosenfeld, 2021). This is consistent with the idea that meat-abstainers pose a symbolic or ideological threat to omnivores. Also consistent with the symbolic-threat account, studies show that prejudice towards meat-abstainers is particularly high among demographics that report high meat consumption – for example, cis-gendered males (Vandermoere et al., 2019), politically right-leaning individuals (Dhont & Hodson, 2014), those who endorse traditional views of gender (Earle & Hodson, 2017), and hierarchical views of society (e.g., Dhont et al., 2016).

Members of the normative majority (i.e., omnivores) are cognisant of the social consequences associated with deviating from societal eating norms (Markowski & Roxburgh, 2019). That is, consumers of animal products often anticipate that were they to attempt such a dietary transition, they too would be met with disproval and denigration (Markowski & Roxburgh, 2019). As a consequence, many people avoid pursuing plant-forward diets for fear of stigmatisation (Markowski & Roxburgh, 2019). Accordingly, endowing stigma upon individuals who abstain from the social eating norm serves as a barrier for others who may be contemplating such dietary change. Further, in a bid to avoid any second-hand prejudice, otherwise known as *courtesy stigma* (Birenbaum, 1970; Birenbaum, 1992), members of the normative majority often report distancing themselves from individuals who abstain from animal products or actively stigmatising them (Markowski & Roxburgh, 2019) – acts which help to reinforce the social norm and one's position as a member of the majority (Phelan et al., 2008). This inadvertently reinforces the social barriers that individuals face when considering a reduction in their animal-product consumption and perpetuates a vicious cycle that reaffirms the social norm which is to consume animal-derived foods (see Figure 2).

Figure 2. *The cyclical nature of social barriers to plant-forward diets.*



Exclusion and a refusal to interact with plant-forward eaters may be particularly problematic at the meso-level of the household, where cohabiting units (e.g., romantic partners and families) are actively engaged in regular food sharing. Given the co-ordinated nature in which cohabiting units consume food, family members and romantic partners exercise a significant influence on the eating patterns of one another (Øygard & Klepp, 1996). Thus, in the event that an individual considers a change in their eating behaviour, this decision is likely to impact on others within the household and thus lead to disruption to the groups eating norms. Indeed, current meat consumers anticipate relational struggles with members of their household, were they to go vegetarian or vegan because of the perceived disruption it would cause to the already established dietary coordination and harmony within the home (Markowski & Roxburgh, 2019). In studies using self-report measures of meat and

animal-product reduction, prospective meat-abstainers often anticipate extreme negative reactions (e.g., hatred, dismissal) or a lack of emotional and tangible social support from their primary social groups—family members, friends, and romantic partners (Hodson & Earle, 2018; Lacroix & Gifford, 2019; Lea et al., 2006; Markowski & Roxburgh, 2019).

Research with practicing vegetarians and vegans appears to corroborate many of the *projected* concerns of omnivores (e.g., Markowski & Roxburgh, 2019). In research with practicing meat-abstainers, the most trying challenge in the pursuit of their dietary transition were fractious interactions with dismissive and unaccommodating family members or partners (Markowski & Roxburgh, 2019; Twine, 2014). Negative reactions by one's primary social units tend to include dismissal, teasing or coaxing the divergent family member to eat animal-derived foods, disputing the rationale for the change, and/or condemning the individual for threatening family values (Roth, 2005). Given the high socio-cultural value that animal product consumption holds, it is thought that negative reactions may be motivated by perceptions of plant-forward diets as a threat to the homeostasis of the household, their shared traditions, and group identity (Roth, 2005). This may be particularly true in cases where the individual's transition is clearly underpinned by moral motivations (e.g., concern for animal wellbeing, Greenebaum, 2012; Wieper & Vonk, 2021). "Nuclear" family members and particularly male relatives (e.g., fathers) also seem to be more receptive to the symbolic threats posed by plant-based eating (Dhont et al., 2016; Jabs et al.1998). The perception of animal product abstention as a symbolic threat or rejection may be a manifestation of right-wing traditionalism which is thought to be more commonly expressed by cis-gendered males, and a robust predictor of highly cynical attitudes toward meat reduction (e.g., see Dhont et al., 2016).

Negative reactions may also depend on the family's perceived capability for managing and adapting to shifting diets within their household. Indeed, previous work has shown that more gradual transitions, as opposed to an abrupt transition, make it easier for families to adjust (Haverstock & Kirby, 2012). Moreover, because of the wider scope of products that they reject, vegans tend to be viewed as more extreme in their dietary restrictions than vegetarians, and, as such, family members are often less *willing* or less *able* to accommodate them (Markowski & Roxburgh, 2019). These factors speak to the more practical, co-ordination related issues that may inhibit cohabiting relational units from embracing and adapting to sustainable diets.

At present, the dominant literature paints a rather pessimistic view for what individuals who transition to a plant-forward diet might expect to experience. Yet, given a family's natural tendency to want to achieve and maintain homeostasis (Godin & Langlois, 2021; Seshadri, 2019), it is unlikely that a period of disruption caused by a dietary transition can continue indefinitely. In the face of such relational tensions, individuals transitioning to plant-forward diets may become strategic in the way that they interact with their families during shared eating practices. Greenebaum (2012) found that vegan individuals engage in so-called "face saving" strategies which seek to present plant-forward diets in a positive light to their combative or critical family members. This includes avoiding confrontation, being strategic about when, where and how to discuss their diet (i.e., not during a meal), emphasising the *health* benefits of their diet as opposed to the animal welfare benefits, and attempting to lead by example (i.e., modelling behaviour). Further, Twine (2014) reports on additional *cohabitation* strategies adopted by individuals seeking to reduce or avoid such conflicts. In this research, vegans were seen manipulating their micro-geographies, specifically utilising time (i.e., eating at different times) and space (i.e., eating in different locations) in order to aid harmonious co-existence. Though such strategies may not be

regarded as conventional, nor conducive to healthy relationships, they are seemingly adaptive and may allow for individuals following discrepant diets to harmoniously co-exist. However, the successes or failures of such strategies are not yet known and there is a clear need for more research into the long-term trajectory of the relational hurdles associated with plant-forward transitions.

In cases where the eating-norms of the family are to consume animal products, transitioning individuals may feel compelled to comply in order to appease such tensions and re-establish homeostasis (Menzies & Sheeska, 2012). Research utilising the retrospective reports of ex-vegetarians and vegans suggests that, if not resolved, social and coordination issues can lead an individual to abandon their plant-forward diet (Asher et al., 2014; Menzies & Sheeska, 2012). It is estimated that approximately 84% of those who adopted a plant-forward diet eventually return to omnivorous eating within the first three-months of their transition (Asher et al., 2014). Social coordination issues – including, a perceived lack of support and difficulty coordinating with those whom they were cohabiting, are a key driver of dietary abandonment (Anderson & Milyavskaya, 2022). Social challenges often go hand-in-hand with accessibility challenges, that is – people who report social coordination issues, often express concern over the additional time and effort required to shop for, prepare, and cook plant-based meals (Anderson & Milyavskaya, 2022). This is suggestive of the fact that a failure to access both functional and enacted support (Hogan et al., 2002) may be key in failed maintenance of plant-forward diets.

On the contrary, research suggests that individuals who *are* able to maintain their plant-forward diet are those who receive emotional and tangible support (e.g., food and recipe provisions) from the people they live with (Menzies & Sheeska, 2012). Where the necessary support is available, it may also be common for the dietary preferences of the transitioning individual to take precedent, influencing others in the household to adopt a similar approach

to eating (Bolderdijk & Cornelissen, 2021). Taken together, previous research highlights the social tensions aroused when an individual makes the decision to adopt a plant-forward diet, and the natural desire to resolve these coordination issues. These tensions may be resolved by either party succumbing to the others dietary preferences, or by striking a harmonious balance of flexible, yet cohesive dietary coordination – the latter of which is likely to be more effortful. However, the leadership styles and emotional bonding that govern intra-family food negotiations in this context remain to be understood.

To summarise, there have been clear advancements in the psychological investigation of plant-forward diets and the socio-cultural context in which they exist. Specifically, through the utilisation of self-report methodology, the field has generated a wealth of descriptive research outlining the social consequences associated with plant-forward diets (e.g., stigmatisation and exclusion) and descriptively that these factors may impede an individual from pursuing or maintaining a plant-forward diet (Graça et al., 2019). This research has culminated in the understanding that the socio-cultural value that we endow upon animal products, and the normative nature in which we consume them, gives rise to a cycle of social barriers that inhibit transitions away from the dominant ideology – *carnism*. Divergent members of society are stigmatised and excluded from society by members of the majority who wish to reaffirm their position as a member of the majority and protect cherished values. These processes are evident in the distal-level prejudice against meat-abstainers and the co-ordination issues that exist at the meso-level (e.g., family households). Together, these social barriers make the alternative – i.e., the adoption of a plant-forward diet – less desirable and less attainable (Lacroix & Gifford, 2019; Lea et al., 2006; Markowski & Roxburgh, 2019).

Methodological limitations and current directions

Though clear advancement has been made in the psychological inquiry of plant-forward diets, research in this space has come under increasing scrutiny concerning its over-

reliance upon self-report methodologies and the relative absence of behavioural measurement (Graça et al., 2019; Kwasny et al., 2022). Although self-report methodologies can be time and cost-effective, these methods are typically limited to cross-sectional measurements (i.e., data collected at a single point in time), which places limitations on what we are able to discern about rich and complex contextual influence as it unfolds over time. Moreover, self-report methodologies rely upon introspection – the participant's ability to observe their own thoughts and feelings and make predictions about their attitudes and subsequent behavioural intentions. Issues inherent in predicting behaviour from intentions (e.g., see Webb & Sheeran, 2006) have highlighted the need to reprioritise behaviour as the means and object of study both at the wider level of psychological inquiry (e.g., see Boyd et al., 2020) and more specifically in relation to research on plant-forward diets (e.g., see Loy et al., 2016). Notably lacking from this field of study is research which utilises methodologies allowing for rich, ecologically valid, and longitudinal measures of behaviour. Recent technological advancements have motivated a shift away from cross-sectionals design, and an uptake of advanced techniques (e.g., the use of smartphones, and wearable devices, or the utilisation of "big" social media data) allowing Psychologists to get closer to human behaviour and study it over time. In the present thesis, I sought to address these limitations and engage with advanced methodologies where possible, employing self-report to provide foundational or supplemented insights.

Experience-based sampling. One such advanced methodology was that of experience-based sampling – a method of data collection in which respondents complete repeated assessments throughout a prolonged period of testing, whilst in situ (Scollon et al., 2003). Experience based sampling entered the realm of psychological research in the 1970's, and as a result of continued advancements in mobile technology has become increasingly sophisticated. Once completed using pen-and-paper, the advent of the pager, the hand-held-

computer and later the smartphone saw increasing sophistication of the capabilities of this methodology and as such, increased uptake by Psychologists.

Experience-based sampling advances traditional self-report methodology in a number of ways. Most notably, it allows for "in situ" assessments of behaviour that are temporally close to the moment of enactment. This reduces the need to recall information from memory – a typically reconstructive process which may be influenced by a multitude of factors (Roediger et al., 1993). Removing the issue of memory bias means that the approach has a high degree of internal and ecological validity (Liu et al., 2016; Scollon et al., 2003). Experience-based sampling can be used daily and for a prolonged testing period which allows researchers to produce a more complete picture of human behaviour over time. The use of smartphone-based experience sampling specifically has a number of advantages above and beyond traditional methods of experience-based sampling, including the ability to control survey timing, check for compliance and minimise missing data through the use of response reminders and enhanced functionality features (e.g., multimedia entries; Scollon et al., 2003).

Experience-based sampling has been applied in a wide range of psychological inquiries, most notably in clinical settings for the investigation of mood and anxiety disorders (e.g., aan het Rot et al., 2012; Walz et al., 2014). There has been a markedly lower uptake by social Psychologists, likely because of the time, resource and financial demands it places on researchers. In the present thesis, we employed smartphone-based experience sampling, utilising respondents own mobile devices to encourage faster and more true-to-life engagement with the study. Through commercial license agreement, the research team secured access to MetricWire (https://metricwire.com/) a digital solution to experience-based sampling methodology that allows researchers to collect in-the-moment data from device users. This software consists of a dual interface: an online Research Tool Application, used

by the researcher to programme surveys and an application interface downloaded and interacted with by the participant.

Computational language analysis with "big data". Self-report methodology dominated 20th Century Psychology because of the relative ease in which it allows for data to be collected. However, in the digital world in which we live, it could be argued that raw behavioural data exists en masse. Over half (~58.3%) of the global population use social media (Statista, 2023e) a figure which is projected to rise to 76% over the next 5 years. Every day, social media users across the globe share approximately 500,000 tweets, 4.75 billion Facebook items and roughly 95 million Instagram posts (Durante, 2023; Marr, 2021). Advancements in computational science have made it easier than ever not only to acquire data from social media platforms, but to analyse the content and context (i.e., who wrote it, when, where) of social media posts. In this way, social media posts can thus be expanded into an array of psychologically meaningful measures (e.g., motivations, emotional states and preoccupations, etc.). As such, the relative ease with which behavioural data can be harvested from online sources dispels the advantages of self-report.

Language has been of long-standing intrigue in the field of Psychology given its integral part in human behaviour. It is considered by many to be a vehicle of thought and therefore laden with deep psychological meaning. That is, *what* people say, and *how* they say it can be important for inferring psychological patterns of thought and behaviour. Research shows that language is a reliable object for psychological analysis, internally and temporally consistent, and different between people. With the correct tools, it is possible to extract rich behavioural insight and associated cognitive functions from a single sample of natural language. Technological advancements have seen the introduction of tools (e.g., Linguistic Inquiry Word Count; Pennebaker et al., 2015) that automate the word counting and conceptualisation processes making it more accessible for Psychologists to conduct advanced

computational text-analysis. Recent research in this space has used language to unearth new insights in a vast array of Psychologically meaningful metrics including personality (e.g., see Boyd & Pennebaker, 2017), values (Boyd et al., 2015), emotion (e.g., see Vine et al. 2020) and cognition (Pennebaker et al., 2014). Together, the increasing availability of language data and advances in computational methods of language analysis have created new opportunities for the study of human behaviour on a scale never before imagined in psychological research.

Overview of the current thesis

This thesis presents a rich exploration of the social-cultural factors that influence an individual's food-related cognitions and decision making – specifically, as it relates to plant-forward diets. In an attempt to provide a complete observation of the *cyclical* nature of the social barriers that inhibit plant-forward dietary transitions, the present thesis includes an investigation into both sides of the proverbial coin: (a) the individuals attempting to navigate plant-forward diets (e.g., individuals attempting a plant-forward commitment) and (b) those perpetuating the negative social consequences associated with plant-forward diets (e.g., those who oppose plant-forward diets).With regards to (a), the studies presented here conducted an analysis of individuals attempting a plant-forward commitment and investigated the intervention potential of receiving social support within such a context (Study 1), as well as an analysis of the role of key relational systems, including the partner (Study 2) and the family (Study 3), in facilitating such dietary commitments. With regards to (b), the remaining studies investigated the group- and dietarian-identities of *informed rejectors* – individuals who are informed of plant-forward diets, and actively oppose them (Study 4 & 5).

Across this body of work, I adopted a whole systems approach. My approach was informed by Boulet et al., (2021) who developed a multi-level framework of household food waste and consumer behaviour. In keeping with Boulet et al. (2021), I consider food-related decision-making, attitudes and behaviour at the *micro*-, *meso*- and *distal*-level. Throughout

this thesis, I define these levels as follows – the "micro" or *individual* level is focused entirely on the individual, the building blocks of a social system, possessing their own internal processes (e.g., incl. attitudes, knowledge, skills) that influence their food-related decision-making. The "meso" or *household* level is an aggregation of the micro and refers to the collection of people who comprise a single social unit within the physical setting of a household. Last, the focal entities of the "distal" level are those social settings and boundaries that exist outside of the household. This encompasses external physical settings (e.g., incl. workplaces and schools), as well as the indirect influences of social values, norms and culture.

Throughout this research, I engaged with the following broad-level research aims:

1. To conduct a micro-level analysis, investigating the facilitative effects of social support for influencing one's commitment to reducing their meat consumption (Study 1).
2. To conduct a meso-level analysis, investigating the influence of one's romantic partner (Study 2) and family members (Study 3) on food decision-making, specifically as they relate to plant-forward diets.
3. To conduct a distal-level analysis of the wider social-cultural context of plant-forward diets at the distal-level, specifically an investigation into the groups of individuals who actively oppose plant-forward diets (Study 4 & 5).

Study 1

In Study 1, we attempted to understand the facilitative potential of social support, within the context of a meat reduction commitment. In self-report research, an anticipated lack of social support is often reported as a key barrier in the pursuit of plant-forward diets (Markowski & Roxburgh, 2019). Research with practicing and former meat-abstainers has

corroborated the limiting effects that a lack of social support might have for those attempting to maintain a plant-forward diet (Twine, 2014). Yet, the facilitative effects of felt social support on behavioural outcomes related to meat-reduction are not yet known (Graça et al., 2019). To the authors' knowledge, no prior research has employed experimental design to test the intervention potential of social support (Graça et al., 2019). Accordingly, in Study 1 we sought to understand whether the provision of social support would aid in the actualisation of meat-reduction behaviours. We were interested in the following research question: does social support facilitate meat reduction commitments?

To address this question, we sought to experimentally manipulate the experience of social support during a meat-reduction pledge – conducted either alone or with other pledgers. This was done to determine whether pledging with supportive others might encourage sustained animal product reduction. To experimentally manipulate the experience of social support, participants completed a meat-reduction pledge under one of three conditions: either alone (lone condition), with support from other pledgers communicating online (nominal-group condition), or with members of their household who were also pledging (known-group condition). During the intervention, intentions to pledge, daily meat consumption, and pledge completion rates were tracked using smartphone-based experience-sampling. Baseline, post-intervention and two-week follow-up surveys were administered to investigate the endurance of meat-reduction behaviours, and explicit- and implicit-attitudes towards plant-based eating. We theorised about the benefits of social support for promoting engagement with the meat-reduction pledge. Specifically, we hypothesised that, relative to the control condition, those in the nominal- and known-group conditions would report greater feelings of social support, given that our manipulation of these conditions had provided them with a *structure* of support. We anticipated that the experience of feeling support would mean that participants would be more likely to follow through on their pledge – consuming fewer

animal products, and reporting greater intentions to pledge, and pledge adherence rates during the intervention. However, the results of our manipulation check indicated that we had been unsuccessful in manipulating social support and as such, were unable to demonstrate its facilitative effects.

Study 2

The results of study 1 prompted a progression in the current body of research: a move from studying food decision-making at the micro- to the meso-level. Specifically, to study the facilitative effects of social support, including tangible assistance and advice, afforded by pre-existing relationships (e.g., family members, partners). In previous research, for example, of former meat abstainers' retrospective reports, participants have indicated that a lack of felt support from a one's primary social group—family members, friends, but, especially, romantic partners—were reasons for abandoning their plant-forward diets (Hodson & Earle, 2018; Lacroix & Gifford, 2019; Markowski & Roxburgh, 2019). Given the co-ordinated nature in which couples consume food (Sobal, 2005), an individual's partner represents a key influence on a person's eating patterns, if not the *strongest* influence (e.g., see Øygard & Klepp, 1996). Clearly, the relational context in which an individual plans to undertake a dietary transition is an important moderator of engagement and success. Nonetheless, research into the relational dynamics affecting the attempt and maintenance of plant-forward transitions, remains largely unexplored.

Hence, in Study 2, we sought to understand how romantic partners might impede or facilitate plant-forward eating. We conducted a foundational investigation to better understand how *dietary alignment* and *relational climate* – the cohesion and flexibility of a relationship (Olson, 2000, 2011) – contributes to the tension individuals anticipate in their relationship when a member reduces their animal-product consumption, and their own openness to reducing. We employed survey methodology as a preliminary step for further

inquiry into the role of relational climate for the pursuit and maintenance of plant-forward diets. Couples were assessed on their dietary alignment and relational climate as predictors of the following outcome variables: dietary coordination, harmony, and tension as well as openness to plant-forward diets and anticipated tension in the event that one member pursued such transition. Here we anticipated that couples aligned in their current dietary practices would anticipate greater diet-related tension in the event that either themselves or their partner reduced their consumption of animal products. In addition, we anticipated that *balanced* relational systems (i.e., moderately flexible, and cohesive couples) would report greater coordination and an increased openness to plant-forward dietary transitions. In sum, we found that couples who were not previously aligned in their eating habits, and with more flexible leadership styles anticipated less tension from such transitions, and, on the whole, were more open to them.

Study 3

Developing upon Study 2, Study 3 employed advanced methodology to investigate the conditions under which the family system may impede or facilitate plant-forward diets. Here we examined with how *dietary harmony* and *relational climate* (Olson, 2000, 2011) as it relates to how family systems respond when a member decides to reduce or abstain from animal products. Additionally, we investigated how this response—unfolding over time—modulates a person's commitment to their dietary transition. In Study 3, we built directly upon the limitations of Study 2. Specifically, Study 2 had focused on the *predictions* that cohabitating individuals made about how themselves and their partner would handle a member's dietary transition. In Study 3, we progressed our inquiry and we sought to determine how the relational climate of a family system relates to a person's commitment to their dietary transition. By employing a longitudinal study, and experience-sampling methodology, we were able to sample participants who were actively undergoing a dietary

transition and collect data from them temporally close to the moment of enactment. With these advances, we could explore how families respond to a member's plant-forward dietary transition in real time. This naturalistic exploration provided rich qualitative data during the experience sampling phase of the study. It illuminated the social environment in which newly transitioning individuals found themselves and offered insights into the strategies families used to manage the social dynamics and tensions emerging due to a member attempting a plant-forward transition.

In Study 3, we had a series of targeted research questions and hypotheses. First, we asked: how does dietary harmony and *relational climate* relate to the transitioning individual's perceptions of social support, coordination, and tension, and the resultant pursuit of their dietary goals? We anticipated that participants who rated their family as more cohesive and flexible, and who reported greater dietary harmony would perceive their living environment to be more conducive to the pursuit of their dietary goals. Specifically, scoring higher on scores of social support and co-ordination and lower on scores of tensions. In terms of participants' longer-term commitments, we asked: is success at maintaining a dietary transition dependent upon perceived social support, and coordination with close others? Here we hypothesised that higher felt social support and social coordination would result in better outcomes over time: reduced consumption of animal products, greater dietary goal achievement and commitment, and greater "stages of change" progression over time. Based on the results of study 3, we were able to confirm these hypotheses and conclude that the provision of *functional* and *enacted* support within the household was facilitative of plant-forward dietary transitions.

Study 4

For Studies 4-5, we switched focus to informed rejectors of plant-forward diets. In Study 4, our investigation concerned those individuals who actively oppose those who

abstain from the consumption of animal food products. Prior to our investigation, a considerable amount of research had been conducted to understand why people denigrate those who eschew meat (e.g., see de Groeve & Rosenfeld, 2021). Though research in this area was largely focused on the form and content of anti-vegan prejudice and the type of people most likely to express such views. The aforementioned research has been invaluable in advancing scientific understanding of prejudice toward meat avoiders. Nonetheless, we identified an important research gap in this space. Previous research had largely focused on the nature of anti-vegan sentiments expressed by members of the general public when answering questions or measures posed by researchers within a study or experiment. Thus, current knowledge of prejudice toward meat-abstainers is derived from from individuals who express such sentiments, *reactively*, i.e., when solicited under experimental conditions. With compelling evidence of a recent escalation of prejudice toward vegans, both in on- and offline settings (Aguilera-Carnerero & Carretero-González, 2021; Nachiappan, 2020) we sought to advance current perspectives of anti-veganism by directly probing this behaviour. In Study 4, we sought to move away from these traditional methods (i.e., questionnaire methodology) and instead adopted a novel approach to understanding a group of people who self-identity as "anti-vegan". To this end, we applied methods of computerized text analysis to language data derived from a community of self-identified anti-vegans on Reddit (*r/AntiVegan*) to understand their group dynamics, identity and governing ideology as well as the consequences of participating in the group on the epistemic commitments of members.

Study 4 was guided by three central research questions. First, we asked: how do *r/AntiVegan* users differ from the general population on Reddit? In our analysis of this question, we compared the online posting behaviours of *r/AntiVegan* users relative to a sample of neutral Reddit users (*r/askreddit*) as an approximation of a "control" group, with the aim of understanding more about the psychosocial characteristics of individuals who

actively engage in a group organised around anti-vegan discussion. Second, we asked: what are the most prominent topics of discussion among users of the *r/AntiVegan* community? Here we used a topic modelling technique to understand the key topics that govern discussion within the *r/AntiVegan* community as a window into the beliefs and motives characteristic of anti-vegan identifiers. In doing so, we sought to understand anti-vegan beliefs and opinions as *they* choose to discuss and enact them. Third, we asked: does engagement with the *r/AntiVegan* community precipitate social psychological change, as evidenced by changes in users' language use? Here we examined longitudinal changes in language-based measures of group members' traits with the aim of understanding the social psychological effects of *r/AntiVegan* membership. In sum, we observed that *r/AntiVegan* users are unique from the population on Reddit in the extent to which they embrace taboo topics and dark humour, they engage in critical and nuanced discussions of the moral and health claims of vegans, and show signs of increased certainty and group commitment over time.

Study 5

In study 5, we sought to gain a richer understanding of the psychological and ideological profile of anti-vegans of which study 4 had been revealing of but was not able to directly test. To this end, we sought to determine whether self-identifying "anti-vegans" would exhibit a unique dietarian identity and ideological profile relative to both omnivores and vegans. Using survey methodology, we engaged in a rich, comparative exploration of the dietarian identities and ideological correlates of individuals who identify as "anti-vegan" relative to both omnivores and vegans. To do this, we employed the *dietarian identity framework* – a theoretical framework for understanding one's thoughts, feelings, and behaviours with respect to their dietary pattern (Rosenfeld & Burrow, 2018). Dietarian identity involves the centrality, motivations, group perceptions, and strictness of a person's diet-based identity. Participants were also assessed on a range of ideological markers which

we had identified as potentially meaningful in Study 4. These included: dark humour, social dominance orientation (SDO), speciesism, male-role norms, moral relativism, and trust in science and scientists.

Here, we anticipated that self-identified anti-vegans would exhibit a unique dietarian identity and ideological profile relative to both omnivores and vegans. Here, our approach was largely exploratory, though we did anticipate and preregister a few predictions based on suggestive lines of evidence stemming from our earlier analysis of *r/AntiVegan* discourse and previous studies of vegan prejudice. Regarding the dietarian identities of anti-vegans, we predicted that the dietary expression of anti-vegans would be more *personally* motivated than both omnivores and vegans given their strong convictions about the health consequences of a vegan diet and the necessity of animal protein for optimal nutrition. Second, consistent with previous literature, we predicted that vegans would be more *morally* motivated and their diet central to their identity at rates higher than both omnivores and anti-vegans because of the restrictiveness of vegan diets and its ethical basis (Kirsten et al., 2020; Rosenfeld, 2019).

Regarding the ideological profile of anti-vegans, we hypothesised that anti-vegans would perceive veganism to be a greater symbolic or ideological threat than omnivores. In line with previous perspectives (e.g., Leite et al., 2018), we hypothesised that anti-vegans would score higher on measures of social dominance orientation (SDO), speciesism, and traditional male-role endorsement than both omnivores and vegans—in other words, they would represent a more extreme subclass of omnivores in this regard. Further, given *r/AntiVegans'* critique of vegans' use of moral absolutism, we anticipated that anti-vegans would adopt a more relativist approach to morality than both omnivores and vegans. Lastly, based on the critical stance of *r/AntiVegans* towards studies that support vegan diets, we hypothesised that relative to vegans and omnivores, anti-vegans would be less trusting of science, particularly research in support of plant-forward diets. In sum, our analysis revealed

a dietarian identity unique to anti-vegans. The dietary patterns of anti-vegans were more central to their identity than for omnivores, though marginally lower than vegans. Like vegans, anti-vegans scored highly on dietarian measures of private regard and personal dietary motivations, and lower than omnivores on public regard. However, anti-vegans scored higher than both omnivores and vegans on a number of ideological measures including dark humour, SDO, speciesism, male-role norms, moral relativism, and distrust of science.

General discussion

The final chapter of this thesis includes a summative and integrative discussion of all five studies. We synthesize the various lines of inquiry which pertain to the influence that one's social-cultural milieu has on their food-related cognitions and decision making – specifically, their thoughts, feelings *and* behaviours as they pertain to plant-forward diets. We paint a rich picture food-related decision-making as it occurs at the micro-, meso- and distal-level including summary of how people navigate plant-forward dietary transitions and why some individuals are reactive to such transitions. We discuss the wider implications and limitations of this body of work, as well as potential future directions.

Study 1: Testing the potential benefits of adhering to a meat-reduction pledge with and without social support

Rebecca Gregson & Dr. Jared Piazza

Abstract

The production and consumption of animal-derived food products has been linked to a mass of negative consequences, prompting non-government and government organizations to call for shifts towards plant-based eating. The present study investigated the potential benefits of adhering to a meat-reduction pledge with and without the provision of social support. Two-hundred and forty-nine participants took part in a pledge intervention to test the value of social support as a facilitator of meat-reduction efforts. Participants completed a temporary meat-reduction pledge under one of three conditions of the experimental manipulation of social support: either alone (solitary condition), as a member of an online support group (nominal-group condition), or with members of their household (known-group condition). During the intervention, intentions to pledge, daily meat consumption, and pledge completion rates were tracked using smartphone-based experience-sampling. Baseline, post-intervention and two-week follow-up surveys were administered to investigate long-term changes in meat-eating behaviours, explicit- and implicit-attitudes. Manipulation check results revealed a failure to induce feelings of social support in participants of the nominal-group condition. Despite higher scores of social support in the known-group condition, we found comparable pledge adherence levels across all conditions. Perceived capacity prior to enacting the meat-reduction pledge predicted pledge adherence, which in turn, predicted a sustained increase in perceived capacity to reduce. Despite the capacity-boosting effects of the pledge, reductions in meat consumption were not sustained. The limitations and implications of this research are discussed against the wider literature on facilitators and barriers to meat reduction, including the use of pledging interventions for the promotion of meat reduction, and social support.

Keywords: meat reduction, experience sampling, smartphones, pledging, social support

Introduction

There is a growing concern that our modern-day animal agriculture industry bears health and ecological costs that cannot be sustained (e.g., see Willett et al., 2019). In comparison, diets reliant on plants offer promising solutions to many of the health and ecological challenges that we currently face (Willet et al., 2019). For this reason, scholars, and non-governmental organisations are calling for large-scale changes in the diets of modern society – a global shift towards more plant-based eating (e.g., see Willet et al., 2019). Despite this, diets reliant on animal-derived proteins remain the norm (e.g., see IPSOS, 2018) and willingness to reduce or forgo these foods is a long way from reaching critical mass (Bryant, 2019). Accordingly, a comprehensive body of research has sought to understand why individuals may be unwilling to reduce their consumption of animal-derived foods, the barriers that stand in the way of plant-forward diets, and how they might be overcome.

A clear obstacle in the advance towards a plant-forward society is the public awareness gap around the negative consequences of animal product production and consumption (Rothgerber, 2014). Public perception research has shown that awareness of the consequences of meat consumption is often inconsistent and incomplete. For example, it is typical for consumers to express a concern about the negative health consequences of animal-derived foods (Cordts et al., 2014), while maintaining the belief that some products, for example, meat is indispensable for a balanced diet and a necessary source of protein and iron (e.g., see Hoek et al., 2017). The environmental impact of meat consumption is equally underappreciated (e.g., see Stea & Pickering, 2019) and consumers are instead focused on transport as the central issue to environmental damage and climate change (Bailey et al., 2014). When probed on ways to help the environment, the vast majority of consumers identify options relating to transport (Joyce et al., 2008) and the foregoing of meat is considered the least environmentally beneficial alternative (Austgulen, 2018).

A wealth of previous research investigating meat reduction interventions has adopted the assumption that resolving the public awareness gap around the negative consequences of meat consumption is likely to be a necessary first step in promoting meat reduction. Indeed, persuading people of the reasons to reduce their consumption of meat and adopt an increasingly plant-forward diet is a common strategy in meat-reduction advocacy and has preoccupied research in this area (e.g., see Graça et al., 2019). The efficacy of these interventions has largely been assessed using *attitudinal* outcomes (e.g., *intentions*, or *willingness* to change) and has produced promising results (e.g., see Mathur et al., 2021). However, fewer work has considered the *behavioural* outcomes of such strategies. That is, limited research has evaluated the efficacy of meat reduction interventions on changes in meat consumption behaviour (Harguess et al., 2020). Where behaviour has been considered, research suggests that efforts to raise awareness of the negative consequences of meat consumption are necessary, but insufficient for changing behaviour (e.g., Loy et al., 2016).

This discrepancy between *attitudinal*- and *behavioural* outcomes is consistent with the intention-behaviour gap (Webb & Sheeran, 2006), the finding that intentions often correlate weakly with measurable behaviour change. Research by Loy et al., (2016) reports that a moderate-to-strong intention to reduce meat consumption is not predictive of actual reduction in an *information-only* condition, whereby participants received information on the environmental, ethical, health and social consequences of meat consumption. Intentions to reduce *were* predictive of actual behaviour change when the information provision was embedded within a *multi-component* intervention, combining the provision of information with a self-regulation strategy. Hence, awareness of the negative consequences of animal product production and consumption may be necessary but is not sufficient in and of itself, for motivating behaviour change.

Until recently, the literature on meat reduction interventions has been preoccupied with awareness raising interventions that seek to boost one's motivations for foregoing animal-derived foods, and or adopting a plant-forward diet (Graça et al., 2019). These approaches assume an *attitude-centric* position on behaviour change, assuming that altered attitudes will later lead to altered behaviours. Such an approach is problematic for two reasons. First, it is inconsistent with theoretical models of behaviour change which recognise that, in addition to attitudes, human behaviour is influenced by many factors including those of a social, cultural and economic nature. Behaviour change models thus make the recommendations that, to promote behaviour change, interventions ought to address the complex landscape of variables that inhibit individuals from adopting the focal behaviour (Davis et al., 2015). Second, it assumes that attitudes are consistent with behaviours which may be a faulty assumption to make if we take heed of the *intention-behaviour* gap (Webb & Sheeran, 2006). Henceforth, interventions aiming to promote a reduction in the consumption of animal derived foods may be more effective if 1) grounded in behaviour change theory and 2) they avert the intention-behaviour gap.

Grounding meat-reduction intervention research in behaviour change theory

In a recent review of the literature, Graça et al. (2019) imposed a top-down theoretical restructuring of the literature on meat-reduction barriers and facilitators. Specifically, the authors organised their review in accordance with the COM-B model of behaviour change (Mitchie et al., 2012) which conceptualizes behaviour as influencing, and being influenced by, three components: *capability*, *opportunity* and *motivation*. The model posits that for sustained behaviour change to occur (e.g., sustained meat reduction), an individual would need to feel sufficiently *motivated* to act (e.g. possessing a desire to avoid animal suffering), and have both the *opportunity* (e.g. a supportive family environment), and the *capability* to do so (e.g., having the skills to prepare a plant-based meal). The review reported on a wealth

of research evidence which demonstrated how each of these domains may serve as both facilitators and barriers of plant-forward diets. It also key limitations in this area. For example, while *descriptive* research on the barriers and facilitators of meat reduction seems extensive (~73% of all papers included in the review), a limited body of work using experimental designs to test the efficacy of potential facilitators in intervention designs was found (~21%). Particularly scarce were interventions testing capability- (e.g., competencies for preparing plant-based meals) and opportunity (e.g., social barriers) variables, as well as studies that consider the interaction between the relevant domains of the COM-B model.

A new direction: *"behaviour-centric"* approaches

The discrepancy between intentions and behaviour has highlighted the need to reprioritize behaviour as the *object* and *means* of study, both across the wider landscape of psychological inquiry (e.g., see Boyd et al., 2020) and specifically in meat-reduction intervention research (e.g., see Mathur et al., 2021). Recent technological advances (e.g., the proliferation of the internet, and the development of smartphones and wearable devices) have aided social scientists in making such a transition. With such advances, social scientists have begun adopting *behavior-centric* approaches to the study of meat-reduction intervention research; manipulating meat-consumption behaviour both as the object and means of study. In brief, *behaviour-centric* approaches provide an opportunity for an individual to engage in the focal behaviour, and it is assumed that this will increase their capacity and motivation for sustaining such behaviours.

Pledging is one such behaviour-centric strategy. A pledge is a commitment device, whereby an individual enacts a commitment to behave in a certain manner (Bryan et al., 2010). Theoretically, it is assumed, that encouraging an individual to commit to a focal behaviour may initiate a process of self-persuasion whereby the individual convinces themselves of their motivations and capabilities for engaging with the committed behaviour,

solidifying newly formed attitudes, and paving the way for new long-term sustained behaviour changes (Cialdini, 2001). Studies evaluating the efficacy of pledging as a mechanism for promoting behaviour change abound. This research spans a wide range of domains, including driver safety (Kello et al., 1988), environmental action (Peterson, 2023; Truelove et al., 2023), voting (Costa et al., 2018), donating blood (Meyer & Tripodi 2021), charitable giving (Andreoni & Serra-Garcia, 2021) and drug and alcohol cessation (e.g., Hemminger et al., 2016). This research converges on the conclusion that pledge interventions are effective in producing behaviour change both during the intervention and in the follow-up period (Lockhorst et al., 2013).

However, the efficacy of a pledge intervention may depend upon a number of moderators, including individual differences at the participant level, as well as particular feature of the pledge design. Research has shown that successful commitments are often those which align with a prior motivation to pursue the focal behaviour. For example, smokers are more likely maintain a pledge to abstain from smoking, if they have previously expressed a desire to quit (Hallaq, 1976). Similar results were reported by Bass et al. (2019) who found that the majority of participants who succeeded in abstaining from a binge drinking event, were those who had expressed a prior concern with or a motivation to abstain from binge drinking. Moreover, certain features of a pledge intervention may enhance its efficacy for promoting behaviour change, for example, public commitments (Pallak et al., 1980), that are substantially challenging (Becker, 1978) and devoid of an external justification (e.g., a monetary incentive; Cahill & Perera, 2011) are those most effective in producing sustained behaviour change.

In the first known experimental study to adopt a behaviour-centric approach to the study of meat-reduction, Piazza et al. (2021) conducted a large-scale, multi-site study, with 325 participants from the UK, Germany and Australia. Participants were assigned to one of

two conditions, either an experimental condition whereby they were asked to commit to a 28-day meat free pledge, or to a no-intervention control condition. Here the authors assumed that having individuals engage in short-term behaviour change, would foster long-term sustained behaviour change. The study employed smartphone-based experience sampling to track participants eating behaviours and cravings for meat across a 28-day period. This extended period of experience sampling was embedded within a longitudinal design, that included a baseline, outtake, and one-month follow-up survey. The research revealed a number of insights, including the finding that participants who were assigned to the pledge condition ate less meat across the intervention phase than those control participants. This was especially true for German participants. Pledgers with high starting motivations and who reported greater meat-related conflict tended to adhere more strictly to the pledge: reporting fewer meat cravings and eating less meat. However, despite the established efficacy of the pledge intervention, the behavioural changes evidenced at outtake, were not maintained one-month post-intervention.

Similar research has since been conducted by Dakin et al. (2021) who employed smartphone-based experience sampling methodology to determine whether prescribing omnivorous participants a 7-day meat reduction diet would lead to attitudinal, and behaviour change two-weeks later. Here the research team were interested in variance between different *types* of pledges. As such, participants in this study were assigned to complete one of four meat reduction diets: vegetarian, reducetarian, climatarian and one-step-for-animals (or abstention from chicken). All participants evidenced a significant reduction of meat consumption during the adherence period, and in the weeks that followed, effects which were particularly pronounced for participants in the vegetarian-pledge condition. In addition to behaviour change, participants also demonstrated attitudinal change as a result of the

adherence period, which included a decrease in meat commitment and meat-eating justifications, effects which were found to moderate the main effects on behaviour change.

Unlike *attitude-centric* approaches, *behaviour-centric* approaches effectively change behaviour in the short-term. However, we are yet to find evidence that these changes are sustained over a prolonged period of time (e.g., one month later). Both Piazza et al. (2021) and Dakin et al. (2021) comment that in order to foster long-term behaviour change, beyond the boundaries of an initial commitment, further barriers to sustaining a meat-free diet ought to be addressed. Here both papers allude to the potential value of multicomponent behaviour-centric interventions, that not only provide an individual with the opportunity to make an initial commitment, but also work to address some of the barriers that meat-reducers report facing whilst attempting plant-based diets. In particular, both research teams recognise the importance of the *social* environment in which an individual decides to reduce their animal product consumption (e.g., having a supportive family) as well as the *practical* hurdles (e.g., the accessibility of plant-based alternatives).

Social barriers to meat product reduction

In the present study, we were particularly concerned with the social barriers to meat reduction. We recognise that eating, and the consumption of animal foods in particular, is a *deeply* social practice. Food products derived from animals are so embedded within the daily lives and cultures of most consumers that they help to define both a "meal" (Sobal, 2005) and who *we* are in relation to our social standing (Chan & Zlatevska, 2019), gender-identity (Ruby & Heine, 2011) and nationality (Leddy-Owen, 2014). Given the socio-cultural importance of animal product consumption, the abstention from such practices is perceived as a rejection of cultural values and a threat to tradition (Stanley, 2022) and as such, may be socially consequential (de Groeve & Rosenfeld, 2022). Indeed, those who abstain from animal products, and particularly vegans, experience social denigration and exclusion as a

result of their diet (MacInnis & Hodson, 2015). Non-vegans are receptive to the social consequences associated with abstaining from animal products, and as such avoid adopting vegetarian or vegan diets out of fear of stigmatisation (Markowski & Roxburgh, 2019).

A wealth of observational or cross-sectional research has documented the social barriers to plant-forward eating (Graça et al. 2019). Much of this work converges on the conclusion that the fear of stigmatisation and lacking the necessary social support may undermine people's efforts to reduce their animal product consumption (e.g., see Lacroix & Gifford, 2019; Lea et al., 2006; Markowski & Roxburgh, 2019). Indeed, research has shown that current meat consumers anticipate relational struggles with their partners and/or family members, were they to go vegetarian or vegan because of the perceived disruption it would cause to the already established dietary coordination and harmony within the household (Markowski & Roxburgh, 2019). Similarly, this work recognises the potential value of perceptions of social support as a facilitator of more plant-based eating (Lea et al., 2006). Despite presenting a real barrier to plant-based eating, social barriers are yet to be *experimentally* investigated, as a potential facilitator of plant-based eating (Graça et al. 2019) – a research gap which the present study aimed to address.

The current study

The present study had two broad aims which were borne out of learnings from the wider literature. Our first aim was to investigate how a *behaviour-centric* meat reduction intervention might foster behaviour change, both during an intervention period and over time. Informed by Graça et al's (2019) theoretical restructuring of the literature, we aimed to design an intervention in accordance with the COM-B model (Michie et al., 2011). That is, our intervention aimed to satisfy each of the three domains of the COM-B model: creating an *opportunity* for participants to engage with the focal behaviour (i.e., a meat-reduction pledge intervention, with and without social support) while providing them with resources to boost

their *motivation* and *capacity* to engage. To address calls for behaviour-centric interventions that additionally address barriers to plant-forward diets (Piazza et al., 2021; Dakin et al., 2021) our second aim was to investigate social support as a potential facilitator of plant-forward diets. We chose to focus on social support as potential facilitator of plant-forward diets for two key reasons. First, because we recognise eating as a deeply social activity; the consumption of animal-derived foods in particular. Second, the lack of experimental research on social barriers as highlighted by Graça et al. (2019).

To address these aims, we sought to experimentally manipulate the experience of social support during a meat-reduction pledge intervention, in order to determine its efficacy for encouraging sustained meat reduction over time. We employed smartphone-based experience sampling to allow for a longitudinal design, with three experimental conditions and four data collection points. All participants were invited to make a pledge to eat one vegetarian meal each day, spanning the 14-day experience sampling period. In order to experimentally manipulate the experience of social support, participants completed their pledge under one of three experimental conditions: either alone (solitary condition), in small groups of strangers (nominal-group condition), or with members of their household (known-group condition). All participants completed a (1) baseline survey, followed by (2) a 14-day meat-reduction pledge intervention utilising smartphone-based experience-sampling, followed up by (3) an outtake survey, and finally (4) a two-week post-intervention follow-up survey.

Hypotheses

Our research was guided by several preregistered questions and hypotheses (AsPredicted #49292; see aspredicted.org/d7ns2.pdf). First, we theorised about the benefits of social support for promoting engagement with a meat-reduction pledge. Given that previous literature has alluded to a lack of social support as a key barrier to plant-forward diets, we

expected that the experience of feeling socially support would be important during a meat-reduction pledge. Accordingly, our original hypotheses stated that relative to those in the solitary condition, those in the nominal-group condition would evidence greater engagement with the pledge, in the form of less meat consumption (Hypothesis 1a), higher daily intention to pledge (Hypothesis 1b), and greater pledge adherence during the 14-day smartphone-based experience sampling intervention (Hypothesis 1c).

Hypotheses 1a-c were pre-registered prior to the decision to recruit participants for a known group condition. In the early stages of testing, it became apparent that a minority of participants had signed up with members of their household. Hence, during testing and prior to any analysis, we made the decision to extend our recruitment to include a group of individuals who were living together during the testing phase. As such, we extended this hypothesis to predict that relative to those in the solitary condition, those in both the nominal-group and known-group conditions would evidence greater engagement with the pledge. We anticipated that the experience of living together would open up opportunity for meal-time coordination and more tangible means of support and would thus mean that participants in the known-group condition may be at and added advantage to those in the nominal-group condition. These predictions were not pre-registered and instead should be considered exploratory.

Second, we theorised about how a person's attachment to eating meat may modulate their engagement with a meat-reduction pledge. We recognised that the social barriers to plant-forward diets do not provide a complete explanation for why individuals may be reluctant to reduce their animal product consumption. Instead, the barriers to plant-forward diets are numerous and include factors intrinsic to the individual themselves, including one's affinity for and attachment to animal derived food products (e.g., see Malek et al., 2019). Accordingly, we hypothesised that, relative to committed meat eaters, those with lower meat

commitments would evidence greater engagement with the pledge in the form of less meat consumption (Hypothesis 2a), higher daily intention to pledge (Hypothesis 2b), and greater pledge adherence during the 14-day smartphone-based experience sampling intervention (Hypothesis 2c).

Lastly, we made a series of hypotheses based around the potential downstream benefits of engaging with the meat-reduction pledge. Given that *behavior-centric* approaches assume that engaging in the focal behaviour will increase capacity and motivation for sustaining such behaviour, we anticipated that engagement with the pledge would be an indicator of sustained change. Accordingly, we hypothesised that participants who abided by the pledge more strictly, relative those who adhered less strictly would show lower levels of meat consumption (Hypothesis 3a), lower levels of implicit positivity for meat-based meals (Hypothesis 3b), an increased motivation to reduce one's consumption of meat (Hypothesis 3c), and an increased perception of one's capacity to eat meat-free (Hypothesis 3d) two-weeks later.

Method

Recruitment strategy

Participants were recruited from Lancaster University, using university-wide advertisement to attract both undergraduate and post-graduate students from a variety of disciplines. Our recruitment strategy was guided by a number of eligibility requirements and exclusion criterion. Specifically, all participants were required to: (1) own a smartphone, (2) have student access to a Microsoft Teams account and (3) identify as someone who consumes animal products. Our original pre-registered recruitment strategy was conducted prior to including the third known-group condition. Hence we conducted an a priori power analysis, based upon a repeated measures between-subjects design with *two* conditions, which

indicated that a total sample of *N*= 172 (86 per condition), which would give us 95% power to detect a modest effect size (*f*=0.20)[1] with an error probability of 0.05.

Later, we conducted a second power analysis to account for the addition of the third, exploratory known-group condition. Again, we based this power analysis upon a repeated measures between-subjects design, this time with three conditions. This analysis indicated that a total sample of *N*= 246 (82 per condition), would give us 95% power to detect a modest effect size (*f*=0.20) with an error probability of 0.05. Given the longitudinal design of our research we anticipated a 10% attrition rate (Hofman & Patel, 2014) and so aimed to over recruit to ensure we were able to meet power. After exclusions our sample consisted of 249 participants – *n* = 97 solitary condition, *n* = 91 nominal-group condition, and *n* = 61 known-group condition – the latter of which fell below our threshold for power. See Supplementary Materials A for further information about our participant pool, including recruitment strategy, exclusions, and condition assignment. All Supplementary Materials can be accessed via the OSF repository here: https://osf.io/qwdr9/.

Demographics

Two-thirds of our 249 participants identified as female (*n*=166, 66.7%), 80 male (32.1%), 2 "other" (.8%) and one indicated that they preferred not to specify their gender identity (0.4%). Age ranged from 18-44 years (*M*= 20.31, *SD*= 3.11). We had a predominantly British sample (*n*=176, 70.7%), with *n*=73 indicating another nationality (29.2%). Our sample was predominantly White/Caucasian (*n*=174, 69.9%), followed by a smaller sample of Asian (*n*=43, 17.3%), Hispanic/Latino (*n*=9, 3.6%) and Black/African (*n*=6, 2.4%) participants. A total of 17 (6.8%) participants indicated an ethnicity other than

[1] We did not know what size effect to expect for condition (i.e., the manipulation of social support). Hence, in our power analysis we set the expected effect size to low-moderate (i.e., *f*=.20).

the options provided. As per our eligibility criteria, participants were those who identified with one of the following classifications: meat lover (*n*=42, 16.9%), omnivore (*n*=174, 69.9%), semi-vegetarian or reducetarian (*n*= 32, 12.9%), and pescatarian (*n*=1, 0.4%). Diet length ranged from 2-months to 44 years (*M*=16.3, *SD*=7.52).

Procedure

Participants attended a ~40-minute online briefing session in groups of up to four participants, or with members of their household. The purpose of the briefing session was to outline the research objectives and introduce the experimental manipulation of the study. During this session, all participants were invited to make a pledge to eat one vegetarian meal, each day, for a period of 14-days. Pledgers were advised that the were not required to adopt a meat (i.e., vegetarian) or animal product-free (i.e., vegan) diet but to replace one meat-based meal (preferably lunch or evening meal) with a vegetarian meal, each day. Participants were made aware that by providing their consent to take part, they were agreeing to the pledge. Group-pledgers were additionally informed that, should they consent to take part in the pledge, they would be participating as part of an online group. All consenting participants were then required to complete a baseline survey, which assessed participant's demographics (*incl*. age, gender, nationality, political orientation, and religious beliefs), dietary classification, dietary motivations, implicit attitudes toward animal foods, meat attachment and their *motivation* and *capacity* to pledge.

Having completed the baseline survey, all participants were asked to download the experience sampling application (MetricWire; https://metricwire.com) to their smartphone device and enrol in the study. All participants received training on how to use the application, including where, when and how to find and complete the daily surveys. To experimentally manipulate the experience of social support participants in the nominal-group condition were added to a private Microsoft Teams account in small groups of three or four. Microsoft

Teams is a GDPR compliant platform that emulates social media in many ways (e.g., allowing the creation of group spaces, shared timelines, and the ability to react to shared content using engagement tools, e.g., likes and comments). Membership to these groups was managed by the project's chief investigator and restricted on an invitation-only basis. All participants were made aware that they are to be respectful in their communication with the group and that they were not permitted to break the privacy and confidentiality of the group (i.e., by adding new members or posting offensive content).

The period of experience-based sampling commenced one day after the participant enrolled in the study. Each day, all participants received three surveys, and one infographic. At 11am, all participants received a MetricWire assessment, regarding their intention to pledge. This survey was live for 4 hours (i.e., until 3pm) and participants received a series of push notification to remind them to complete the survey. To provide participants with the *motivation*, and to support them in their *capacity* to pledge, all participants received a random daily infographic at 12 noon. Solitary and household pledgers received their infographic via the MetricWire application, while those in the nominal-group condition received their infographic via their shared Microsoft Teams forum. At 6pm, all participants received two MetricWire assessments regarding 1) their food consumption that day, and 2) their pledge adherence and satisfaction. These surveys were live for 5 hours and again participants received a series of push notification prompting their engagement.

Immediately following, and approximately two-weeks after the 14-day period of pledging and experience-based sampling, all participants were emailed a survey containing all items described at baseline[2]. To assess the successes of our manipulation, participants in

[2]Average completion time between baseline and post intervention was *M*=15.68 days (*SD*=1.23, *min*=15, *max*=22). Between the post intervention and the two-week follow-up, average completion time was *M*=14.73

the nominal- and known-group conditions, were additionally asked to complete a manipulation check measure – an assessment of how socially supported they felt during the pledge.

Materials

All scales and scale items, excluding those presented in text, can be found in Supplementary Materials B.

Baseline survey

Dietary classification. Dietary classification was assessed using an eight-item scale (Piazza et al., 2018), which included the following eight single-choice options: meat lover (*I prefer to have meat in all or most of my meals)*, omnivore (*I eat meat and other animal products, like dairy and/or eggs)*, semi-vegetarian or reducetarian (*I eat meat, but only on rare occasions or only certain types of meat*), pescatarian (*I eat fish and/or seafood, as well as dairy products and eggs, but no other meat*), lacto- or ovo-vegetarian (*I eat dairy products and/or eggs, but no meat or fish*), strict vegetarian (*I eat no animal products, including dairy and eggs, but would not consider myself full "vegan*), dietary vegan (*I eat no animal products, including dairy, eggs, honey, gelatine, etc.*) and lifestyle vegan (*I never consume any animal products, and avoid all non-food animal products, including leather, silk, wool, cosmetics containing animal ingredients, etc*). Participants were additionally asked to indicate how long they had been eating this way.

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days (*SD*=2.88, *min*=8, *max* =30). Overall, between baseline and two-week follow-up, average completion time was *M*=30.29 days (*SD*=2.90, *min*=25, *max*=45).

Dietary motivations. To assess dietary motivations participants were asked to select from the following, their reasons for following their diet: ethical reasons (*eating this way helps animals*), health reasons (*eating this way is healthy*), environmental reasons (*eating this way helps the environment*), taste (*I eat this way because I like or don't like the taste or smell of certain foods*), religious reasons (*my religion forbids or encourages eating certain foods*), habit (*I am accustomed to eating this way*) and other. Participants were encouraged to select all options that applied to them.

24hr meat consumption. To capture a measure of meat-eating behaviour, participants were asked to complete a 24hr food consumption survey. They were asked: *"In the past day, how many times did you consume the following foods?"* and were provided a list of 17 foods, which included: (1) pork, (2) dairy, (3) beans, (4) beef, (5) other meats, (6) chicken, (7) turkey, (8) fish, (9) shellfish, (10) pasta, (11) egg, (12) bread, (13) fruit, (14) vegetables, (15) rice, (16) meat alternatives, (17) dairy alternatives. For each category, the participant was asked to indicate on a scale of 0-5 or more, how many meals or snacks had contained each of these foods. We specified that the "past day" referred to everything that person had eaten yesterday, between waking and sleeping. From these data, we computed our longitudinal meat consumption variable. Of the 17 items that participants rated, we were interested in 7 meat-based target items. These included: (1) pork, (4) beef, (5) other meats, (6) chicken, (7) turkey, (8) fish and (9) shellfish. Our longitudinal meat consumption variable was the sum of scores across these 7 items, with missing data omitted to remove the presence of false zeros.

Implicit attitudes. To assess implicit attitudes toward meat, participants completed an Implicit Association Test (IAT), designed by the research team using the open-source platform iatgen (Carpenter et al. 2019). We designed and developed an IAT to test the strength of an individual's subconscious association between images of meat-based (target A)

and plant-based (target B) culinary preparations, and positively verses negatively valanced attribute words. From the open-source *food-pics* database (Blechert et al., 2019) we selected 40 images: 20 meat- and 20 plant-based culinary preparations, matched on ratings of recognisability, familiarity, and complexity. We used nine positively- and nine negatively-valanced words, contextually relevant to the topic of food (e.g., appetising versus flavourless, delicious versus revolting and healthy versus unhealthy). Iatgen produces a *D*-score (Greenwald et al., 2003), with positive values indicating association in the form of *target A + positive* and *target B + negative,* and negative values indicating the opposite bias (i.e., *target A + negative* and *target B + positive*). Here, positive scores indicated an implicit preference for meat, while negative scores an implicit preference for plant-based foods.

Prior to inclusion in the present study, the IAT was piloted with a sample of 98 participants (68.4% male-identified, *Mage*= 25.98 years, *Sdage*= 7.05*).* Based on a split-half correlation with Spearman Brown correction, the IAT had a strong internal consistency (*r*=.89). Erroneous responses occurred on just a small proportion of trials (0.08). The results of a one-sample t-test were non-significant, $t(97) = -1.04$, $p = .29$, $d = -0.1$, suggesting no implicit bias for either vegetarian or meat dishes, at the total sample level. To explore the corollaries of the IAT, participants provided demographic information and responded to the following measures: The Meat Commitment Scale (Piazza et al. (2015), the Human Supremacy Belief Scale (Dohnt & Hodson, 2014), and the Conflicted Omnivore Scale (Ruby et al., 2022). Participants who demonstrated an implicit preference for meat-based dishes, tended to be male-identified, $t(96) = 4.55$, $p < .001$, $d = .49$, reported higher levels of meat commitment, $r(96) = 0.51$, $p < .001$, had stronger belief in human supremacy, $r(96) = 0.51$, $p < .001$, and were less conflicted over their consumption of meat, $r(96) = -0.26$, $p < .001$. Given the high internal reliability rate, low error rate and relationship with relevant explicit measures, the IAT was included in the present study.

Meat commitment. We assessed commitment to the consumption of meat using the seven-item Meat Commitment Scale, developed by Piazza et al. (2015). Each item was assessed on a 7-point Likert scale of agreement (1 = *strongly disagree*, and 7 = *strongly agree*). Example items include: "I don't want to eat meals without meat"; "When choosing food, I virtually always select the meat option". Higher scores indicating stronger commitment to the consumption of meat products (α = .88).

Motivation and capacity. To assess the individual's level of intention to pledge, the research team developed a 10-item scale. Informed by the COM-B model of behaviour change (Michie et al., 2012) *intention* to pledge was assessed using two subscales: motivation and capacity. Each subscale associated with five-items. Items from the *motivation* subscale included: "overall, how motivated are you to pledge one vegetarian meal each day for the next 14-days?". Items from the *capacity* subscale included: "overall how well do you think you will perform on this pledge?". All items were rated on a 7-point Likert scale, higher scores indicating greater motivation (α= .80) or capacity to carry out the pledge (α= .74).[3] Between the baseline, post-intervention and two-week follow-up surveys, slight wording changes were made to these items in order to reflect the progression of the study. For example, the baseline item, *"How difficult do you think it will be to accomplish this pledge?"*, became *"How difficult did you find it to accomplish this pledge?"* at post-intervention.

Intervention phase

Daily intention to pledge. To assess intentions to pledge, participants were asked, *"do you plan to eat (at least) one vegetarian meal today?"* and responses were scored on a

[3] We made the decision to treat motivation as capacity as independent metrics of intention, based on an exploratory principal components analysis, detailed in Supplementary Materials C.

binary Yes/No measure. Conditionally, those who selected "No" were prompted with a second item, *"In a few words, explain why you don't intend to pledge a vegetarian meal today"* and provided with a blank field where they could submit a written response.

Infographics. To provide participants with the motivation, and to support them in their ability to maintain their pledge, a bank of seven *motivation*- and seven *capacity*-boosting infographics were designed by the research team. The 14 infographics were developed in accordance with the Health Action Process Model (HAPA: Schwazer, 2016) which outlines the prerequisites for possessing a motivation and a capacity to change one's behaviour. In accordance with the HAPA model, the *motivation*-boosting infographics identified the following: (1) a risk associated with the current situation, (2) positive consequences associated with change, and (3) the individual's ability to engage with the desired action. Whereas the *capacity*-boosting infographics identified the following: (1) an action plan, detailing when, where and how the behaviour will be performed, (2) a coping plan, recognizing that barriers may arise and generating alternative behaviours to overcome them and (3) an optimism about one's ability to cope with said barriers. See Supplementary Materials D for more detail on the development of these infographics. The final sample of infographics utilised in this study have been made available via the OSF repository (https://osf.io/qwdr9/).

Daily meat consumption. To measure meat consumption behaviour, participants were asked if they had eaten breakfast, lunch and dinner that day (e.g., *"Did you eat breakfast today?"*) and responses were scored on a binary Yes/No measure. Conditionally, those who selected yes for each were provided with a list of 17 food items (as in the 24hr food consumption survey) and asked to select from that list all of the food elements that had been contained in that specific meal. This survey was live for 5 hours (i.e., until 11pm) and participants received a series of push notification to remind them to complete the survey. The

daily meat consumption variable was the sum of scores across the 7 target items, with false zeros omitted.

Pledge adherence and dietary satisfaction. To measure pledge adherence, participants were asked: *"did you successfully complete your pledge to eat one vegetarian meal today?"* and responses were scored using a binary Yes/ No measure. Conditionally, those who affirmed the former were asked to describe the vegetarian dish in a short phrase or sentence. Participants saw the prompt: *What did you eat for today's vegetarian meal? You can say something like: "Vegetarian Burger and Chips"* and were provided a blank field in which to provide their written response. Pledging participants were then asked to upload an image of their meal, which they had been instructed should be: the dish plated, prior to consumption. Pledging participants were then asked to rate the difficulty in which they completed their pledge: *"how easy or difficult did you find it to complete your vegetarian pledge today?"* with responses scored on a 5-point Likert scale of ease (1 = *extremely easy* and 5 = *extremely difficult).* Lastly, pledging participants were asked to rate their satisfaction with their vegetarian meal: *"how satisfied were you with your vegetarian meal?"* with responses scored on a 5-point Likert scale of satisfaction (1 = *extremely satisfied* and 5 = *extremely unsatisfied* [reversed]). Conditionally, those who selected "No" received the following prompt: *"In a few words, explain why you weren't able to complete your vegetarian pledge today"* and were asked to type their response in the open-ended text box provided.

Post-intervention and two-week follow-up

Manipulation check. To assess the successes of our manipulation, all participants in the nominal- and known-group conditions, were asked to complete an additional 5-item survey assessing the extent to which they felt social supported by their group during the pledge. These items covered: *frequency of engagement*, *group engagement*, *group support*,

group enjoyment and *group benefit*. Items were worded slightly different depending on the condition so as to reflect the different ways in which these individuals were engaging). In the nominal-group condition, frequency of engagement was measured using this following item: How frequently did you interact (e.g., like, comment, post) with your group on the shared Microsoft Teams page? Responses were measured on a 4-point frequency scale (*1=Never, 4=Everyday*). Group engagement was measured using the following item: How interactive was your group within Microsoft Teams? Responses were measured on a 7-point Likert scale (*1=Not interactive at all, 7=Very interactive*). Group support was measured using the following item: How would you rate your group members in terms of how supportive they were in helping you to complete the pledge? Responses measured on a 7-point Likert scale (*1=Not supportive at all, 7=Very supportive*). Group enjoyment was measured using the following item: How much did you enjoy interacting with your group? Responses were measured on a 7-point Likert scale (*1=Did not enjoy at all, 7=Very much enjoy*). And finally, group benefit was measured using the following item: How much do you think you benefited from the posts and discussions that occurred on Microsoft Teams? Responses were measured on a 7-point Likert scale (*1=No benefit at all, 7=Benefited a lot*).

In the household condition, frequency of engagement was measured using the following item: How frequently did you coordinate your pledge to eat one vegetarian meal a day with the other member(s) of your household (e.g., shopping, cooking and eating together)? Responses were measured on a 4-point frequency scale (*1=Never, 4=Everyday*). Group engagement was measured using the following item: To what extent did you see your pledge as a team effort, amongst yourself and the other member(s) of household? Responses were measured on a 7-point Likert scale (*1=Not a team effort at all, 7=Very much a team effort*). Group support was measured using the following item: How would you rate the other member(s) of your household in terms of how supportive they were in helping you to

complete the pledge? Responses were measured on a 7-point Likert scale (*1 = Not supportive at all, 7 = Very supportive*). Group enjoyment was measured using the following item: How much did you enjoy pledging with other member(s) of your household? Responses were measured on a 7-point Likert scale (*1 = Did not enjoy at all, 7 = Very much enjoy*). And finally, group benefit was measured using the following item: How much do you think you benefited from taking part in this pledge with someone else/as part of a group as opposed to doing it alone? Responses were measured on a 7-point Likert scale (*1 = No benefit at all, 7 = Benefited a lot).*

Analysis plan

Anonymized data files can be accessed via the OSF repository: https://osf.io/qwdr9/.

Quantitative data. We consulted the manipulation check data to determine the extent to which participants in the nominal- and known-group conditions experienced feeling of social support during their pledge. Specifically, we consulted the average scores on our manipulation check measures (see Section 3.4.3.1) for each group and engaged in a comparative analysis between these two groups. We additionally inspected descriptive and inferential statistics for pledge intention, adherence, difficulty, and satisfaction – outcomes designed in part to provide some additional insights as to the participant's experience with the pledge.

We used multilevel modelling to analyse the repeated measures data, collected during the experience sampling and pledging phase of the experiment. To test the predictive power of social support and meat commitment on meat consumption levels during the pledge (i.e., hypothesis 1a and 2a, respectively), we ran a mixed-effects linear model. Specifically, we modelled meat consumption scores with pledge condition (3 levels; solitary, nominal- and known-groups) and meat commitment as fixed effects. To accommodate for within-

participant variability we included a random intercept over Subject variable. Daily meat consumption data were highly positively skewed (skewness = 1.53, SE = 0.01) and as such, were refitted these data to a Poisson distribution. To test the predictive power of social support and meat commitment on intentions to pledge and pledge adherences levels (i.e., hypotheses 1b-c and 2b-c, respectively), we used mixed-effects logistic regression model, modelling the same variables as those for testing hypotheses 1a and 2a (see above).

In all cases, when running linear models, we used the lme4 package (Bates et al., 2014) in R Core Team (2014). We first examined whether more parsimonious models better fit the data than more complex models and followed a stepwise procedure of eliminating parameters (Tenenbaum & Filho, 2016). To compare different models, we used likelihood ratio tests, which tests the improvement of model fit (log-likelihood) of a more complex model with a simpler one (Jaeger, 2008). In all cases, the hypothesized model was first tested against an Intercept-only model. A comparison of models with and without random effects was also performed to examine whether the inclusion of the random effect was justified. The Intraclass Correlation Coefficient (ICC) was used as an index of the amount of variation explained by the random effect of Subjects (Rabe-Hesketh & Skrondal, 2012).

To test hypotheses 3a-d, that participants who adhered to the pledge more strictly, would show lower levels of meat consumption, implicit positivity for meat-based meals, and an increased motivation and capacity to eat meat-free meals two-weeks later we ran a series of analyses. First, we conducted a series of one-way repeated-measures ANOVAs to determine change in each of the four outcome variables across Time (3-levels: baseline, outtake, follow-up). 24-hr meat consumption rates were non-normally distributed and transformed using square root. Where a main effect of Time was observed, we followed up with Bonferroni-corrected pairwise t-tests, where alpha was adjusted to $p < .0167$ for multiple comparisons (i.e., $p = .05/3 = .0167$). Second, to estimate the predictive power of pledge

adherence rates we ran a series of linear regression models, to estimate variance in the four outcome variables at both outtake and follow-up.

Qualitative data. Qualitative data were coded by a group of two trained coders, each coder providing a rating for every data point, thus producing two independent observations per entry. These data were coded using a coding scheme developed by the research team, which can be viewed in Table 1.1. Agreement across all codes was strong (κ = .693-1.00), and statistically significantly different from zero ($p < .001$). Accordingly, ratings were collapsed to present a single average rating.

Table 1.1. *Qualitative code scheme – labels and descriptors.*

Barriers	Description
Social	The participant mentions the wider cultural (e.g., tradition) and social factors (e.g., social norms, group identity) pressures to consume meat products.
Practical	The participants mention the perceived impracticalities of plant-based eating (e.g., time or resource costs).
Cognitive	The participant mentions instances whereby a planning error or inhibits their ability to adhere to the pledge.
Emotional	The participant mentions an emotional attachment to or dependency on meat products (e.g., feelings of comfort or pleasure).
Convenience	The participant mentions the poor availability of plant-based and the relative ease of consuming meat-based products.

The image data that we accrued was coded by four trained coders: each coder rating approximately half of the sample (n=432), thus producing two independent observations per image. To analyse these data, the research team developed a manual coding scheme, which can be viewed in Table 1.2. Agreement across all four categories was moderate to strong (κ =

.430-.100) and statistically significantly different from zero ($p < .001$). Accordingly, ratings were collapsed to present a single average rating.

Table 1.2. *Image data coding scheme.*

Category	Subcategory	Descriptor
Dish classification	Pescatarian	No meat, but contains fish
	Vegetarian	No meat nor fish, but dairy and/or eggs
	Vegan	No meat, fish, dairy and/or eggs
Preparation level	Self-prepared	The dish appears to have been prepared by the individual
	Instant meal	Microwave or instant meals (e.g., pot noodles)
	Take out	The dish appears to have been purchased from a takeaway or restaurant
Meat substitute	Absence	Meat alternative product not present
	Presence	Meat alternative product is present (e.g., branded products like Quorn, but also tofu, tempeh etc.)
Substance	Meal	Preparation of a substantive amount of food
	Snack	Snack-based food (i.e., crisps, cereal bar, toast, fruit)

Results

Manipulation check

Independent t-tests revealed statistically meaningful differences between our two conditions across all five manipulation check measures. Relative to those in the nominal-group, participants in the known-group, reported significantly higher scores of felt social support across all five measures: group engagement, effort, support, enjoyment, and benefit, Table 1.3 presents a summary of the group differences. We take these results to suggest that the experimental manipulation applied to the nominal-group had not been successful for promoting feelings of social support. By contrast, it is clear that feelings of social support were experienced in some capacity by those in the household condition. Though, it is

important to note that while these differences were significant, scores of engagement in the known-group condition were still somewhat low, suggesting that while feelings of support were high amongst this group, the physical enactment of support may not have been at play. Hence, analyses testing the predictive power of condition ought to be interpreted with the caveat that social support in the nominal-group condition was not successful, and tangible assistance in the known-group condition limited.

Table 1.3. *A comparative analysis of the manipulation check measures between nominal- and known-group conditions.*

	Mean (SD)				
	Nominal-group (*n*=91)	Known-group (*n*=61)	*t*-value	95% CI	*d*
Engagement	1.36 (.77)$_b$	2.41 (1.00)$_a$	-7.95	[-.144, -.86]	1.17
Effort	1.36 (.77)$_b$	4.14 (1.00)	-11.44	[-3.19, -2.36]	3.11
Support	1.97 (1.56)$_b$	4.97 (1.46)$_a$	-11.79	[-3.50, -2.50]	1.99
Enjoyment	2.14 (1.59)$_b$	5.19 (1.15)$_a$	-13.46	[-3.47, -2.58]	2.20
Benefit	2.42 (1.71)$_b$	4.98 (1.70)$_a$	-9.01	[-3.13, -2.00]	1.50

Main effects are significantly different at $p < .01$. Subscripts ($_a$ indicating largest mean value) differ significantly at $p < .01$.

Meat-reduction intervention: descriptive statistics

At the total sample level, participants intended to adhere to the pledge 97.31% of the time (*n*=2,930) and successfully adhered to the pledge 90.06% of the time (*n*=2,818). Concerning the difficulty at which participants completed their pledge the average rating was notably low (*M*=1.75, *SD* = 0.80). By contrast, ratings pertaining to the satisfaction that participants derived from having completed their pledge were notably high (*M*=4.11, *SD*=.85). Table 1.4 presents a summary of these descriptive statistics at the group level. A

one-way between-subjects ANOVA revealed no significant difference in difficulty ratings between conditions, $F(2,2815) = 0.89$, $p = .249$, $\eta_p^2 = .001$.). There was a statistically significant difference in satisfaction between conditions, $F(2,2815) = 4.154$, $p = 0.16$, $\eta_p^2 = .003$. Household pledgers reported significantly lower satisfaction than both solitary, $t(1808) = -2.63$, $p = .009$, 95% CI = [-.19, -.03], and nominal group pledgers, $t(1724) = -2.43$, $p = .015$, 95% CI = [-.19, -.02]. There was no difference in satisfaction between solitary and nominal groups, $t(2098) = .191$, $p = .849$, 95% CI = [-.06, .08]. In sum, the descriptive statistics reported by participants during the pledging intervention phase suggest that at the total sample level and across all conditions, participants were engaged with the pledge and found the experience both easy and satisfying.

Table 1.4. *Intervention phase descriptive statistics at total sample and group level.*

	Total sample (N=249)	Solitary condition (*n*=97)	Nominal-group (*n*=91)	Known-group (*n*=61)
Intention to pledge	97.31%	97.05%	96.71%	98.64%
Pledge adherence	90.06%	89.36%	89.13%	92.53%
Difficulty	1.75 (0.80)	1.73 (0.77)	1.75 (0.83)	1.79 (0.79)
Satisfaction	4.11 (0.85)	4.14 (0.83)	4.14 (0.83)	4.03 (0.91)

Hypothesis testing

Daily meat consumption (Hypothesis 1a and 2a). When modelling daily meat consumption, the model which included Subject as a random effect outperformed a model without this random effect, $X^2(1) = 270$, $p < .001$, thus justifying its inclusion. Our first model showed improvement on the Intercept-only model $X^2(2) = 21.8$, $p < .001$. However, Condition did not contribute significantly to the full model $\beta = -0.02$, SE = 0.05, $t = -0.37$, $p = 0.71$,

95% CI [-0.11, 0.08]. Removing Condition led to better performance of the model $X^2(1) = 21.61$, $p < .001$. Thus, the final model retained Meat Commitment and Subject as a random effect. As the effect of Condition failed to improve model fit, and was thus eliminated, Hypothesis 1a regarding the effect of condition on meat consumed during the pledge, was not supported. However, consistent with Hypothesis 2a, the effect of Meat Commitment did have an effect on daily meat consumption, with non-committed meat eaters consuming less meat during the 14-day intervention than committed meat eaters. Table 1.5 presents the estimate for the Intercept-only model and the best-fit model.

Table 1.5. *Estimates for the Intercept-only and best-fit model of daily meat consumption.*

	Intercept-only				Best-fit model			
Fixed Effects	Estimate	*SE*	Z	*p*	Estimate	*SE*	Z	*p*
Intercept	-.24	.04	-5.96	<.001	-.76	.12	-6.42	<.001
MC					.14	.03	4.75	<.001
Random Effects	Variance	*SD*			Variance	*SD*		
Subject	.28	.53			.24	.49		

Notes. MC = Meat commitment. 3115 observations, 249 Subjects. *Pseudo-*R^2 (Best-fit model) = 0.25. The random effect had an ICC of 0.20.

Daily intention to pledge (Hypothesis 1b and 2b). When modelling daily intentions to pledge, the model which included Subject as a random effect outperformed a model without this random effect, $X^2(1) = 53.25$, $p < .001$, thus justifying its inclusion. However, the full model failed to show improvement on the Intercept-only model $X^2(2) = 4.27$, $p = .12$. Neither Condition, $\beta = 0.39$, SE = 0.26, $t = 1.50$, $p = 0.13$, 95% CI [-0.12, 0.89], nor Meat Commitment, $\beta = -0.23$, SE = 0.15, $t = -1.51$, $p = 0.13$, 95% CI [-0.52, 0.07], evidenced

significant effects on intention to pledge. Thus, inconsistent with Hypothesis 1b and 2b, condition and meat commitment were unrelated to daily intentions to pledge.

Daily pledge adherence (Hypothesis 1c and 2c). When modelling daily pledge adherence, the model which included Subject as a random effect outperformed a model without this random effect, $X^2(1) = 141.78$, $p < .001$, thus justifying its inclusion. However, the full model failed to show improvement on the Intercept-only model $X^2(2) = 5.79$, $p = .06$. Neither Condition, $\beta = 0.22$, SE = 0.14, $t = 1.58$, $p = 0.11$, 95% CI [-0.05, 0.50], nor Meat Commitment, $\beta = -0.16$, SE = 0.08, $t = -1.84$, $p = 0.07$, 95% CI [-0.32, 0.01], evidenced significant effects on intention to pledge. Thus, inconsistent with Hypothesis 1c and 2c, condition and meat commitment were unrelated to daily pledge adherence rates.

Outcomes over time. Analyses of variance revealed a main effect of Time on all outcome variables captured at baseline, outtake and follow-up, with the exception of implicit attitudes which returned a null effect, F (1.9,342.1) = 1.05, $p = .35$, $\eta_p^2 = .001$. Where a main effect of Time was found, follow up Bonferroni-corrected pairwise t-tests revealed several differences between baseline, outtake and follow-up scores. Table 1.6 presents a summary of the descriptive statistics and main effects.

Table 1.6. *A summary of the one-way repeated measures ANOVA testing change in outcomes over time.*

	Mean (SD)					
	Baseline (*n*=248)	Outtake (*n*=249)	Follow-up (*n*=186)	F	*p*	ηp^2
Meat consumption	2.27 $(2.62)_a$	1.71 $(2.30)_b$	2.02 (2.71)	11.33	<.001	.02
Implicit attitudes	-.07 (.53)	-.13 (.51)	-.10 (.49)	1.05	*ns*	.001

Motivation	5.40 (.80)$_a$	5.12 (.98)$_b$	4.85 (1.34)$_c$	44.79	<.001	.05
Capacity	4.95 (.96)$_a$	5.16 (.91)$_b$	5.09 (.96)	5.70	.004	.008

Notes. Subscripts ($_a$ indicating largest mean value) differ significantly at $p < .01$.

There was a significant effect of Time on meat consumption, F (2,370) = 11.33, $p <$ .001, $\eta_p^2 = .02$. Post-hoc tests revealed that participants reported significantly lower meat consumption at outtake, relative to baseline, $t(247) = 5.18$, $p < .001$, $d = 0.33$, 95% CI = [.20, .46]. However, participants reported significantly higher meat consumption at follow-up, relative to outtake, $t(185) = 3.22$, $p < .001$, $d = 0.24$, 95% CI = [.09, .38]. There was no significant difference between baseline and follow-up, $t(185) = 1.53$, $p = .387$, $d = 0.11$, 95% CI = [-.26, .03]. Hence, immediately following the completion of the pledge, participants reported lower levels of meat consumption relative to baseline. However, these reductions in meat consumption were not sustained two-weeks later.

There was a significant effect of Time on motivations to reduce meat consumption, F (1.66,306.7) = 44.79, $p < .001$, $\eta_p^2 = .05$. Post-hoc tests revealed that participants reported significantly lower motivations to reduce their consumption at outtake, relative to baseline, $t(247) = 5.16$, $p < .001$, $d = 0.33$, 95% CI = [.20, .45]. Further, motivations to reduce meat consumption were significantly lower at follow-up, relative to both baseline, $t(185) = 7.82$, $p < .001$, $d = -0.57$, 95% CI = [-.73, -.42] and outtake, $t(185) = 6.31$, $p < .001$, $d = -0.46$, 95% CI = [-.61, -.31]. Hence, motivations to reduce one's consumption of meat were highest at baseline and decreased exponentially across the three data collection points.

There was a significant effect of Time on capacity to reduce meat consumption, F (1.87,346.7) = 5.70, $p = .004$, $\eta_p^2 = .01$. Post-hoc tests revealed that participants reported significantly great capacity to reduce their consumption at outtake, relative to baseline, $t(247) = -4.47$, $p < .001$, $d = -0.27$, 95% CI = [-.40, -.15]. There was no significant difference

between capacity ratings at follow-up, relative to baseline, $t(185) = -1.63$, $p = .318$, $d = 0.12$, 95% CI = [-.03, .26] nor outtake, $t(185) = -1.87$, $p = .189$, $d = -0.14$, 95% CI = [-.28, .01]. Hence, immediately following the completion of the pledge, participants reported higher levels of capacity to reduce their meat consumption. However, these increases in one's perceived capacity were not sustained two-weeks later.

Pledge adherence (Hypotheses 3a-d). The regression model with Pledge Adherence as a predictor of meat consumed at outtake was overall significant, $F(1,246) = 8.13$, $p < .001$, adj.R^2=.003. The model revealed that increasing pledge adherence was predictive of lower meat consumption at outtake, $B = -0.17$, $t(246) = -2.85$, $p < .001$, 95% CI [-.29, -.05]. In comparison, the regression model with Pledge Adherence as a predictor of meat consumed at follow-up was not significant, $F(1,184) = .70$, $p = .406$, adj.R^2= -.002. Hence, greater adherence to the pledge predicted lower meat consumption in the days immediately following the intervention, but not two-weeks later. As such, we were unable to uphold Hypothesis 3a, that those who abided by the pledge more strictly would show lower levels of meat consumption two-weeks later.

The regression model with Pledge Adherence as a predictor of implicit attitudes at outtake was not significant, $F(1,244) = 2.57$, $p = .11$, adj.R^2= .01. Similarly, the regression model with Pledge Adherence as a predictor of implicit attitudes at follow-up was not significant, $F(1,18) = 2.72$, $p = .10$, adj.R^2= .01. Hence, greater adherence to the pledge did not predict lower implicit positivity to meat-based meals in the days immediately following the intervention, nor two-weeks later. As such, we were unable to uphold Hypothesis 3b, that those who abided by the pledge more strictly would show lower levels of implicit positivity for meat-based meals two-weeks later.

The regression model with Pledge Adherence as a predictor of motivations to reduce meat consumption at outtake was overall significant, $F(1,246) = 4.37$, $p = .04$, adj.R^2=.01.

The model revealed that increasing pledge adherence was predictive of higher motivations to reduce meat consumption at outtake, B= .05, t(246) = -2.85, p = .038, 95% CI [.00, .11]. In comparison, the regression model with Pledge Adherence as a predictor of meat consumed at follow-up was not significant, F(1,184) = .68, p = .412, adj.R^2= -.00. Hence, greater adherence to the pledge predicted higher motivations to reduce one's meat consumption in the days immediately following the intervention, but not two-weeks later. As such, we were unable to uphold Hypothesis 3c, that those who abided by the pledge more strictly would show higher motivations to reduce meat consumption two-weeks later.

The regression model with Pledge Adherence as a predictor of capacity to reduce one's meat consumption at outtake was overall significant, F(1,246) = 61.20, p < .001, adj.R^2=.20. The model revealed that increasing pledge adherence was predictive of higher perceived capacity to reduce one's meat consumption at outtake, B= .17, t(246) = 7.82, p < .001, 95% CI [.13, .21]. Similarly, the regression model with Pledge Adherence as a predictor of capacity to reduce one's meat consumption at follow-up was overall significant, F(1,184) = 24.15, p < .001, adj.R^2= .11. The model revealed that increasing pledge adherence was predictive of higher perceived capacity to reduce one's meat consumption at outtake, B= .14, t(184) = 4.91, p < .001, 95% CI [.08, .20]. Hence, greater adherence to the pledge predicted high perceived capacity to reduce one's meat consumption both in the days immediately following the intervention, and two-weeks later. As such, we were able to uphold Hypothesis 3d, that those who abided by the pledge more strictly would show higher levels of capacity to reduce their meat consumption two-weeks later.

Exploratory analysis: predictors of pledge adherence. We conducted an additional exploration into the moderating effects of the participants prior attitudinal and behavioural state on their engagement with the pledge. Specifically, we ran a series of linear regression analyses to understand the predictive power of baseline ratings of motivations and capacity,

meat commitment, implicit attitudes, and meat consumption behaviours on pledge adherence rates. The regression model with baseline scores of motivation as a predictor of pledge adherence was not significant, $F(1,246) = .34$, $p = .56$, adj.R^2= -.00. In comparison, the regression model with baseline scores of capacity as a predictor of pledge adherence was significant, $F(1,246) = 12.93$, $p < .001$, adj.R^2= .05. The model revealed that participants who rated their capacity to engage in the pledge higher at baseline, completed their pledge on more occasions, B= .56, $t(246) = 3.60$, $p < .001$, 95% CI [.25, .87]. All further regression models returned none significant findings, including those modelling baseline implicit attitudes, $F(1,242) = .35$, $p = .56$, adj.R^2= -.00, and meat consumption, $F(1,246) = 3.60$, $p = .06$, adj.R^2= .01, as predictors of pledge adherence. Hence, participants baseline capacity scores emerged as the only significant predictor of pledge adherence.

Qualitative data

Failed pledge intention and adherence. There were 392 instances whereby a participant logged a lack of intention (n=81) or a failure to complete (n=311) their pledge. Intention and completion rates were significantly correlated with one another, $r(2759)=.38$, $p<.001$. We collected 387 text entries whereby participants detailed the obstacles that had inhibited them from intending or failing to complete their pledge. The coders ratings, displayed in Table 1.7, revealed that the greatest proportion of barriers inhibiting pledge intention and completion were of a *practical* nature. Practical barriers included a lack of vegetarian alternatives at one's disposal (i.e., "*I didn't have anything vegetarian to cook*"), partly due to one's limited time (e.g., *"I didn't have time to prepare something vegetarian"*) and financial freedoms (e.g., *"the vegetarian option was expensive").* These practical barriers were further exacerbated by the ongoing COVID-19 pandemic at the time of testing (i.e., *"I wasn't able to get hold of vegan meals because of self-isolation"*). As participants were still consuming meat-based products, they often had meat products that needed consuming before

going out of date (i.e., "*I had leftover chicken I needed to eat before it went bad"*). This speaks to the potential impracticalities of a meat-reduction pledge, relative to a commitment to total abstention.

Table 1.7. *Relative occurrence of barriers inhibiting pledge intention and completion.*

	Practical	Convenience	Emotional	Cognitive	Social
Intention	83.4%	56.8%	22.2%	6.2%	6.8%
Completion	77.8%	47.4%	23.5%	11.1%	13.0%

Convenience barriers typically included mention of the difficulty to source vegetarian foods when away from the home, and the implied convenience of meat-based foods (e.g., *"I was travelling on a train for the day making it difficult to find a vegetarian option"*). Emotional barriers typically included mention of not feeling well, both physically (e.g., *"was sick so I didn't eat anything"*) and mentally (e.g., *"bad mental health day"*), being hungover, lacking motivation (*"just wasn't feeling like it today"*) or using food (and meat in particular) as a source of celebration (e.g., *"fancied a takeaway because Biden won"*).

Social barriers typically included mention of the challenges of eating or preparing meals with others, including roommates, family members and partners. Social pressures were felt both in the home (e.g., *"I was preparing meal together with my friends and they wanted to eat meat"*) and when eating out (e.g., *"I ate out with some friends and they had my favourite chicken burger"*). Finally, cognitive barriers typically included mention of having forgotten about the pledge (e.g., *"I forgot to cook a vegetarian meal today"*) and meal planning errors (e.g., *"I thought my ravioli were pumpkin and pine nut, but I picked up the sausage and Parmesan ones by accident"*).

Images. A total of 846 images were collected during the meat-reduction pledge intervention. The coders ratings, displayed in Table 1.8, demonstrate that in approximately one-third of cases, participants exceeded the requirements of the meat-reduction pledge and opted for a vegan dish. More often than not, participants dishes constituted a substantial meal and had been self-prepared. That participants were exceeding the requirements of their pledge and preparing for themselves substantial vegan meals is further evidence of their autonomy and capability for pursuing plant-forward eating. It is also noteworthy that in roughly 80% of cases, participants opted for a meat-free meal in which they had not sought to replace the animal-derived protein for a meat substitute product. Rather than experiment with meat replacements, many participants simply removed the meat in what would otherwise be a meat-centric dish (e.g., *"spaghetti carbonara without meat"*). This demonstrates a failure to engage with strategies that would otherwise support a long-term transition (i.e., the replacement of meat with plant-forward alternatives) and perhaps reflects participants diminishing intentions to sustain a plant-forward diet.

Table 1.8. *Relative occurrence of image coding categories.*

		Average ratings
Dish classification	Pescatarian	0.30%
	Vegetarian	59.90%
	Vegan	39.50%
Preparation level	Self-prepared	84.20%
	Instant meal	4.60%
	Take out	9.70%
Meat substitute	Absence	80.20%
	Presence	19.80%
Substance	Meal	93.20%

Snack	6.90%

Discussion

Previous research has painted a rich, descriptive picture of the barriers that may inhibit an individual from reducing their consumption of meat. However, fewer works have used experimental designs to evaluate the efficacy of interventions that facilitate meat-reduction. In the current study, we sought to investigate the value of social support as a facilitator of meat-reduction, amongst a group of participants who made a commitment to reducing their consumption of meat. In the present study, all participants made a pledge to temporarily reduce their consumption of meat and they did so either alone (lone condition), in small groups where opportunities to interact were facilitated via an online medium (nominal-group condition), or with members of their household (known-group condition). Unfortunately, participants in the nominal-group condition reported poor levels of engagement and support and as such we conclude that our attempts to experimentally induce feelings of social support were unsuccessful. Despite the failed manipulation of social support, our investigation returned several important findings, which we see adding to the literature on the facilitators and barriers to meat reduction including insights around pledging as an intervention to promote meat reduction and the importance of one's social environment during such an undertaking.

Pledging: a tool for promoting meat-reduction

In the present study, we addressed calls to prioritize experimental studies, designed to evaluate the efficacy of meat-reduction interventions (Graça et al., 2019). Drawing on insights from the literature on commitment devices (Cialdini, 2001) and behaviour change theory (Mitchie et al., 2012), we designed a meat-reduction intervention. Regardless of the

experimental manipulation of social support, all participants were provided the *opportunity* to pledge a temporary reduction of their meat consumption and were supported with *motivation*- and *capacity*-boosting information during the intervention. Our meat-reduction intervention was thus compliant with the COM-B model of behaviour change (Mitchie et al., 2012). Using smartphone-based experience sampling, we captured a rich assessment of participants experience with completing their pledge, including: their relative successes and impeding variables; plus, an exploration into the potential moderating effects of participants prior attitudinal and behavioural state on their engagement and the downstream benefits of engaging with the meat-reduction pledge. We provide a discussion of these findings, below.

Concerning participant's experience while completing the pledge, descriptive statistics suggest that participants found it easy and enjoyable to engage with the pledge intervention. Across all conditions, difficulty ratings were almost at floor, and scores of satisfactions were high. Accordingly, the pledge intervention yielded a high level of engagement at the total sample level. Intentions to pledge and pledge adherence rates were high across all conditions (97%, and 90%, respectively). These findings show promise that a meat-reduction pledge that is compliant with behaviour change theory, and which invites participants to *temporarily* reduce their consumption of meat is relatively accessible. Though this is not without some clear obstacles. Across the intervention, there were 392 instances whereby a participant logged a lack of *intention* (*n*=81) or a failure to *complete* (*n*=311) their pledge. Participants provided detail of the obstacles that had inhibited them from intending or completing their pledge, the vast majority of which were of a practical nature. Practical barriers pertained to the poor accessibility, increased time demands and perceived costliness of meat-free alternatives. Hence, so long as they are pitched at a similar price point to their traditional alternative, we anticipate that the increasing availability of meat-free alternatives

to animal products would help to appease many of the concerns that individuals face when first attempting to reduce their meat consumption.

Commitment devices like pledges are considered a *behavior-centric* approach to behaviour change as they are built upon the assumption that providing an individual with the opportunity to engage in short-term behaviour change, may increase capacities for maintaining such change long-term (Cialdini, 2001). While the exact mechanism remains unclear, it is assumed that making a commitment to change one's behaviour initiates a process of self-persuasion whereby the individual convinces themselves of their determination for engaging with the commitment and builds competencies for enacting the behaviour. It is assumed that these processes pave the way for new long-term sustained behaviour changes to occur. Our findings suggest that partaking in a meat-reduction pledge assists in some short- and long-term alternations of one's attitudes and behaviour, dependent in part upon the extent to which participants adhere to their pledge.

In the present research, we found a short-term increase in one's perceived capacity for reducing their consumption of meat in the days immediately following the intervention. Moreover, the extent to which participants adhered to their pledge predicted sustained increases in their capacity perceptions. These increases in one's perceived capacity were accompanied by a decrease in participant's meat consumption rates at outtake. However, irrespective of adherence rates, these behavioural changes (i.e., meat reduction) were not sustained beyond the boundaries of the pledge and meat consumption rates returned to baseline levels two weeks after the intervention. Hence, our findings uphold the general consensus that commitment devices like pledges, particularly when adhered to strongly, may advance the skills and knowledge necessary to enact such change behaviour. Yet, at least in the context of meat consumption, pledging may serve only as a temporary opportunity to alter one's behaviour.

By contrast, we found that at the total sample level, motivations to reduce one's consumption of meat decreased over the course of the study. In the days immediately following the pledge intervention, participants reported significantly lower motivations to reduce relative to baseline and further reductions were evident two-weeks later. This very decline in motivations may help to explain why participants temporary reductions in meat consumption were not sustained in the weeks following the pledge. Indeed, behaviour change theory posits that intention to change is a prerequisite for action and intentions are comprised of one's motivation, capability, and opportunity (Mitchie et al., 2012). Hence, it is possible that behavioural changes were not sustained because, despite the increases in capacity, motivation was diminished. In addition, the opportunity to practice meat reduction (i.e., the pledge intervention) had been removed, further detracting from one's intentions to change their behaviour. It is noteworthy that these patterns in one's motivation to reduce meat consumption were, in part, dependent upon the extent to which the individual had engaged with their pledge. That is, participants who reported higher pledge adherence rates also reported an increase, rather than a decrease in the continued motivations to reduce in the days immediately following the intervention.

Pledge engagement and the moderating effect of capacity. In our additional explorations of the data, we considered how the attitudinal state of the pledger moderated their engagement with the pledge. This included an exploratory analysis into the facilitating effects of prior *explicit* as well as *implicit* attitudes, and behaviour on pledge adherence rates. The vast majority of previous research reports that an individual's engagement with a commitment is influenced by their prior motivations to engage in the focal behaviour change (e.g., Bass et al., 2019; Piazza et al., 2021). In the work by Piazza et al. (2021), items assessing participants "motivation" loaded with capacity-related items and were collapsed to form a single instrument assessing intention. This work found that prior motivations

modulated engagement with the pledge, predicting lower meat cravings and consumption. In the present study, results of a principal components analysis gave the suggestion that we ought to decompose participants starting motivations into specific domains of intention (i.e., *motivation* and *capacity*). Hence, in the present study we expanded upon prior knowledge by providing a more nuanced investigation of participants starting motivations and capacity as predictive of pledge engagement and success. Though we did not find a facilitative effect of prior *motivations*, we did find that pledgers' perceived *capacity* for pursuing the meat-reduction pledge was predictive of their engagement levels. That is, participants who had higher capacity ratings at baseline, were more likely to report higher pledge completion rates. In accordance with self-efficacy theory (Bandura, 1997), this highlights the impact of an individual's belief in their capacity to execute the behaviours necessary to foster sustained reductions in their meat consumption. It may be a fruitful endeavour for other scholars working in this space to compartmentalise *motivation* and *capacity* in their investigations of *intention* to change.

Limitations of the pledge design. In consultation with wider psychological theory and research we now consider how certain features of our pledge may have inhibited participants from developing intrinsic motivations to reduce, specifically: our use of external justification, and the relative ease of the pledge. Previous theorizing has suggested that incentivizing a commitment can have a damaging impact on its potential for long-term sustained behaviour change (Festinger & Carlsmith, 1959). Theoretically, the presence of an external justification is thought to restrict the formation of internally based justifications and the necessary attitudinal change to support continued behaviour change (Festinger & Carlsmith, 1959). Whether extrinsic rewards hamper intrinsic motivations has been a widely debated question in psychology for many decades. A debate which has direct implications for recruitment strategizing in psychological designs and the wider lessons for organisational

psychology. In one of the most recent meta-analyses on the effects of extrinsic rewards and their effects on intrinsic motivations, Wiersma (1992) conclude that the effects of intrinsic and extrinsic motivations are additive and may enhance task performance *during* the testing phase. However, extrinsic rewards may have a crowding out effect on intrinsic motivation for task behaviour *outside* of the testing phase (Wiersma, 1992). Hence, while the extrinsic reward provided in the present study may have aided pledge adherence during the intervention it may have contributed to participants diminished motivations in the days and weeks following the intervention. this explaining our failure to promote more sustained reductions in meat consumption.

An alternative explanation for the failure of the current intervention to promote sustained reductions in meat consumption concerns the relative ease of the pledge. Previous research argues that commitment devices may be more effective when they present a substantial challenge to the individual. Theoretically, it is assumed that the greater the challenge placed on the individual to meet the pledged commitments, the greater the potential for attitudinal shift (Cialdini, 2001). This hypothesis was confirmed in research conducted by Becker (1978) where participants were asked to make a verbal commitment to reduce their electricity consumption. Half of the participants in study were given an easy goal, to reduce their energy consumption by just 2%. The other half of participants were given a significantly harder goal, to reduce their consumption by 20%. Findings suggest that participants prescribed a more difficult goal were those who were more likely to report sustain reductions in their energy consumption beyond the boundaries of the initial pledge. In the present study, daily ratings of pledge difficulty were at floor across all conditions suggesting that the requirements of our 14-day meat-reduction pledge may not have posed a sufficient challenge to participants. Hence, participants diminishing motivations and subsequent return to meat consumption may be explained by the relative ease in which they completed the pledge.

Reflecting on the facilitative effects of social support

Previous research suggests that when contemplating a plant-forward transition, many individuals anticipate receiving insufficient support from their primary social units (e.g., family, friends and partners; see Asher et al., 2014; Markowski & Roxburgh, 2019) which serves as a barrier to meat-reduction. In recognising the importance of the *social* environment in which an individual decides to reduce their consumption of animal foods, scholars have encouraged the investigation of social support as potential means for promoting long-term commitment (e.g., Dakin et al., 2021; Piazza et al., 2021). To the authors knowledge, the present study was the first to test the potential facilitative effects of social support on efforts to reduce one's consumption of meat. Using smartphone-based experience sampling methodology, we designed an intervention that provided the functionality to manipulate the experience of social support in an online setting and study naturally occurring support in known-groups. The results of our manipulation check measure indicated that the intended facilitation of social support, at least for participants in the nominal-group condition, had not been successful. And, despite the elevated reports of felt social support in the known-group, performance on the pledge was not significantly different across conditions. In consultation with wider psychological theory and research we now consider the limitations of our attempts to manipulate and measure the experience of social support.

The failure to manipulate the experience of social support encouraged the research team to reconsider wider theoretical accounts of social support. Broadly, the wider psychological literature conceptualizes social support in three ways: *structural, functional* and *enacted* support (Hogan et al., 2002). Structural support refers to the structure of one's support network and the *availability* of potential support givers. Functional support pertains to the emotional experience of *feeling* supported, where *enacted* support is the provision of supportive behaviours (e.g., tangible assistance, advice). Moreover, the literature

differentiates between two sources of support: natural support (i.e., that coming from one's primary social units, e.g., family members, partners, or friends) and formal support (i.e., support from professionals, or community) – the former of which is considered to be most impactful (Wing & Jeffrey, 1999). Previous research suggests that interventions which establish *structural* support (i.e., via the provision of a social network, or peer support group), may also elicit *functional* support (e.g., see Hwang et al., 2014), but not always (e.g., Helgeson & Cohen, 1996). And, by definition are typically unable to simulate *enacted* support (Hogan et al., 2002).

By these definitions, it could be argued that while the manipulation of social support in the nominal-group condition established a structure for support (i.e., access to a group of peers), participants did not receive functional, nor enacted support. Indeed, those in the nominal-condition reported low levels of group engagement, and perceived support. In comparison, those in those in known-group condition, reported significantly higher levels of perceived social support arguably facilitated by the already well-established relationship amongst those living together. Yet, their levels of engagement were still relatively low. This suggesting that while known-group participants report *feeling* supported, their lack of engagement flags a potential absence of tangible assistance (e.g., meal-time co-ordinations and food provisions). Indeed, households of cohabiting students are unlikely to pool their finances, and shared food related tasks (e.g., shopping and cooking). Moreover, our qualitative findings demonstrated the particularly impeding nature of *practical* challenges that individuals were facing during the pledge. Taken together, this may suggest that when people are attempting a dietary transition with others, beyond any feelings of "togetherness" or shared goals, the most facilitative "social support" may come in the form of tangible assistance and help managing the practical challenges, (e.g., what to cook, which alternatives tastes good, and how to shop for plant-based items). This might help to explain why we did

not observe increased levels of meat reduction or pledge adherence in the household condition relative to the other conditions. Future work should consider the facilitative effects of enacted support, specifically from pre-existing (or *natural*) structures of support (e.g., amongst families and cohabiting couples).

The results of the present study speak to the limitations of computer-mediated interactions for evoking feelings of connectedness amongst strangers. It also shows promise that pre-existing relationships may help to foster environments of social support during meat-reduction efforts, though this is not without its caveats. Given the importance of prior capacities for enacting meat reduction, we anticipate that experience of tangible assistance from one's support system will be of particular influence on plant-forward dietary transitions. Hence, future research sought to consider the influence of naturally occurring support amongst relational units equipped to provide both functional and enacted support. For example, future work may consider the relational systems of cohabiting families and couples who typically operate within a hierarchical system of financial pooling and shared food practices (e.g., parents' sole sourcing and provision of food). Research studying the facilitative effects of supportive, relative to unsupportive family and relational systems would thus advance current knowledge and understanding of the barriers to plant-forward diets.

Limitations

While the limitations of the present research have been discussed throughout this section (e.g., our failing to experimentally manipulate social support), we wanted to draw the reader's attention to a number of notable limitations that may have further contrived our conclusions. First, pledge adherence rates were high across all three conditions, making it difficult to capture variability across conditions. This was likely due to the presence of an extrinsic reward and the low difficulty of the pledge. Second, the decision to include a known-group condition sat outside of our initial pre-registered study plan, and thus any

analysis which tested the effect of condition should be considered exploratory. Further, the known-group condition had less than ideal power, further limiting the conclusions that we were able to draw from this sample.

Moreover, our interest in the manipulation of social support led to an oversight on behalf of the research team who failed to consider the inclusion of an additional control group, whereby participants would receive no intervention nor pledge commitment. Such control condition would have allowed the researchers to draw more concrete conclusions about the effectiveness of the pledge intervention. Hence, our conclusions pertaining to the efficacy of the meat-reduction pledge employed in our design ought to be considered exploratory. For further reading around the efficacy of meat-free pledging, we refer the interested reader to Piazza et al. (2021).

Finally, in a recent review of the literature it was argued that social support may be particularly important during the later stages of behaviour change (e.g., maintenance; Bryant et al., 2022). Hence, that our sample were not already engaged in the maintaining a plant-forward diet, may further explain why they were unreceptive to the provision of social support. Given the clear temporal significance of certain meat-reduction barriers (Bryant et al., 2022), researchers ought to consider participants stage of change as a potential modulating effect of intervention success.

Conclusion

Temporary, meat-reduction pledges that provide recipients with the opportunity, motivation, and capacity to change their eating behaviours are well received and easily completed. However, the downstream successes of a pledge intervention may be dependent upon the extent to which participants adhere to their commitment, which in turn, may depend upon their prior capacities for enacting the focal behaviour (e.g., perceptions of one's ability

to cook plant-based foods). In the present study, greater pledge adherence to a meat-reduction pledge led to increased motivations for reducing meat in the days immediately following the intervention as well as enhanced perceptions of capacity for plant-forward eating two-weeks later. This waning of motivations, even in the face of enhanced capabilities may help to explain why reductions in meat consumption were not sustained beyond the boundaries of the pledge. Furthermore, the present study speaks to the limitations of computer-mediated interactions for evoking feelings of connectedness amongst strangers. By contrast, pre-existing relationships may help to foster feelings of social support during meat-reduction efforts, though this may not lead to the actualisation of behaviour change in poorly engaged households where tangible assistance is absent. Future research studying the facilitative effects of supportive relational systems (i.e., families, and romantic partners) would thus advance current knowledge and understanding of the barriers to plant-forward diets.

Study 2: Relational climate and openness to plant-forward diets among cohabitating couples

Rebecca Gregson & Dr. Jared Piazza

Abstract

Plant-forward diets offer a potential solution to many of the health and ecological crises that we find ourselves facing today. A key barrier to the adoption and maintenance of plant-forward diets is an anticipated lack of support from family members, friends, and romantic partners. The present study examined how *relational climate* (i.e., the cohesion and flexibility of a partnership) contributes to the tension individuals anticipate in their relationship when a member reduces their animal-product consumption, and their own openness to reducing. Four hundred and ninety-six coupled individuals took part in an online survey. Analyses revealed that couples with more flexible leadership styles anticipated less tension should they or their partner adopt a plant-forward diet. However, dimensions of relational climate were largely unrelated to openness to plant-forward diets. Romantic couples who perceived themselves to be *matched* in terms of dietary habits were less open to reducing their animal-product consumption than *unmatched* couples. Politically left-leaning couples and females were more open to plant-forward diets. The meat attachments of male partners were reported as a particular barrier to dietary goals, as were practical concerns about meal coordination, finance, and health. We discuss implications for promoting plant-forward dietary transitions.

Keywords: meat reduction, relationships, relational climate, cohesion, flexibility

Introduction

There is a growing concern that modern-day animal agriculture bears health and ecological costs that cannot be sustained (e.g., see Willett et al., 2019). The production and consumption of industrially reared animal foods has been linked to a number of personal and public health consequences (e.g., the emergence of zoonotic diseases; see Jones et al., 2013), and a disproportionate share of food-related environmental impacts (Dagevos & Voordouw, 2013). In contrast, plant-forward diets offer a potential solution to many of the health and ecological crises that society faces, and that we can expect to face in the near future (Willet et al., 2019). Nonetheless, the consumption of animal foods remains a socially normative practice. It is estimated that approximately 73% of the global population maintain an omnivorous diet (IPSOS Mori, 2018), consuming on average 43kg of meat each year (Ritchie et al., 2017) rates which continue to rise exponentially (Whitnall & Pitts, 2019). As such, willingness to reduce or forego the consumption of animal products remains low in most western societies, with intention estimates between 14%-16% for meat-consumption reduction (Bryant, 2019; Lacroix & Gifford, 2019; Lea et al., 2006). Accordingly, a comprehensive body of research has sought to understand why individuals may be unwilling to reduce and how these barriers might be overcome (for recent reviews, see Bryant et al., 2021; Graça et al., 2019).

One barrier sometimes identified in self-report studies of meat and animal-product reduction is an anticipated lack of support among a person's primary social group—family members, friends, but, especially, romantic partners (Hodson & Earle, 2018; Lacroix & Gifford, 2019; Markowski & Roxburgh, 2019). In particular, studies of ex-vegetarians and vegans' retrospective reports often include mention of the struggles they faced coordinating their diets with close others (e.g., see Asher et al., 2014; Haverstock & Forgays, 2012; Menzies & Sheeshka, 2012). Clearly, the relational context in which an individual undertakes

a dietary transition is an important moderator of engagement and success. Nonetheless, research into the relational dynamics affecting the attempt and maintenance of plant-forward transitions, remains largely unexplored. Here, we conducted a foundational investigation to better understand how *relational climate* -- the cohesion and flexibility of a relationship -- relates to the current dietary practices of cohabitating couples and an individual's openness to pursuing a plant-forward transition. This preliminary work should provide scope for further inquiry into the role of relational climate for the pursuit and maintenance of plant-forward diets.

Social and relational barriers to meat reduction

Romantic relationships represent a primary social group in which individuals derive socially normative behaviour. Berger and Kellner's (1964) classic work on the social construction of identity, argues that forming a committed relationship is a process whereby two strangers come together, redefine themselves and begin to view themselves as a collective unit. One aspect of daily life that couple's must fuse together is diet: establishing collective consumption practises (e.g., shopping, cooking, eating) and deciding what food products fulfil their shared needs. Given the co-ordinated nature in which couples consume food (Sobal, 2005), an individual's partner represents a key influence on a person's eating patterns, if not, for couples, the *strongest* influence (e.g., see Øygard & Klepp, 1996). Thus, when a partner considers a change in their eating behaviour, a decision of this nature inextricably impacts on the other and can lead to complications, if one's partner resists (Eriksen, 1994). As a result, diet, and dietary *transitions* in particular, can be a significant source of friction among partners. Indeed, studies suggest that close relationships represent a *mixed* source of dietary support and impediment. For example, Paisley et al. (2008) explored dieters' transitions to low-sugar, low-carb diets, and found that emotional responses from the partner varied considerably, from cooperation and encouragement to scepticism, aggravation,

and hostility. Transitions away from animal products may be especially contentious for couples, given the strong attachments many people have with these foods (Graça et al., 2015). Thus, how partners relate to one another, and the perceptions they have of their partner's support, likely modulate their openness to plant-forward dietary transitions.

The present research considered how the "relational climate" of a couple impacts on their orientation towards plant-forward transitions. According to Family Systems Theory (Miller & Brown, 2005; Olson, 2011), relational systems can be modelled along four dimensions: flexibility, cohesion, communication, and satisfaction. Here, we focused on flexibility and cohesion. *Flexibility* entails how relational units manage and adapt to changes in leadership, roles, and rules. Moderately flexible relationships involve egalitarian styles of leadership and mostly democratic approaches to decision-making where negotiations are open, roles are shared, and rules can change when necessary. Overly flexible or "chaotically flexible" relationships are characterised by erratic or limited leadership. Within such units, decisions can be impulsive, roles and rules are unclear and fluid. At the other extreme, rigid flexibility is characterised by one-sided, highly controlling leadership, strictly defined roles and rules, leaving limited room for negotiation. *Cohesion* relates to the emotional bonding that a couple or family members have towards one another. Moderately cohesive relationships strike a healthy balance between independence and connection. They value emotional closeness, togetherness, and joint-decision making, while respecting the other's independence. In the extreme, "enmeshed cohesion" demands high levels of dependence and loyalty, restricts personal boundaries and freedom. At the opposite extreme, "disengaged cohesion" is characterised by extreme emotional separateness and independence, with individuals tending to lead their own lives, preoccupied with their own social circles and personal interests.

In addition to the relational context itself, openness to dietary change is likely shaped by partner attributes, including gender identity and ideology. In the context of plant-forward transitions, gender identity may be important moderator particularly among heterosexual couples. Compared to men, women tend to be more conscious of their animal-product consumption and are more willing to change these consumption patterns (e.g., see Fonseca & Sanchez-Sabate, 2022). Furthermore, traditional views of masculinity are often at odds with meat-free diets, due to the symbolic potency of meat as a "male" prerogative (e.g., see Rozin et al., 2012; Salmen & Dhont, 2022; Sobal, 2005). In practice, the food preferences of heterosexual women often fall subordinate to those of their male partner and their children (Bove et al., 2003; Charles & Kerr, 1988; Hochschild & Machung, 2015). Though, research suggests that this may be modulated by one's views around gender roles, with egalitarian partnerships more inclined to compromise on food choices than those couples who endorse more traditional gender roles (Brown & Miller, 2002). Indeed, attitudes towards animal products are shaped by wider ideological factors, such as political orientation - with politically right-leaning individuals often consuming more animal products than left-leaning or centrist individuals (e.g., see Dhont & Hodson, 2014; Grünhage & Reuter, 2020).

The current study and research questions

In the present study, we sought to investigate how the dietary alignment and relational climate of cohabiting couples relates to their current dietary practises and openness to plant-forward dietary transitions. In particular, we considered the *flexibility* and *cohesion* dimensions of relational climate (Olson, 2011) of animal-product consumers currently within a long-term relationship. Our research was guided by several preregistered questions (AsPredicted: #93437, available here: https://aspredicted.org/fu3td.pdf). We considered how relational climate and a person's perception of their dietary alignment with their partner relates to their current dietary practises and their predictions about how smoothly they would

manage a transition to a plant-based diet. Though the study was largely exploratory, we hypothesised that, relative to unmatched meat-eating couples, matched couples would anticipate greater diet-related tension in the event that either themselves or their partner reduced their consumption of animal products. In addition, we pre-registered the prediction that *balanced* relational systems (i.e., moderately flexible and cohesive couples) would foster greater dietary coordination, lower tension and increased openness to plant-forward dietary transitions.

We also engaged in an exploratory analysis to understand how characteristics of the couple—specifically, gender and political orientation—might interact with relational climate to impact on these diet-related outcomes. We expected left-leaning partnerships would foster a relational environment that is more seamlessly able to adopt plant-forward diets. In addition, we expected that, within heterosexual couples, women would report being more open to plant-forward diets than their male counterparts, whose preferences for animal products may be a potential source of conflict.

Method

Recruitment and sample demographics

We recruited a sample of people in a romantic relationship and cohabiting with their partner. To do this, we used the pre-screening tools of the crowdsourcing platform, Prolific. Participants confirmed that they were 1) "in a romantic relationship, cohabiting with my partner" (n = 162), or 2) "married, or in a domestic partnership, cohabiting with my partner" (n = 334)[4]. Participants who indicated "neither of the above apply to me" were ineligible. The

[4] The vast majority of the sample (n = 442, 89.1%) indicated that they had been in a relationship with their partner for five years or more, 50 indicated that they had been with their partner between 1-5 years (10.1%), and four were together less than year (0.8%).

study was concerned with individuals who eat at least some animal products. As preregistered, we used Prolific's pre-screening tool to omit individuals practicing a 'Vegan Diet' and included those who selected 'I do not follow any diet', 'Vegetarian Diet', 'Pescatarian Diet', as well as other non-vegan diets (e.g., 'Atkins Diet').

Our recruitment strategy was guided by an a *priori* power analysis. We calculated that a lower-bound sample target of $N = 386$ would give us 0.95 power to detect a modest effect size ($f = 0.20$) with an error probability of 0.05. We aimed to over sample, with an upper-bound target of 500 participants. For group-based comparisons of diet-matched and unmatched couples, we calculated that we would need a minimum split of $N = 105/395$ in order to detect a modest effect size ($f = 0.40$) with 0.95 power and an error probability of 0.05. Five-hundred participants completed the survey. Four participants were excluded having indicated that they abstained from all animal food products, either by classifying themselves as a *dietary vegan* (n=1) or *strict vegetarian* (n=3). Our final sample thus met these thresholds for power. See Table 2.1 for sample demographics.

Table 2.1. *Sample demographics by participant and partner.*

	Participant	**Partner**
Gender	244 male (48.4%), 249 female (49.8%), two agender/non-binary (0.4%), 1 other (0.2%)	253 male (51%), 240 female (48.4%), 3 agender/non-binary (0.6%)
Age	*M*= 45.50 years, *SD*= 12.86, range 20-82	*M*= 45.69 years, *SD*= 13.28, range 20-85
Nationality	450 British (90.7%), 46 other (9.3%)	439 British (88.5%), 57 other (11.5%)
Ethnicity	470 White (94.8%), 15 Asian (3.0%), 3 Black/African (0.6%), 3 Latino (0.6%), 5 other (1.0%)	453 White (91.3%), 25 Asian (5%), 7 Black/African (1.4%), 3 Latino (0.6%), 8 other (1.6%)
Political orientation	226 liberal (45.5%), 129 neutral (26.0%), 141 conservative (28.4%)	211 liberal (42.5%), 153 neutral (30.8%), 132 conservative (26.6%)
Sexual orientation	462 heterosexual (93.1%), 15 bisexual (3.0%), 6 gay (1.2%), 3 lesbian (0.6%), 5 pansexual (1.0%), 3 queer (0.6%), 1 questioning or unsure (0.2%), 1 preferred not to say (0.2%)	468 heterosexual (94.4%), 13 bisexual (2.6%), 5 gay (1%), 2 lesbian (0.4%), 4 pansexual (0.8%), 2 queer (0.4%), 2 were questioning or unsure (0.4%)

Materials

Current eating habits. To profile participants and their partner on their current eating habits, we used a pre-existing scale of dietary classification (Piazza et al., 2018). Participants were asked to select the category (definitions provided) that best matches their current dietary identity, and that of their partner: (1) meat lover (i.e., *I prefer to have meat in all or most of my meals*), (2) omnivore (*I eat meat and other animal products, like dairy and/or eggs*), (3) semi-vegetarian or reducetarian (*I eat meat, but only on rare occasions or only certain types of meat*), (4) pescatarian (*I eat fish and/or seafood, as well as dairy products and eggs, but no other meat*), (5) lacto- or ovo-vegetarian (*I eat dairy products and/or eggs, but no meat or fish*), (6) strict vegetarian (*I eat no animal products, including dairy and eggs, but would not consider myself full vegan*), (7) dietary vegan (*I eat no animal products, including dairy, eggs, honey, gelatin, etc.*) and (8) lifestyle vegan (*I never consume any animal products, and avoid all non-food animal products, including leather, silk, wool, cosmetics containing animal ingredients, etc*). They indicated whether they themselves, or their partner, were currently transitioning between dietary classifications (Yes/No) and, if so, to which category they were transitioning.

Next, participants reported the extent to which they, and, secondly, their partner, were currently reducing each of the following products: red meat, white meat, fish, seafood, dairy milk, dairy cheese, and eggs, on a 1-7 Likert scale, where *1 = not reducing at all, to 7 = actively reducing*. An additional option, *"I/They never eat this"*, was included for those who had already eliminated the product. See Supplemental Materials A for descriptive details on reduced and eliminated products.

Perceived dietary alignment. To assess whether participants perceived themselves matched or unmatched with their partner's dietary goals, we had participants complete the following question: "Would you say that you and your partner are aligned in your eating

habits and dietary goals?" Participants selected one of three options: *1) 'yes we are completely aligned', 2) 'we are sort of aligned, but not in every aspect' and 3) 'we are not aligned'*. As pre-registered, participants who selected option 1 (*n*=138) were placed into the matched group, and those selecting option 2 *(n*=332) or 3 *(n*=26) were placed into the unmatched group (*n*=358).[5]

Relational climate. Relational climate was assessed using an adapted version of the cohesion and flexibility subscales of the FACES-IV Scale, a highly valid and reliable scale (Cronbach α =0.90; Olson, 2011). Small alterations were made to the wording of certain items to ensure that we asked about the couple rather than the family unit, e.g., "Family members are involved in each other's lives*"* was changed to *"*My partner and I are involved in each other's lives*"*. Participants rated a total of 42 statements on the extent to which they agreed or disagree with each on a 1-7 Likert scales (1 = *strongly disagree,* 7 = *strongly agree*). Twenty-one items each comprised the cohesion scale and the flexibility scale. The two scales are further broken down into three subscales of seven items. The cohesion scale measures the extent to which a couple is: *balanced* (e.g., "My partner and I have a good balanced of separateness and closeness"), *disengaged* (e.g., "My partner and I mainly operate independently") and *enmeshed* (e.g., "My partner and I feel pressure to spend most free time together"). The flexibility scale measures the extent to which a couple is: *balanced* (e.g., "My partner and I are able to adjust to change when necessary"), *rigid* (e.g., "Our relationship becomes frustrated when there is a change in our plans or routines") and *chaotic* (e.g., "We

[5] Irrespective of our pre-registration, the small sample size for option 3 necessitated that we collapse options 2 and 3 into a single group. However, for transparency, we report on the mean scores for each of our five dependent variables across these samples two samples. Coordination ($M_{option2}$= 5.14, SD= .80; $M_{option3}$= 3.52, SD=1.04), harmony ($M_{option2}$= 5.39, SD= 1.17; $M_{option3}$= 4.45, SD =2.00), tension ($M_{option2}$= 1.64, SD= .97; $M_{option3}$= 2.58, SD=1.79), anticipated-tension ($M_{option2}$= 2.21, SD= 1.40; $M_{option3}$= 2.23, SD=1.68), openness ($M_{option2}$= 3.71, SD= 1.50; $M_{option3}$= 3.22, SD=1.57). These means may constitute meaningful differences amongst equal- and well-powered samples, which may warrant further exploration.

feel hectic and disorganized"). Following Olson (2011), cohesion and flexibility scores are calculated with the formula:

$$Cohesion = Balanced + \frac{(Disengaged - Enmeshed)}{2}$$

$$Flexibility = Balanced + \frac{(Rigid - Chaotic)}{2}$$

For a full list of the FACES-IV Scale items, see Supplemental Materials B.

Food coordination. To assess the degree of food preparation and consumption couples engaged in together, participants were asked how frequently they performed the following activities with their partner: *shopping*, *cooking*, and *eating*, each on 1-7 Likert scales (1 = *never,* 7 = *often*). Participants were additionally asked how frequently they eat the same foods as their partner (1 = *never eat the same foods,* 7 = *always eat the same foods*). Lastly, participants rated, overall, how aligned they perceived their partner's eating habits and dietary goals to be with their own (1 = *not at all aligned, 7 = very aligned*). These five items were developed by the research team and aggregated to provide an average score of food coordination (α = .70) with higher scores indicating greater coordination. We asked an additional two miscellaneous coordination items, not used to calculate the *coordination* index, but for descriptive purposes. Participants were asked to indicate who in their household is predominantly responsible for 1) buying food and 2) cooking meals. They were asked to indicate their response by selecting one of the following options: *myself* (*n*=204, *n*=203, respectively), *my partner* (*n*=78, *n*=132), or *equal responsibility* (*n*=214, *n*=161).

Dietary harmony. To assess how harmonious participants perceived their efforts to coordinate their food habits with their partner, they were asked: "How harmoniously would

you say you and your partner perform the following activities together?" The items included *shopping*, *cooking*, and *eating*, scored on a 1-7 Likert scales (1 = *not at all harmoniously,* 7 = *very harmoniously*). The three items were devised by the research team and aggregated to form an index of *harmony* (α = .70), with higher scores indicating greater harmony.

Current diet-related tension. To assess the extent to which participants perceived there to be *diet-related tension* in their relationship, participants rated, "To what extent does your diet, or your partner's diet, cause tension in your relationship?" on a 1-7 Likert scale (1 = *no tension at all,* 7 = *a lot of tension*), a single-item measure, devised by the research team. Higher scores indicated greater perceived diet-related tension.

Openness to plant-based dietary transitions. To determine the extent to which participants were open to reducing their consumption of animal products, participants first read: "There is a growing consensus among scientists that diets low in meat and animal products, comprised mainly of plant-based sources (e.g., fruits, vegetables, grains, pulses), are both better for human health and the planet – for example, they generate a smaller carbon footprint." Participants were then presented with the following food items: *red meat*, *white meat*, *fish*, *seafood*, *dairy milk*, *dairy cheese*, and *eggs.* They were asked: "How open are you to reducing your daily consumption of the following foods?" and indicated their response on a 1-7 Likert scale (1 = *not open at all,* 7 = *very open*). We included an additional option, "I never eat this", for those who had already eliminated the product from their diet. The seven items were averaged to provide an index of *openness to plant-forward diets* (α = .90), with higher scores indicating greater openness. See Supplemental Materials C for descriptive details of openness to reduce ratings, by animal product.

Anticipated diet-related tension. To assess the extent to which a member reducing their animal-product consumption would cause tension in the relationship, we asked: "To what extent would further reduction in meat and animal products in your diet, or your

partner's diet, cause tension in your relationship?" Participants indicated their response on a 1-7 Likert scale (1 = *no tension at all,* 7 = *a lot of tension*), a single-item measure, devised by the research team. Higher scores indicated greater anticipated tension. Participants who selected any option between 2-7 were additionally asked: "Why do you think further reduction would cause tension in your relationship?" Participants were required to provide a written response to this open-ended question.

Procedure

Participants took part in an online survey, hosted via the crowdsourcing platform Prolific. All participants provided their consent and answered demographic questions. Participants then completed measures pertaining to their current eating habits and that of their partners, their perceived diet-matching, relational climate, coordination, harmony, tension, openness to plant-forward diets and anticipated tension. Upon completion of the survey, all participants were debriefed and compensated £2.41 (a sum higher that UK National Living Wage, or £13.13/11 minutes) for their time.

Analysis Plan

An anonymized version of our data, as well as all Supplementary Materials can be accessed via OSF here: https://osf.io/gb79m/.

Quantitative data. To explore the corollaries of perceived dietary matching, we conducted a series of independent t-tests, comparing the means of matched and unmatched couples on each of our five outcome variables of interest: food-related coordination, harmony, tension, openness to plant-forward diets and anticipated tension. Here we adjusted alpha to $p < .01$ for multiple testing (i.e., $p = .05/5 = .01$). When equal variances were not

assumed, Welch's test was used. Where data were non-normally distributed[6], we employed Mann-Whitney *U*. Next, we conducted an exploratory correlation analysis to determine how the variables in our dataset, related to one another, including the relational climate dimensions, flexibility, and cohesion, each of their subscales, and our five outcome variables. Where data were non-normally distributed, we employed Spearman's rho.

This preliminary correlation analysis preceded our regression analysis which investigated the relationship between relational climate and the five outcome variables. Flexibility and cohesion were included as simultaneous predictors in each model and as such, we adjusted alpha by the number of predictors (i.e., $p = .05/2 = .025$). To further explore the relevance of these relational constructs in a more nuanced manner, we decomposed each dimension into their three subcomponents: (a) balanced, disengaged, and enmeshed cohesion, and (b) balanced, rigid, and chaotic flexibility. Two further sets of regression models were conducted, treating each subscale as a simultaneous predictor of the three relevant outcomes (thus, $p = .05/3 = .0167$). We supplemented our analysis with a number of exploratory tests investigating the relationship between key demographic variables (i.e., age, gender and political orientation) and openness to plant-based dietary transitions.

Qualitative data. A qualitative analysis was conducted to shed further light on why a reduction of animal-product consumption might lead to relational tension. We acquired a total of 274 qualitative responses, where participants explained why they felt that further reduction of their animal-product consumption would lead to relational tension. To process this data, we adopted a stepwise coding method, akin to that of Juvan and Donclair (2014), comprised of two-steps: first, we reviewed the data to create a data-driven code scheme;

[6] Cohesion (Skewness = -2.50, *SE* = .11), balanced cohesion (Skewness = -3.48, *SE* = .11) and tension (Skewness = 2.25, *SE* = .11) failed to meet thresholds for normally distributed data (i.e., *Skewness* ±2; George & Mallery, 2010) and, as such, we adopted non-parametric alternative tests where appropriate.

second, the data was independently coded by two trained blind coders. On first inspection of the data, a number of themes were apparent. A sizable portion of participants felt that tension might arise because neither themselves nor their partner were open to reducing. In general, the barriers perceived by participants related to *practicality* (e.g., the need to cook two separate meals, less choice), *emotion* (e.g., the responsibility falling on one person leading to stress) and *finance* (e.g., additional cost of cooking two meals). Where the participant was open to reducing their consumption of animal foods, they often indicated that their partner or the wider family unit (e.g., children) were a barrier to personal reduction.

Based on this initial inspection, the research team developed a binary coding scheme which coded for presence (1) or absence (0) of seven themes, divided into two categories. The first category related to the source of the anticipated tension and was associated with two mutually exclusive themes: 1) tension from both parties and 2) tension from one party. The remainder of the codes (non-exclusive themes) fell into the final category and were related to barriers that participants anticipated in relation to reduced animal-product consumption: 3) practicality, 4) emotion, 5) finance, 6) social, and 7) health. Entries (274 total) were scored for the occurrence of each code – see Table 2.2 for definitions – by two trained coders, blind to the study's specific aims. To determine agreement across the coding scheme, we ran a series of Cohen's κ statistics. Agreement was moderate-to-strong (κ range = .653-.983) and differed significantly from zero for all ($p < .001$)—see Supplemental Materials D for details on code prevalence.

Table 2.2. *Qualitative code scheme – labels and descriptors.*

Category	Code Label	Description

Source of anticipated tension	Both parties	The participant indicates that neither themselves nor their partner would want to reduce. Hence, they anticipate that tension would arise from both sides of the relationship.
	One party	The participant indicates that though they might be open to reduction, their partner would not be as open (or vice versa). Hence, they anticipate that tension would arise from one side of the relationship.
Barriers to reducing animal product consumption	Practicality	The participant mentions the added impracticality brought about by reducing, e.g., the need to cook extra or separate meals, which would incur a time or resource hardship.
	Emotion	The participant sees the consequences of reducing as emotional in nature (e.g., causing frustration, stress).
	Finance	The participant argues that reduction would lead to an added financial cost.
	Social	The participant argues that a reduction would be difficult to manage in social settings, outside of the relationship (e.g., family BBQs, at restaurants, etc.)
	Health	The participant argues that reduction would cause them to incur a health or nutritional consequence (e.g., loss of protein, etc.)

Results

Most of our sample identified as *omnivore* (*n* = 305, 61.5%), followed by *meat lover* (*n* = 100, 20.2%), *semi-vegetarian* or *reducetarian* (*n* = 61, 12.3%), *lacto- or ovo-vegetarian* (*n* = 17, 3.4%), *pescatarian* (*n* = 13, 2.6%). The vast majority of participants in our sample indicated that their partners identified as an omnivore (*n* = 274, 55.2%), followed by *meat lover* (*n*=137, 27.6%), *semi-vegetarian* or *reducetarian* (*n*=59, 11.9%), pescatarian (*n*=10, 2%), *lacto- or ovo- vegetarian* (*n*=10, 2%), *strict vegetarian* (*n*=5, 1%) *dietary vegan* (*n*=1, 0.2%). Most participants indicated that they (*n* = 475, 95.8%) and their partner (*n* = 476,

96%) were not currently pursuing a transition between dietary classifications. See Supplemental Materials E for descriptive details on dietary transitions.

Distribution of matched and unmatched couples

Contrary to expectations, the vast majority of participants perceived the eating habits and dietary goal of themselves and their partner to be unmatched (n = 358), with a smaller group matched (n = 138). We pre-registered that we would additionally manually code the dietary classifications and dietary goals of participants and their partners for being either 'matched' or 'unmatched', as an ancillary check on the direct measure of perceived dietary alignment. However, too few participants provided an affirmative response to the question on dietary transitions for us to perform this computation with the data. In terms of current dietary classification, 334 participants were matched with their partner and 162 were unmatched. Of note, reported dietary classifications of the couples often failed to align with their *perception* of being matched or unmatched. Though the vast majority of our participants reported the same dietary classification as their partner (n = 334), much fewer *perceived* the eating habits and dietary goals of their partner to entirely match their own *(n* =138). Arguably, the subjective experience of dietary alignment (perceived alignment) is psychologically more meaningful than dietary classifications (e.g., a person may classify their partner with the same label but still feel unmatched), thus, below we report the results for perceived matching and supplement the analyses for classification matching[7] (see Supplemental Materials F).

Hypothesis testing: dietary characteristics of matched and unmatched couples

We found that matched couples reported significantly greater food coordination than unmatched couples, $t(494) = 9.485$, $p < .001$, $d = 0.95$, 95% CI [.75, 1.16]. Matched couples

[7] Since classifications and perceptions were at times misaligned, we made the decision to explore both of these variables in relation to our outcome variables. This decision was made post data collection and therefore fell outside of our pre-registered analysis plan.

reported significantly greater harmony than unmatched couples, $t(300.18) = 10.336$, $p < .001$, $d = 0.49$, 95% CI [.29, .69]. Matched couples ($M_{rank} = 211.92$) reported significantly lower diet-related tension than unmatched couples ($M_{rank} = 262.60$), $U = 29750.50$, $z = 4.08$, $p < .001$, 95% CI [.00, .03]. Contrary to expectations, there was no significant difference between matched couples and unmatched couples on anticipated diet-related tension, $t(494) = -0.97$, $p = .333$, $d = -.097$, 95% CI [-.29, -.10]. Lastly, matched couples reported significantly lower openness to plant-forward transitions than unmatched couples, $t(223.94) = -3.18$, $p = .002$, $d = -0.34$, 95% CI [-.53, -.14]. See Table 2.3 for all means and standard deviations.

Table 2.3. *Dietary characteristics of matched and unmatched couples.*

	Matched	Unmatched
Food coordination	5.8_a (0.8)	5.0_b (0.9)
Dietary harmony	5.9_a (1.0)	5.3_b (1.3)
Current diet-related tension	1.4_b (0.9)	1.7_a (1.1)
Anticipated diet-related tension	2.1_a (1.5)	2.2_a (1.4)
Openness to plant-based dietary transitions	3.1_b (1.7)	3.7_a (1.5)

Note. Subscripts are significantly different at $p < .01$.

Relational climate: exploratory correlation analysis

We observed the correlational relationship between the dimensions of relational climate and all outcome measures. Table 2.4 provides a matrix of these correlations. In sum, couples who reported greater overall cohesion, balanced cohesion, overall flexibility, and balanced flexibility reported greater food coordination, greater dietary harmony and lower diet-related tension. By contrast, couples who reported greater disengaged cohesion and chaotic flexibility reported less food coordination. Further, couples who reported greater disengaged and enmeshed cohesion, rigid and chaotic flexibility reported less dietary

harmony and greater diet-related tension. Couples high in disengaged and enmeshed cohesion and chaotic flexibility were more likely to anticipate tension if one member of the relationship transitioned to a plant-forward diet. In contrast, couples that reported greater overall flexibility and cohesion, as well as *balanced* flexibility and cohesion were less likely to anticipate tension if one transitioned to a plant-forward diet. Couples who reported greater balanced cohesion and greater overall flexibility reported a lower openness to plant-based dietary transitions, whereas couples who reported greater chaotic flexibility reported greater openness[8].

[8] Though significant, it is important to note that the magnitude of these effects were small.

Table 2.4. *Correlation matrix of the relational climate measures and diet-related outcome.*

	Diet-related outcomes				
	Food coordination	Dietary harmony	Current diet-related tension	Anticipated diet-related tension	Openness to plant-based transitions
Overall cohesion	.196**	.259*	-.181**	-.122**	-.035
Balanced	.430**	.443**	-.312**	-.163**	-.113*
Disengaged	-.383**	-.393**	.292**	.126**	-.004
Enmeshed	-.001	-.106*	.157**	.097*	-.062
Overall flexibility	.358**	.331**	-.206**	-.121**	-.110*
Balanced	.420**	.449**	-.279**	-.170**	-.076
Rigid	-.073	-.176**	.157**	.070	-.032
Chaotic	-.254**	-.256**	.182**	.089*	.111*

Notes: **correlation is sig at 0.01 level, *correlation is sig at 0.05 level. Spearman's rho was employed as a non-parametric alternative to Pearson's r for variables that were non-normally distributed.

Next, we observed the correlational relationship between our five outcome variables. Table 2.5 provides a matrix of these correlations. In sum, participants who reported being coordinated with their partner in their dietary goals reported more harmonious eating habits, less eating-related tension, anticipated less tension if they or their partner transitioned to eating fewer animal products. Of note, couples with higher levels of food-related tension reported somewhat more openness to plant-based diets, though the magnitude of this correlation was small. Not surprising, those who frequently experienced food-related tensions were more likely to anticipate tension if one of the two transitioned to a plant-forward diet. Openness to a plant-based diet was unrelated to food coordination, harmony, and anticipated tension.

Table 2.5. *Correlation matrix of the diet related outcome measures.*

	1.	2.	3.	4.	5.
1. Food coordination	-	.639**	-.273**	-.133**	-.045
2. Dietary harmony		-	-.311**	-.191**	-.024
3. Current diet-related tension			-	.342**	.147**
4. Anticipated diet-related tension				-	-.086
5. Openness to plant-based dietary transitions					-

Notes: **correlation is sig at 0.01 level, *correlation is sig at 0.05 level. Spearman's rho was employed as a non-parametric alternative to Pearson's r for variables that were non-normally distributed.

Relational climate, food-related coordination, harmony, and tension

The overall correlation between cohesion and flexibility was weakly positive, $r(496) = .24$, $p < .001$, which speaks to the independence of these constructs. The regression analysis with flexibility and cohesion as simultaneous predictors (adjusted alpha $p = .05/2 = .025$)

revealed that increasing relational flexibility was predictive of greater food coordination, *B*= .342, *t*(494) = 8.01, *p* < .001, 95% CI [.03, .05]. More flexible couples reported greater food-goal alignment. However, cohesion did not independently predict levels of alignment, *B*= .086, *t*(494) = 2.02, *p* = 0.44, 95% CI [.00, .03]. The regression model was overall significant, *F*(2,493) = 38.57, *p* < .001, adj.R^2=.132. Flexibility was predictive of food-related harmony in the relationship, *B*= .299, *t*(494) = 7.02, *p* < .001, 95% CI [.03, .06]. Cohesion was also predictive of food-related harmony, *B*= .169, *t*(494) = 3.97, *p*< .001, 95% CI [.02, .05], though to a lesser degree. The regression model was significant, *F*(2,493) = 39.26, *p* < .001, adj.R^2=.134. Lastly, more flexible couples reported less diet-related tension, *B*= -.151, *t*(494) = -3.36, *p* = .001, 95% CI [-.03, -.01], and so did more cohesive couples, *B*= -.113, *t*(494) = -2.51, *p*= .012, 95% CI [-.04, -.00], with an overall significant regression model, *F*(2,493) = 10.77, *p* < .001, adj.R^2=.038. Thus, as predicted, cohesive couples experienced less tension and more harmony in their food preparation efforts. However, unexpectedly, their eating habits and goals were not necessarily more tightly aligned. By contrast, flexible couples experienced higher levels of harmony, less tension, and were quite aligned in their diet-related practices.

To explore the relevance of these relational constructs in a more nuanced manner, we decomposed each dimension into their three subcomponents: (a) balanced, disengaged, and enmeshed cohesion, and (b) balanced, rigid, and chaotic flexibility. Two sets of regression models were conducted, treating each subscale as a simultaneous predictor of the three relevant outcomes (thus, *p* = .05/3 = .0167). First, with regards to cohesion, balanced couples reported greater food coordination, *B*= .247, *t*(494) = 5.41, *p* < .001, 95% CI [.03, .06], whereas disengaged couples reported lower scores of food coordination, *B*= -.294, *t*(494) = -6.2, *p* < .001, 95% CI [-.06, -.03]. Enmeshed cohesion did not predict levels of food coordination, *B*= .099, *t*(494) = 2.36, *p* =.019, 95% CI [.00, .03]. The regression model was

overall significant, $F(3,492) = 42.61$, $p < .001$, adj.R^2=.201. Balanced couples reported greater food-related harmony, B= .274, $t(494) = 6.03$, $p < .001$, 95% CI [.04, .08], whereas disengaged couples reported lower food-related harmony, B= -259, $t(494) = -5.49$, $p < .001$, 95% CI [-.07, -.03]. Enmeshed cohesion did not predict levels of food-related harmony, B= -.016, $t(494) = -.39$, p =.698, 95% CI [-.02, .01]. The regression model was overall significant, $F(3,492) = 44.29$, $p < .001$, adj.R^2=.208. Balanced couples reported less diet-related tension, B= -.140, $t(494) = -2.89$, p = .004, 95% CI [-.04, -.01], whereas disengaged couples reported higher diet-related tension, B= .202, $t(494) = 3.99$, $p < .001$, 95% CI [.02, .05]. Enmeshed cohesion did not predict levels of diet-related tension, B= .055, $t(494) = 1.21$, p =.226, 95% CI [-.01, .02]. The regression model was overall significant, $F(3,492) = 17.64$, $p < .001$, adj.R^2=.092.

Second, with regards to flexibility, balanced couples reported greater food coordination, B= .375, $t(494) = 8.86$, $p < .001$, 95% CI [.05, .07], whereas chaotic couples reported lower scores of food coordination, B= -.141, $t(494) = -3.34$, $p < .001$, 95% CI [-.03, -.01]. Rigid flexibility did not predict levels of food coordination, B= -.065, $t(494)$= -1.62, p =.107, 95% CI [-.02, .00]. The regression model was overall significant, $F(3,492) = 40.61$, $p < .001$, adj.R^2=.194. Balanced couples reported higher scores of food-related harmony, B= .404, $t(494)$= 9.82, $p < .001$, 95% CI [.07, .10], whereas chaotic, B= -.135, $t(494)$= -3.30, $p < .001$, 95% CI [-.04, -.01], and rigid couples reported lower scores of food-related harmony, B= -.168, $t(494)$= -4.28, $p < .001$, 95% CI [-.04, -.01]. The regression model was overall significant, $F(3,492) = 53.32$, $p < .001$, adj.R^2=.241. Balanced couples reported lower scores of diet-related tension, B= .-.249, $t(494)$= -5.59, $p < .001$, 95% CI [-.06, -.03], whereas rigid couples reported higher scores of diet-related tension, B= -.178, $t(494) = -4.19$, $p < .001$, 95% CI [.01, .03]. Chaotic flexibility did not predict diet-related tension, B= -.085, $t(494)$= -1.92, p

=.55, 95% CI [.00, .03]. The regression model was overall significant overall, $F(3,492) = 21.43$, $p < .001$, adj.R^2=.110.

Relational climate, openness to plant-based eating, and anticipated tension

Next, we explored how relational climate relates to plant-forward transition outcomes. As predicted, flexibility was associated with lower anticipated tension if a member transitioned to a plant-forward diet, B= -.115, $t(494)$= -2.52, p = .012, 95% CI [-.03, -.00]. However, greater cohesion in a relationship was unrelated to anticipated tension, B= -.035, $t(494)$ = -.77, p= .441, 95% CI [-.03, .01]. The regression model was significant, $F(2,493) = 3.98$, p = .019, adj.R^2=.013. Unexpectedly, more flexible couples tended to report *lower* levels of openness to plant-based transitions, B= -.115, $t(494)$= -2.51, p= .012, 95% CI [-.04, -.01], and cohesion was unrelated to openness to greater plant-based eating, B= .025, $t(494)$= .54, p= .590, 95% CI [-.02, .03]; however, the overall regression model did not meet the adjusted threshold for significance, $F(2,493) = 3.16$, p = .043, adj.R^2=.009, therefore, this result should be treated with caution.

We further explored the association between flexibility and lower anticipated tension by testing the subcomponents of flexibility in a regression. Balanced flexibility was associated with lower scores of anticipated tension, B= -.156, $t(494)$= -3.35, p = .001, 95% CI [-.06, -.02]. However, neither rigid flexibility, B= 0.66, $t(494)$= 1.49, p = .136, 95% CI [-.00, .03], nor chaotic flexibility, B= .043, $t(494)$= .91, p = .361, 95% CI [-.01, .03], were significantly related to anticipated tension. Thus, it is mainly among well-balanced (i.e., moderately flexible) couples where we observe *lower* levels of anticipated dietary tension.

Exploration of couples' demographics

Correlational analysis revealed a positive relationship between a liberal political identity and openness to plant-based diets, both for the participant, $r(496) = .236$, $p < .001$,

and the partner, $r(496) = .221$, $p < .001$. We also found a negative relationship between the political orientations of the partner and anticipated tension, $r(496) = -.093$, $p = .039$, suggesting that having a more conservative partner is related to anticipating greater tension. Of the relational climate dimensions, we found a positive relationship between liberal political identity and chaotic flexibility, both for the participant, $r(496) = .154$, $p = .001$, and the partner, $r(496) = .181$, $p < .001$. Note that, unsurprisingly, the reported political orientation of participants and their partners was highly correlated, $r(496) = .704$, $p < .001$, with the majority of participants reporting the same orientation ($n = 294$, 59.27%). Participant age, $r(496) = -.096$ $p = .033$, but not partner age, $r(496) = -.070$, $p = .120$, was negatively related to openness, with younger participants reporting more openness to plant-based diets. Of the relational climate dimensions, we found a negative relationship between age and balanced flexibility, both for the participant, $r(496) = -.091$, $p = .042$, and the partner, $r(496) = -.107$, $p = .018$. Male- ($M = 3.43$, $SD = 1.57$) and female-identified participants ($M = 3.62$, $SD = 1.54$) did not differ significantly in their levels of openness, $t(491) = -1.342$, $p = .180$, $d = -.12$, 95% CI [-.46, .09]. However, male participants anticipated less tension (M = 2.0, SD = 1.3) than female participants ($M = 2.3$, $SD = 1.6$) if a member adopted a plant-forward diet, $t(477.38) = -2.28$, $p = .023$, $d = -0.20$, 95% CI [-0.55, -.04].

Qualitative analyses: Anticipated tension

There were 77 instances whereby participants anticipated that tensions would arise *jointly*. They saw the reduction of animal food products as something that would threaten both members' freedoms, which would have negative consequences for the relationship: *"we would be irritable for not being able to eat what we want".* Reduction of animal foods was often framed negatively as something *"taken away"* and linked to shared negative affect, including collective sadness (*"we would be sad without cheese"*), irritability (*"we would be irritable"*) and stress (*"taking something away would add to the stress of what to eat"*).

There was also mention of the psychophysiological state of being *"hangry",* a portmanteau of hungry and angry and a colloquial term that has since been validated by scientific research (Swami et al., 2022). Where participants anticipated that tension would arise jointly, they sometimes appealed to the nutritional and satiation value of animal-derived food products as reasons for its continued consumption: e.g., "*It* [meat] *is a good source of protein*"; "*It is something we…crave for energy*"; "*It would be hard to find varied meals that keep us full*". Others simply affirmed that tensions would arise from their shared hedonic liking of animal products and a reluctance to forgo these products: *"we like meat products", "neither of us want to do it", "we eat meat a lot and enjoy it", "we both enjoy meat-based meals, we would not want to change this".*

There were 87 instances whereby participants anticipated that tensions would arise *asymmetrically* or predominantly from one party, typically the partner and male counterpart. In fact, 72% of responses where the partner was anticipated to be the principal source of tension, the partner was male. In these instances, it was often expressed that this anticipated tension would derail the (female) participant's own desire to reduce animal foods: *"My partner* [male] *would prefer meat and I* [female] *would want to reduce"; "my husband loves meat too much whereas I* [female] *enjoy meals without meat but I have to make sure meat is served most days".* Male participants who anticipated being the main source of tension, often spoke of their own hedonic liking of animal foods and their personal reluctance to reduce their consumption: *"I* [male] *love meat", "I* [male] *enjoy meat, so I would be disappointed if was further reduced."* Further exploratory quantitative analysis corroborated this finding: participants with a male partner anticipated greater tension (M= 2.3, SD= 1.6) than participants with a female partner (M= 2.1, SD=1.3), $t(482.78) = 2.11$, p =.035, d = .19, 95% CI [.02, .53].

A number of additional, qualitative responses added further insight as to why we find a gender difference amongst these data—including beliefs about male partners' attachment to meat and their commitment to traditional values. Practical concerns that arise when cooking for two people was the most common barrier reported for asymmetric couples, followed by emotion and finances. See Supplemental Materials G for elaboration on these points.

Discussion

The present study explored how the relational climate of cohabiting meat-eating couples relates to their current dietary practices and openness to reduce their consumption of animal products. This study advances current knowledge by probing the relational dynamics that modulate consumers' willingness and perceived ability to practice a more plant-forward diet. Below, we discuss the key findings and consider their practical application.

Key findings and applications

One novel insight involves the attitudes of dietary matched and unmatched couples towards meat reduction. Couples who were matched in their dietary orientation tended to report greater levels of food coordination and harmony than unmatched couples. However, at the same time, they were less open to plant-forward dietary transitions. One potential interpretation of this finding relates to the inevitable disruption caused by a partner transitioning to a meat-reduced diet. In our methods we had couples consider the asymmetric situation of one member reducing their consumption of animal products. One way to interpret our findings is that matched couples are less willing to disrupt the dietary harmony that they have worked to generate, whereas unmatched couples are less resistant because they are already engaged in managing dietary non-alignment. The qualitative responses further supported this interpretation and further illuminated the concerns participants had with animal-product reduction. These initial findings have important implications for plant-based

advocacy. It is important to recognise that plant-forward dietary transitions will often be perceived by couples as relationally disruptive, since they require individuals to reconfigure how they relate to their partner's eating patterns. This will be less of a concern for individuals transitioning outside of a relational context.

Some participants recognised that relational tension would come from both members of the relationship, typically due to a hedonic liking of animal products or due to concerns about the appetitive and emotional consequences of plant-based diets (e.g., being frustrated, "hangry", missing out). That individuals rationalise their continued consumption of animal foods for the gustatory pleasure and perceived nutritional benefits aligns with two of the 4Ns of meat justification (Piazza et al., 2015). Other participants recognised themselves, or their partner (typically a male partner), as the isolated source of anticipated relational tension and a barrier to personal reduction. Many couples feared that transitioning would place strain on the relationship due to negative impacts on their own wellbeing or that of their partner. These strains concerned additional practical, emotional, and financial pressures, such as the need to cook two separate meals, the added costs, and the responsibility falling on one person.

Surprisingly, perhaps, it is those couples who do not share the same eating habits or dietary goals who may be most open to reducing their consumption of animal products. We suspect that this may be the case for a number of reasons. It is likely that unmatched couples have already-established work arounds for the practical, emotional, and financial barriers that matched couples report. For example, it may be the case that couples who are unmatched presently, are more practiced in managing differences in their eating habits and have a pre-established culture of independence when it comes to food and possibly other behaviours. With regards to relational climate, we found evidence to suggest that cohesive couples are more aligned in their dietary goals and subsequently experience less tension around food choices. Specifically, more cohesive couples reported greater food coordination and dietary

harmony, and lower scores of diet-related tensions. Similarly, greater overall flexibility related to higher scores of coordination and harmony, and lower scores of diet-related tensions. Yet, contrary to our expectations, relational cohesion was not an important marker for predicting openness to dietary transitions or concerns about the tensions such transitions might precipitate.

By contrast, relational flexibility was negatively related to tensions anticipated by a member reducing their consumption of animal products. This suggests that couples with more balanced or egalitarian leadership styles may be better able to handle the inevitable disruption caused by a member transitioning to a plant-forward diet. Arguably, this increased confidence among flexible couples relates to the finding that unmatched couples—i.e., those already practiced in managing idiosyncratic dietary patterns—are more open to further transition. It is important to note, however, that, like cohesion, flexibility was not reliably related to openness to plant-based dietary transitions. We suspect this is because plant-based transitions may require individuals to first overcome the core, hedonic barriers they perceive to accompany animal-product reduction—namely, concerns pertaining to convenience, finance, and health—highlighted in our qualitative analysis.

Individual differences among couples related to age, gender, and political orientation also posed roadblocks to plant-forward transitions. A key theme of our research relates to that of gender and politics. Left-leaning individuals were more open to reducing their consumption of animal foods, consistent with previous findings (e.g., Hodson & Earle, 2018; Rosenfeld & Tomiyama, 2020). Advancing research on this topic we observed how political orientation can interplay with relational systems. Our samples evinced attributes of political homophily (e.g., see Huber & Malhotra, 2017) and political orientation was related to the relational dimension of flexibility. Liberal couples were more likely to report greater levels of chaotic flexibility, which was positively correlated with openness to plant-forward dietary

transitions (though this relationship did not hold up in the regression analysis). Olson (2000) explains that chaotic relationships are those which lack clear leadership or where leadership roles may shift. Hence, left-leaning individuals who seek one another for partnership may create a relational climate where a flexible leadership style may facilitate plant-forward transitions.

In terms of gender, we found that male partners represented a large barrier to plant-forward transitions—transitions that women are typically more open to (e.g., see Hodson & Earle, 2018). This may be especially true for couples whereby the male counterpart holds traditional values around food, gender roles and politics. Even in contemporary society, women are still looked to as the primary food preparer in the home (Fielding-Singh, 2017). At the same time, the dietary choices of women are often subordinated to that of their male partner (see Asher & Cherry, 2015). This may be particularly true in the case of meat, which is still socially represented in many cultures as a symbol of masculinity and power (Sobal, 2005). By contrast, we found that couples who are more liberal in their political orientations, and who have more flexible leadership styles, believe that less conflict would arise when making a plant-forward transition. These findings may reflect the adoption of more egalitarian values within these groups, which have been associated with fewer disagreements (Rhoden, 2003) and greater willingness to compromise on food choices (Brown & Miller, 2002).

Limitations

This research was limited to mostly cis-gendered, heterosexual couples, which constrains the generalisability of our conclusions. LGBTQA+ individuals represented a small proportion of our sample, and so we were unable to explore how relational climate might interact with couples' sexual orientation or more diverse gender identities. Our inferences about openness to plant-forward diets and resultant tensions are based in relational dynamics

that may not extend to LGBTQA+ relationships. The underrepresentation of minority perspective is a wider issue in the literature on animal-product consumption which deserves greater attention. We see future research with LGBTQA+ individuals as a fruitful space for new explorations into the interplay between relational climate and meat consumption.

Our research was also limited in the sense that it looked only at *attitudes* towards dietary change, specifically an openness to plant-based diets, as opposed to measuring *behavioural* outcomes. Although attitudes can be used as a proxy for estimating behavioural change, these estimations ought to be interpreted with caution, as intentions to change do not always convert to behaviour (Webb & Sheeran, 2006). A recent review estimated that roughly 64% of all research on meat consumption has employed attitude-centric outcomes to estimate behavioural change (Harguess et al., 2020). Hence, future work ought to build upon this initial, foundational research and consider how relational climate impacts on how couples behaviourally pursue and manage plant-forward dietary transitions. Our conclusions are also limited by having only sampled one member of the relationship, as opposed to both parties. Here we must note that, as per Olson (2000), multi-person assessments of family and relational systems are preferable because family members and partners may not concur in their judgements of relational quality or in their attitudes and behaviours. Thus, to provide a more complete picture of the relational system, future work should strive to capture both perspectives.

Conclusion

The present study of the relational climate of cohabitating couples yielded novel insights regarding why many consumers are apprehensive about plant-forward dietary transitions and the relational variables predictive of a willingness to change. Dietary matched couples were less willing than unmatched couples to transition for fear it would disrupt the harmony already established in their shared consumption practices. Couples with more

flexible leadership styles, with left-leaning political views, and where partners (men in particular) were less hedonically attached to meat, anticipated less tension from such transitions, and, on the whole, were more open to them, though not without concerns. These findings highlight how flexible leadership and the demographic makeup of a relationship can help facilitate receptivity to healthier, more sustainable diets. Future work ought to consider how the relational climate of cohabiting units (e.g., families and couples) navigate and manage the disruption that plant-forward diets pose, as such transitions unfold (i.e., “in situ”).

Study 3: Family climates and plant-forward diets: A 14-day experience-sampling study

Rebecca Gregson & Dr. Jared Piazza

Abstract

Plant-forward diets can help address the health and ecological crises faced by modern society. A key barrier to the adoption and maintenance of plant-forward diets is an anticipated lack of support from primary social groups (incl. family members, partners, and friends). The present study examined *relational climate* (i.e., the cohesion and flexibility) as it relates to how family systems respond when a member decides to reduce or abstain from animal products. Eighty-four individuals who were actively reducing their consumption of animal products, took part in a 14-day smartphone-based experience sampling study where they documented, daily, their family's response to their dietary change. This included qualitative diary entries and quantitative ratings of support, coordination, and tension. Baseline, out-take, and two-week follow-up surveys were administered to investigate the moderating effects of *relational climate*, as well as long-term changes in animal product consumption, stage of change, goal achievement and success. Analyses revealed that participants who reported a more balanced relational system, at least in terms of their emotional bonding, felt more supported in their dietary goal, which in turn, was related to greater goal achievement and lower animal product consumption over time. In contrast, highly interdependent or "enmeshed" systems were typically less supportive and this was associated with greater tension and increased animal product consumption. The implications of this research are discussed against the wider literature on facilitators and barriers of animal product reduction.

Keywords: animal product reduction, social support family systems, relational climate, experience sampling

Introduction

Food choice and consumption are deeply social activities (Rozin, 1996). The vast majority of us eat meals in the company of others (Sobal & Hanson, 2014), a socially facilitative act, which helps to define group boundaries, strengthen, and maintain relationships as well as teach and reinforce important values (Ochs & Shohet, 2006). The consumption of animal products in particular is a widely prevalent, and socially normative practice (Piazza et al., 2015). In a recent exploration into global diets, it was estimated that approximately 86% of the global population follow an omnivorous diet (Statista, 2023a). Throughout our history, and still today, the consumption of animal products is a means through which one can express their social status (e.g., see Chan & Zlatevska, 2019) and national identity (Leddy-Owen, 2012; Nguyen & Platow, 2021). Food products derived from animals are so embedded within the daily lives and cultures of most consumers (Fiddes, 1994) that, for many, a meal is not considered a "meal" in the absence of meat (Sobal, 2005). Yet, despite the socio-cultural value ascribed to animal products, there is a growing concern that our modern-day animal agriculture industry bears public health and environmental costs that cannot be sustained (Willet et al., 2019). The production and consumption of animal products have been linked to a number of personal and public health consequences, issues of animal welfare, and ecological concerns over climate change and biodiversity loss (Poore & Nemeck, 2018; Clark et al., 2022). Such consequences have motivated scholars and non-governmental organisations to call for large-scale changes in the diets of westernised societies, with less emphasis on animal-derived proteins and a greater centrality of plant-based proteins (Grundy et al., 2022; Willet et al., 2019).

Social barriers to plant-forward transitions

At present, a small but growing proportion of the population abstain from animal derived foods (Dagevos, 2021). Research estimates that approximately 2-25% of the global

population identify as vegetarian (Statista, 2023e), and 3-10% as vegan (Statista, 2023f). As such, vegetarians and vegans represent a minority who deviate from the social norm which is to consume animal products (Kurz et al., 2020). Deviation from such a prevalent and normative practice is perceived to be socially costly and associated with a number of social hardships, including stigmatisation and exclusion (Cheah et al., 2020; Higgs, 2015). Moreover, given the co-ordinated nature in which cohabiting units prepare and consume food (Boulet et al., 2021), individuals contemplating plant-forward diets often anticipate that their dietary transition will cause disruption to the food-related decision-making of the household (Lea et al., 2006). Indeed, research has shown that meat consumers *anticipate* relational struggles with their romantic partners and family members were they to adopt a vegetarian or vegan diet. These anticipated struggles appear to relate to the perceived practical, financial, and emotional hardships of coordinating a plant-forward diet with an unmatched or unsupportive partner or family unit (Gregson & Piazza, 2023 – study 2; Markowski & Roxburgh, 2019).

Research with practicing vegetarians and vegans appears to corroborate many of the *projected* concerns of meat eaters (e.g., Markowski & Roxburgh, 2019). Vegans report that the most trying challenge in the pursuit of their dietary transition were fractious interactions with dismissive and unaccommodating family members (Markowski & Roxburgh, 2019; Twine, 2014). Given the high socio-cultural value that animal product consumption holds, family members often perceive the adoption of a plant-forward diet as a threat to the family's homeostasis, traditions, and group identity (Roth, 2005). As such, it is common for families to respond to a member's initial decision to reduce or abstain from animal products by: dismissing the change as temporary, coaxing the family member to eat animal-derived foods, disputing the rationale for the change, and/or condemning them for threatening family values (Roth, 2005).

At present, the dominant literature paints a rather pessimistic view for what individuals who transition to a plant-forward diet might expect to experience. Yet, negative reactions of this kind are not likely to exist in every household and are likely to depend upon a number of factors. This may include individual differences on behalf of the family members observing the transition, and the individual undergoing transition but also how these individuals interact with one another and their relational quality. Research by Jabs et al. (1998) has found that opposition to plant-forward diets comes most frequently from nuclear family members, particularly male relatives (e.g., fathers) who often perceive the transition as a symbolic threat; a rejection of theirs and their family's values. Hence, these family members can be antagonistic and confrontational about such change. The perception of animal product abstention as a symbolic threat or rejection may be a manifestation of right-wing traditionalism which is thought to be more commonly expressed by cis-gendered males, and a robust predictor of highly cynical attitudes toward meat reduction (e.g., see Dhont et al., 2016).

Such confrontations may also depend on the gender-identity of the individual transitioning. Merriman (2010) has shown that because men are traditionally seen as capable of governing their own bodies, male vegetarians are often viewed in a neutral or even positive light. Whereas, the same level of perceived capability and autonomy is not extended to women, and so female vegetarians are often met with disproval and hostility, typically from male family members. Reactions may also depend upon features of the individual's transition, including the speed and the nature in which a person pursues a plant-forward diet. Indeed, previous work has shown that more gradual transitions, as opposed to an abrupt transition, make it easier for families to adjust (Haverstock & Kirby, 2012). Because of the wider scope of products that they reject, vegans tend to be viewed as more extreme in their dietary restrictions than vegetarians, and, as such, family members are often less willing or

less able to accommodate them (Markowski & Roxburgh, 2019). Furthermore, the motivations that the individual professes for making such a dietary transition may also influence the reactions from others, as health motives tend to foster more support and less backlash than moral motives (e.g., see Greenebaum, 2012, Wieper & Vonk, 2021).

Navigating social hurdles

Given families' natural drive to want to achieve and maintain relational harmony (Godin & Langlois, 2021; Seshadri, 2019), it is unlikely that a period of disruption caused by a dietary transition can continue indefinitely. In the face of such relational tensions, individuals transitioning to plant-forward diets may become strategic in the way that they interact with their families during shared eating practices. Greenebaum (2012) found that vegan individuals engage in so-called "face saving" strategies which seek to present plant-forward diets in a positive light to their combative or critical family members. This includes: avoiding confrontation, being strategic about when where and how to discuss their diet (i.e., not during a meal), emphasising the *health* benefits of their diet as opposed to the animal welfare benefits, and attempting to lead by example (i.e., modelling behaviour).

Further, Twine (2014) reports on additional *cohabitation* strategies adopted by individuals seeking to reduce or avoid such conflicts. In this research, vegans were seen manipulating their micro-geographies, specifically utilising time (i.e., eating at different times) and space (i.e., eating in different locations) in order to aid a harmonious co-existence. Though such strategies may not be regarded as conventional, nor conducive to healthy relationships, they are seemingly adaptive and may allow for individuals following discrepant diets to harmoniously co-exist under one roof. However, the successes or failures of such strategies are not yet known and there is a clear need for more research into the long-term trajectory of the relational hurdles associated with plant-forward transitions.

In cases where the family norm is to consume animal products, transitioning individuals may feel a pressure to comply in order to allay such tensions and re-establish homeostasis (Menzies & Sheeska, 2012). Research into the retrospective reports of ex-vegetarians and vegans suggests that, if not resolved, social and coordination issues can cause individuals to abandon their diets (Asher et al., 2014; Menzies & Sheeshka, 2012). It is estimated that approximately 84% of those who adopt a plant-forward diet eventually return to an omnivorous diet within the first three-months of their transition (Asher et al., 2014). According to Anderson and Milyavskaya (2022) key drivers of abandonment include: dissatisfaction with plant-based foods (47%), perceived health issues (30%), accessibility changes (25%), a loss of motivation (20%), social coordination issues (15%) and financial issues (10%). Of the social issues individuals report a perceived lack of support and difficulty coordinating with those whom they cohabitate. Furthermore, social struggles may often go hand-in-hand with accessibility challenges, for example, the additional time and effort required to shop for, prepare, and cook plant-based meals (Anderson & Milyavskaya, 2022).

On the contrary, such tensions may be resolved if family members eventually come round to the individual's transition. Research by Menzies and Sheeshka (2012) suggests that those individuals who are able to maintain their plant-forward diet are those who receive emotional and tangible support (e.g., food and recipe provisions) from the people they live with. In supportive environments like this, it may also be common for the dietary preferences of transitioning individuals to take precedence, influencing others in the household to adopt a similar approach to eating (Bolderdijk & Cornelissen, 2021). Taken together, previous research highlights the disruption posed by plant-forward and the natural impetus to resolve coordination issues within the household. These tensions may be resolved by either party succumbing to the other's dietary preferences, or by striking a harmonious balance of

flexible, yet cohesive dietary coordination, which is likely to be more effortful. However, the variables that prompt relational systems to adopt these routes remain largely unexplored.

The current study

The research conducted to date has been invaluable in advancing scientific understanding of the domestic response to plant-forward diets and how transitioning individuals navigate these social consequences. However, absent from this literature is a family systems perspective, specifically an investigation into how the relational climate of a family unit influences how a person navigates a plant-forward dietary transition, and further, how this modulates the long-term successes (or failures) of the individual's transition. Our research team recently adopted a *relational-climate* framework (Olson, 2011) to understand how the cohesion and flexibility of a romantic partnership impacts a person's openness to reduce their animal-product consumption (Gregson & Piazza, 2023 – study 2). Within a relational-climate framework, *cohesion* relates to the emotional bonding that a couple or family members have towards one another, and *flexibility* entails how a relational unit manages and adapts to changes in leadership, roles, and rules. We found that relational flexibility predicted a couple's perceived capacity to manage a plant-forward transition – couples with more flexible leadership styles anticipated less tension should they or their partner adopt a plant-forward diet (Gregson & Piazza, 2023 – study 2).

However, this preliminary work is limited in several respects. First, it focused on the *predictions* cohabitating individuals made about how they or their partner would handle a member's dietary transition. It remains to be seen whether relational climate would relate to *actual* dietary practices within the context of animal-product reduction. Second, the study focused exclusively on cohabitating couples (i.e., romantic partners). Here, we considered whether relational climate is an important structural factor by which families, more broadly, manage plant-forward transitions.

The present study concerns itself with how the relational climate of a family system shapes its response to a member's transitioning to a plant-forward diet, and how this response—unfolding over time—modulates the person's long-term commitment to the dietary transition. The overarching aim was to explore the relationship between the relational climate of family systems and how this relates to the maintenance of plant-forward commitments. The study employed a longitudinal design, with four data collection phases: (1) a baseline survey (baseline), (2) a 14-day phase of smartphone-based experience sampling (testing phase), (3) an outtake survey (outtake), and (4) a 2-week follow-up survey (two-week follow up). There was no experimentally manipulated condition. At baseline, participants were profiled on the flexibility and cohesion of their family system, and the reported dietary harmony of their family system. During the testing phase, participants reported their daily animal-product consumption, and the extent to which they felt their dietary goals were supported by their family, coordinated with them, and led to tension. At baseline, outtake, and the two-week follow up, participants completed measures of animal-product consumption, dietary goal achievement, dietary goal commitment, and their "stage of change".

Research questions and hypotheses

Our research was guided by several preregistered research questions and hypotheses (AsPredicted: #100059, available here: https://aspredicted.org/fh2ab.pdf). We submitted a second pre-registered document as a correction to our initial a *priori* power and sample size analysis (AsPredicted: #104275, available here: https://aspredicted.org/mi64f.pdf).

RQ1: How do families respond to a member's plant-forward dietary transition?

Our first aim was largely exploratory. It was to investigate how different families respond and adapt to a member's decision to reduce their consumption of, or abstain from, animal products. Hence, our first research question was: how do families respond to a member's

plant-forward dietary transition? We sought to address this purely exploratory research question through qualitative analysis – specifically an analysis of participants' daily responses to questions about how family members respond to their dietary transition. Given the exploratory nature of this aim, our investigation was not guided by any *a priori* hypothesis, but loose expectations that there might be emerging themes related to moral reactions by family members, invalidation attempts, issues pertaining to coordinating meals, and the use of cohabitation strategies to manage potential conflicts.

RQ2: How does *relational climate* and dietary harmony relate to a transitioning individual's experience of support? Our second aim concerned how *relational climate* – particularly, the cohesion and flexibility of a family unit – and dietary harmony, relate to the transitioning individual's experience of social support, coordination, and tension, and the resultant pursuit of their dietary goals. In relation to this aim, we pre-registered the following research questions and predictions. First, we sought to investigate the relationship amongst our predictor variables, namely, relational climate and dietary harmony. We did this to determine the applicability of family systems theory to research concerning shared consumption practices. Here, we anticipated that *balanced* relational systems – moderately cohesive (Hypothesis 1a) and moderately flexible (Hypothesis 1b) family units would foster greater dietary harmony.

We then sought to determine how our predictor variables – relational climate and dietary harmony – related to our outcome measures, measured both during the phase of experience sampling and later during outtake and follow-up. During an individual's dietary transition, we expected that participants who rated their family as more (a) cohesive and (b) flexible, and who reported (c) greater dietary harmony would perceive their living environment to be more conducive to the pursuit of their dietary goals, specifically, scoring

higher on social support (Hypothesis 2a-c) and co-ordination (Hypothesis 3a-c), and lower on tension (Hypothesis 4a-c).

RQ3: Does the maintenance of a plant-forward diet depend upon received support? Our final research aim concerned the importance of felt social support and coordination for pursuing and maintaining a plant-forward dietary goal. The research question guiding this part of the research was: does the maintenance of a plant-forward diet depend upon received support? We hypothesised that higher felt social support (Hypothesis 5a-d) and social coordination (Hypothesis 6a-d) would result in better outcomes over time (i.e., immediately following the testing phase, and two-weeks later). Specifically, we assessed four different outcomes in the short-term and long-term: (a) animal-product consumption, (b) perceived dietary goal achievement, (c) perceived dietary goal commitment, and (d) "stages of change" progression. We expected experienced social support and coordination to relate to reduced animal-product consumption, and greater goal achievement, commitment, and stage-of-change progression at both assessment points.

Method

Sample recruitment and demographics

Our pre-registered recruitment strategy was to recruit 90 participants. To determine the required sample size for this project, an *a priori* power analysis was conducted using G*Power (3.1). The power analysis was based on a linear multiple regression (fixed model, R^2 deviation from zero) with three predictors (i.e., flexibility, cohesion and harmony). The results indicated that a sample of N=90 would give us 0.95 power to detect a modest effect size (f=0.20) with an error probability of 0.05 (two-tailed test). We were able to recruit a sample of 88 Lancaster University students who met our inclusion criteria. We were forced to stop recruiting just short of our target sample due to time and resource constraints imposed by

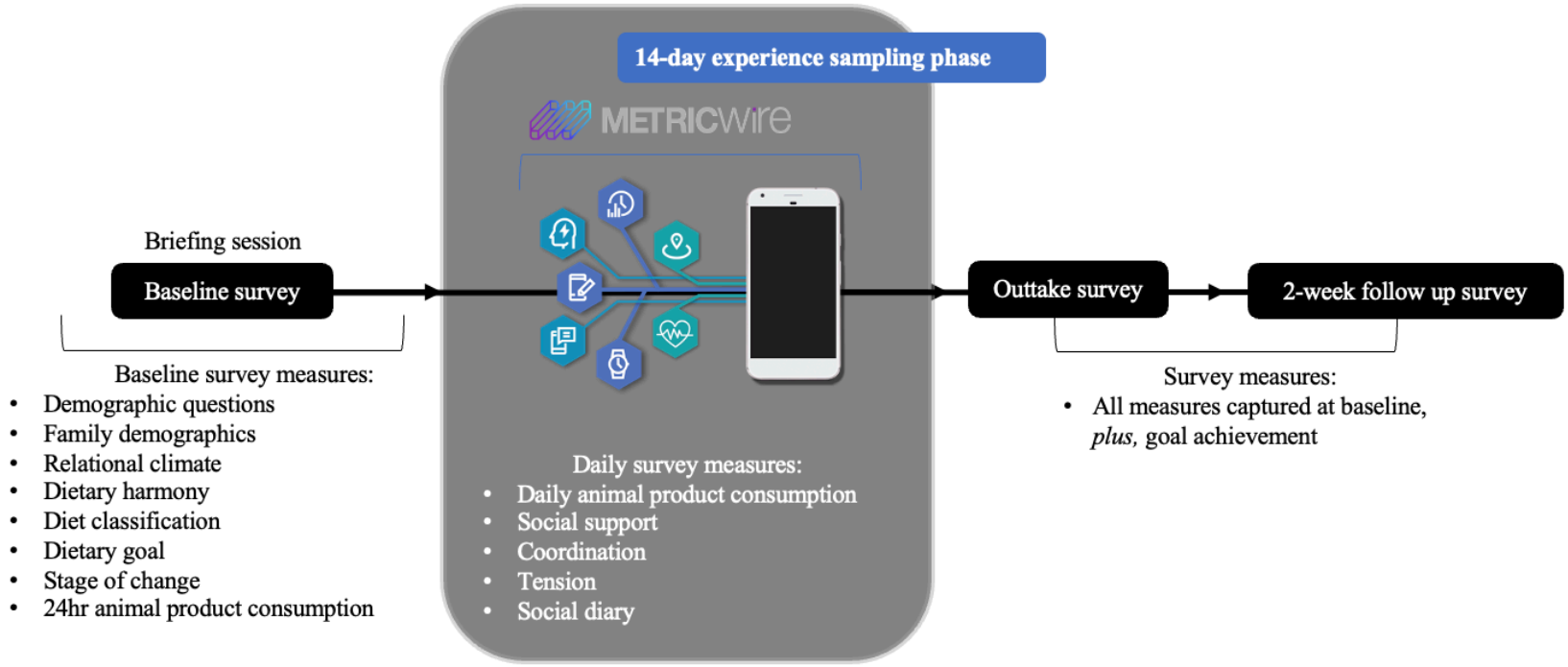
our stringent eligibility criteria. Eligible participants were students at Lancaster University, who were actively trying to reduce their consumption of animal products (incl. meat, fish, dairy and or eggs), and, at the time of testing, were living at home with their family (e.g., outside of term time, during summer and Christmas vacation). In keeping with our pre-registered recruitment strategy, four participants were excluded from analysis for: 1) failing to complete a sufficient number of daily surveys (*n*=3) or having identified as being in the precontemplation stage of behaviour change (*n*=1). Hence, our final sample totalled 84 participants. Although this fell slightly under the pre-registered threshold for 95% power, it was sufficient for providing a substantial amount of power (92%) to detect a medium size effect.

Of the 84 participants, age ranged from 18-46 years (*M*=22.83, *SD*=5.55). Our sample skewed toward female-identified participants (*n*=60, 71.4%), with a further 17 male-identified (20.2%) and seven agender/non-binary (8.3%) participants. With regard to nationality and ethnicity, the vast majority of the sample identified as British (*n*= 59, 70.2%) and White/Caucasian (*n*=61, 72.6%). The sample was predominantly liberal in their political orientation (*M*=2.61, *SD*=1.14), measured on a 7-point Likert scale (1= *extremely liberal*, 7= *extremely conservative*). Participants identified with the following dietary classifications: meat lover (*n*=1, 1.2%), omnivore (*n*=20, 23.8%), semi-vegetarian, flexitarian or reducetarian (*n*=29, 34.5%), pescatarian (*n*=10, 11.9%), lacto- or ovo-vegetarian (*n*=6, 7.1%), strict vegetarian (*n*=9, 10.7%), dietary vegan (*n*=2, 2.4%), and lifestyle vegan (*n*=7, 8.3 %).

Procedure

For an overview of procedures, see Figure 3.1.

Figure 3.1. *Overview of procedures and survey items.*



Participants first attended a ~40-minute briefing session, held over Microsoft Teams. The purpose of the briefing session was threefold. First, to explain to participants the aims of the research and what would be expected of them, were they to agree to take part. Participants were told that the aim of the study was to better understand the relational context in which people transition to diets of reduced animal products (i.e., meat, dairy and eggs).

Second, consenting participants were required to complete a baseline survey that included: demographic questions (*incl*. age, gender, nationality, political orientation, and religious beliefs), family demographics (*incl*. the people who they live with and their dietary patterns), questions about their diet (*incl.* 24hr animal product consumption, dietary classification, dietary goal, commitment to dietary goal, and current stage of change), relational climate, and the dietary harmony of their family.

After completing the baseline survey, all participants were asked to download the MetricWire application (https://metricwire.com/) to their smartphone device. Hence, the third aim of the briefing session was to provide technical support during the installation and setup process. All participants received training on how to use the application, including where, when and how to find and complete the daily survey.

The period of experience sampling commenced the day after the participant enrolled in the study. Participants received one daily survey which opened at 6pm and closed at midnight, every day, for a period of 14-days. During the briefing session, participants were instructed that they should complete their daily survey having eaten their last meal of the day. Participants were prompted to complete the survey with push notifications delivered every two hours. The daily survey was comprised of items assessing: daily food consumption, family support, coordination and tension. In addition to the daily survey, participants

completed a social diary which remained open within the MetricWire app for the duration of the survey, allowing for multiple entries.

Immediately following, and approximately two-weeks after the 14-day period of experience sampling[9], all participants were emailed a survey containing all measures asked at baseline, plus additional questions about their goal achievement.

Materials

Baseline survey

Family composition. To assess the overall composition of participants' family systems, participants indicated with whom they currently lived with, from the following multi-choice options: parents/guardians (*n*=60, 71.4%), single parent/guardian (i.e., mother or father, *n*=8, 9.5%), step-parent (*n*=2, 2.4%), sibling(s) (*n*=46, 54.8%), grandparent(s) (*n*= 5, 6%) and other (*n*=7, 8.3%). Thus, the majority of participants were living with at least one parent or guardian and/or a sibling. Participants also indicated the typical eating patterns of the people whom they lived with, by selecting one of the two options (developed for this study): 1) *all of the people I currently live with eat an omnivorous diet (i.e., they eat meat and other animals products, like dairy and/or eggs)* (*n*=65, 77.4%), or 2) *not all of the people I live with eat an omnivorous diet (i.e., some exclude meat, and/or dairy and/or eggs)* (*n*=21, 22.6%). Those who selected option two further identified which family member followed a non-omnivorous diet and they classified the person's diet via a text response. Participants received the following guidance: "For example you might write: My mother, she is a pescatarian. My dad is a semi-vegetarian."

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[9]Average completion time between baseline and outtake was *M*=20.08 days (*SD*=7.41, *min*=15, *max*=62). Between the outtake and the two-week follow-up, average completion time was *M*=15.65 days (*SD*=3.11, *min*=10, *max* =28). Overall, between baseline and two-week follow-up, average completion time was *M*=35.73 days (*SD*=8.59, *min*=29, *max*=80).

Relational climate. Relational climate of participants' family system was assessed using the FACES-IV Scale, a highly valid and reliable scale (Olson, 2011). Participants read 42 statements and rated their level of agreement or disagreement on a 7-point Likert scale (1 = *strongly disagree,* 7 = *strongly agree*). Twenty-one items each comprised the cohesion and flexibility scales. The two scales are further broken down into three subscales of seven items to measure balanced cohesion (e.g., *"*We have a good balanced of separateness and closeness*"*), disengaged cohesion (e.g., *"*We mainly operate independently*"*), and enmeshed cohesion (e.g., *"*We feel pressure to spend most free time together*"*); balanced flexibility (e.g., *"*We are able to adjust to change when necessary*"*), rigid flexibility (e.g., *"*Our family becomes frustrated when there is a change in our plans or routines*"*), and chaotic flexibility (e.g., *"*We feel hectic and disorganized*"*). All subscales returned satisfactory reliability (α= .72-.93). For a full list of the FACES-IV Scale items, please see Supplementary Materials A. Following Olson (2011), overall cohesion and flexibility scores were calculated by summing the balanced score with the average of the unbalanced scores (see formula below). Conceptually this produces a ratio score, which compares the relative amount of balanced versus unbalanced characteristics in a family system, with higher scores indicating more balance.

$$Cohesion = Balanced + \frac{(Disengaged - Enmeshed)}{2}$$

$$Flexibility = Balanced + \frac{(Rigid - Chaotic)}{2}$$

Dietary harmony. To measure the extent to which participants' eating habits are generally harmoniously aligned within their family, participants responded to a three-item

measure of harmony, adapted from Gregson and Piazza (2023). Participants were asked: "How harmoniously would you say you perform the following activities together?" with regard to the following activities: *shopping*, *cooking* and *eating*, on a 7-point Likert scale (1 = *not at all harmoniously,* 7 = *very harmoniously*). These items were aggregated to form an index of *harmony* (α = .74), with higher scores indicating greater harmony.

Current dietary classification, dietary goal, dietary commitment, and stage of change. Current dietary classification was assessed using an eight-item scale (Piazza et al., 2018), which included the following single-choice options: (1) meat lover (*I prefer to have meat in all or most of my meals)*, (2) omnivore (*I eat meat and other animal products, like dairy and/or eggs)*, (3) semi-vegetarian or reducetarian (*I eat meat, but only on rare occasions or only certain types of meat*), (4) pescatarian (*I eat fish and/or seafood, as well as dairy products and eggs, but no other meat*), (5) lacto- or ovo-vegetarian (*I eat dairy products and/or eggs, but no meat or fish*), (6) strict vegetarian (*I eat no animal products, including dairy and eggs, but would not consider myself full vegan*), (7) dietary vegan (*I eat no animal products, including dairy, eggs, honey, gelatin, etc.*) and (8) lifestyle vegan (*I never consume any animal products, and avoid all non-food animal products, including leather, silk, wool, cosmetics containing animal ingredients, etc*).

To assess which dietary practice participants were currently striving towards, participants selected which dietary classification that "they were currently striving towards" from the same list as before. Twenty-six participants indicated they were striving to be flexitarian or reducetarian (31%), nine pescatarian (10.7%), 18 lacto- or ovo-vegetarian (21.4%), 13 strict vegetarian (15.5%), eight dietary vegan (9.5%) and ten lifestyle vegan (11.9%). Additionally, participants were asked to indicate their reasons for striving for this new dietary goal, using the following options: animal welfare (*n*=50, 59.5%), environmental (*n*=63, 75%), social justice (*n*=22, 26.2%), health (*n*=50, 59.5%), personal challenge (*n*=12,

14.3%) or other (*n*=7, 8.3%). Participants selected all options that applied to them.

Participants also answered questions (developed for this study) regarding the duration of their goal pursuit and number of attempts: "How are you working towards this dietary goal or identity?" with options: *gradually, over many months* (*n*=28, 33.3%), *somewhat gradually*, *over many weeks or a few months* (*n*=29, 34.5%), *somewhat fast*, *over a few days or weeks* (*n*=14, 16.7%) or *very fast overnight change or quit "cold turkey* (*n*=13, 15.5%); "Have you tried to reduce your animal-product consumption before (i.e., made a previous attempt prior to the current one)?" with options: Yes (*n*=51, 60.7%) or No *(n* = 33; 39.3%). Regarding their commitment to their dietary goal, participants answered, "How committed are you to this dietary goal or identity?" using a 7-point Likert scale (1 = *not committed at all* and 7 = *highly committed*).

To understand where participants were with regard to their stage of behavioural change, and to be able to identify any progression along these stages, we had participants complete an adapted version of Bamberg's (2007, 2013a, 2013b) stage-screening tool. This instrument asks participants to indicate which stage of change, from the Transtheoretical Model (Prochaska & DiClemente, 1983), they perceived themselves to be at (at that point in time) with regards to their dietary goal: (1) *precontemplation*, (2) *contemplation*, (3) *preparation*, (4) *action*, or (5) *maintenance*. Participants were presented with the following items which mapped onto the stages of change: (1) "I am not currently reducing my consumption of animal food products (e.g., meat, eggs, dairy), and I don't intend to do so" (as pre-registered, selecting this first option led to exclusion); (2) "I am not currently reducing my consumption of animal food products, but I sometimes think about it"; (3) "I'm ready to reduce my consumption of animal food products, but I have not yet begun to do so"; (4) "I am currently reducing my consumption of animal food products in some way, but I've only been doing this for a short period of time"; (5) "I am currently reducing my consumption of

animal food products in some way, and I have maintained this behaviour for a while". Participants indicated which option best applied to them.

24hr animal-product consumption. To capture a behavioural measure of animal-product consumption, participants were asked to complete a 24hr food consumption survey, adapted from Piazza et al. (2022). They were asked: *"In the past day, how many times did you consume the following foods?"* It was specified that the "past day" referred to everything that the person had eaten yesterday, from the moment they woke up until the moment they went to sleep. They selected from a list of 17 foods, which included: (1) pork, (2) dairy, (3) beans, (4) beef, (5) other meats, (6) chicken, (7) turkey, (8) fish, (9) shellfish, (10) pasta, (11) egg, (12) bread, (13) fruit, (14) vegetables, (15) rice, (16) meat alternatives, (17) dairy alternatives. For each category, participants indicated on a 0-6 scale from "0" to "5 or more", how many meals or snacks had contained each of these foods. Of the 17 items that participants rated, we were interested in 9 animal-derived food products. These included: (1) pork, (2) dairy, (4) beef, (5) other meats, (6) chicken, (7) turkey, (8) fish (9) shellfish and (11) egg. To calculate a 24hr animal-product consumption variable we summed the number of animal products consumed, relative to those that the participant specified they were trying to reduce. For participants pursuing a semi-vegetarian or lacto- or ovo-vegetarian diet, this included all meat and fish/shellfish products. For participants pursing a pescatarian diet, this included meat products only. For participants pursuing either a strict vegetarian, dietary vegan, or lifestyle vegan diet, this included all nine animal products.

Daily survey

Daily animal-product consumption. Each day, during the experience sampling phase of the study, participants were asked to indiciate if they had eaten breakfast, lunch and dinner (e.g., *"Did you eat breakfast today?"*), on a binary Yes/No scale. If they selected "yes", they were provided a list of 17 food items (as in the 24hr food consumption survey)

and asked to select all food elements consumed in that specific meal. The daily animal-product consumption variable was computed in the same way as the 24hr animal-product consumption (see above), with scores for each of the three meals summed to create a single daily total.

Social support. To assess the extent to which participants felt supported by their family in their pursuit of a plant-forward diet, they completed two items: "How accommodating was your household toward your dietary goal? on a 5-point Likert scale of accommodation (1 = *not at all accommodating*, 5 = *highly accommodating*) and "How socially supported have you felt in achieving your goal today?" on a 5-point Likert scale of difficulty (1 = *not at all supported*; 5 = *very supported*). These two items, which were developed by the research team, were aggregated to form an index of *social support* (r = .71), with higher scores indicating greater support.

Coordination. To assess the extent to which participants felt that their eating habits were coordinated with that of their families, they completed two items adapted from Gregson and Piazza (2023): "To what extent were your eating activities (shopping, cooking, eating) aligned with your household? on a 5-point Likert scale of alignment (1 = *not at all aligned*, 5 = *highly aligned*); "How easy was it to co-ordinate your eating activities with your household?" on a 5-point Likert scale of difficulty (1 = *extremely difficult*; 5 = *extremely easy*). These two items were aggregated to form an index of *coordination* (r = .58), with higher scores indicating greater coordination.

Tension. To assess the extent to which participants felt that the pursuit of their dietary goal was a source of friction in the household, they responded to a single item, adapted from Gregson and Piazza (2023): "To what extent did your eating activities cause tension in your household?" on a 5-point Likert scale of tension (*1 = caused no tension, 5 = caused a lot of tension)*. Higher scores on this item indicating greater tension.

Social diary. Using Ecological Momentary Assessment (EMA; Shiffman et al., 2008), participants were encouraged to write about as many social- and food-related events as they wish, in the moments after the event has occurred. All participants were prompted with the following text: *"We are interested to know more about how your household responded to your eating activities today. Please write about the encounters that you had with people specifically around food. Write as much as you like and at least 70 words. Include who you were with, what happened, and how you felt."*

Outtake and follow-up

Goal achievement. In the outtake and two-week follow-up surveys, participants answered a single item developed by the authors to measure goal achievement: "How successful have you been in working towards this dietary goal/identity?" Success was assessed on a 7-point Likert scale (*1= not at all successful, 7 = very successful*) with higher scores indicating greater achievement. For descriptive purposes participants were also asked several exploratory questions about their commitment to their dietary goal. First, they were asked: "Are you still working towards this goal?" with binary Yes/No options. Second: "Has this goal changed at all over the course of the study?" again, with binary Yes/No options. Participants who indicated that their goal had changed were also asked: "How has your goal changed? Has your goal advanced forward or regressed backwards?". Here, participants could indicate either that their goal had advanced forward (*I am aiming to reduce my consumption of animal-derived food products even more*) or regressed backward *(I am aiming to be less restrictive when it comes to my consumption of animal-derived food products).*

Analysis plan

Anonymized data files, as well as all Supplementary Materials can be accessed via OSF here: https://osf.io/kty4a/.

RQ1. To address our first research question, regarding how families respond to a member's animal-product reduction, we drew on the qualitative data collected during the testing phase of the study. We acquired a total of 540 qualitative responses, where participants explained how their family members were responding to their dietary transition, and how the family system sought to resolve any such conflicts. These data were independently coded by two trained blind coders – see Supplementary Materials B for further detail regarding the development of the coding scheme. The coding scheme, which can be viewed in Table 3.1 included the following broad category themes: support, tension, nature of family response, conflict resolution strategies and cohabitation strategies. Inter-rater agreement across all codes was moderate-to-strong (κ = .59-.99) and significantly different from zero ($ps < .001$).

Table 3.1. *Qualitative code scheme – labels and descriptors.*

Category	Code	Description
Support	Absence (0)	The participant reports a lack of support
	Presence (1)	The participant reports feeling supported
	No mention (2)	The participant's entry does not mention support
Tension	Absence (0)	The participant reports a lack of tension
	Presence (1)	The participant reports the presence of tension
	No mention (2)	The participant's entry does not mention tension
Nature of family response (0,1)	Dismissal	Family/partner fails to show appropriate consideration
	Antagonism	Family members display active hostility or opposition directed at the participants plant-forward diet
	Logistical concerns	Family expresses concern over the impracticalities of the participant's plant-forward diet
	Wellbeing concerns	Family expresses concern over participant's health and the nutritional quality of plant-forward eating
Conflict resolution strategies (0,1)	Positive problem solving	Collective compromise and negotiation (i.e., making concessions to accommodate the participant)
	Conflict engagement	Participant engages in family antagonism (e.g., personal attacks and losing control)
	Withdrawal	Refusing to discuss the issue further, or distancing oneself from the conflict
	Compliance	Participant gives in to the social norm, and not defending one's position
Cohabitation strategies (0,1)	Temporal strategies	Time as a means for ensuring harmony (e.g., eating at separate points in time)
	Spatial strategies	Space as a means for ensuring harmony (e.g., eating at different places in the house)
	Substitutions	Swapping or substituting animal product (e.g., with another animal product, or plant-alternative)

Notes. "(0,1)" connotes presence (1) and no mention (0)

RQ2. To address RQ2**,** concerning how relational climate and dietary harmony, relates to the family system's response including their support, coordination and tension, we conducted several analyses. First, we ran correlation analysis to determine the relationship between all predictor and all dependent variables measured during the experience sampling phase of the study. This analysis provided a complete picture of the relationship between all variables and helped to address our second research question, and Hypotheses 1a-b, concerning the relationship between our predictor variables - relational climate and dietary harmony.

To address hypotheses 2a-4c we used the lme4 package (Bates et al., 2014) in R Core Team (2014) to run a series of mixed effects linear models, modelling the fixed effects Cohesion, Flexibility and Harmony as independent predictors of our repeated-measures outcome variables: social support, coordination and tension. Where our hypotheses around the relational climate variables were upheld, we conducted further exploratory analysis investigating the cohesion (i.e., balanced, disengaged, enmeshed) and flexibility subscales (i.e., balanced, rigid, chaotic), using the method of mixed effects linear modelling described here. In all cases, we included a random intercept over Subject and Day variables to accommodate for within-participant variability and variability between days of the experience sampling phase, respectively. The hypothesized model was first tested against an Intercept-only model. Following a stepwise procedure, we eliminated parameters that failed to explain fit. To compare different models, we used likelihood ratio tests, which tests the improvement of model fit (log-likelihood) of a more complex model with a simpler one (Jaeger, 2008). A comparison of models with and without random effects was also performed to examine whether the inclusion of the random effect was justified. The Intraclass Correlation Coefficient (ICC) was used as an index of the amount of variation explained by the random effects (Rabe-Hesketh & Skrondal, 2012).

RQ3. To address our third research question, concerning the importance of felt social support and coordination for pursuing and maintaining a plant-forward dietary goal we conducted a correlation analysis. To test Hypotheses 5a-d and 6a-d, we inspected the relationship between social support, coordination, and tension with (a) animal product consumption, (b) goal achievement, (c) long-term commitment and (d) stage of change reported at both outtake and follow-up.

Results

RQ1: How do families respond to a member's plant-forward dietary transition?

The relative occurrence of qualitative codes are displayed in Table 3.2.

Table 3.2. *Relative presence of qualitative codes by category.*

		Frequency (*n*, %)	
Category	Subcategory	Presence	Absence
Support		296 (54.8%)	97 (18%)
Tension		138 (25.5%)	257 (47.6%)
Nature of family response	Dismissal	72 (13.3%)	-
	Antagonism	64 (11.9%)	-
	Logistical concerns	49 (9.1%)	-
	Wellbeing concerns	19 (3.5%)	-
Conflict resolution strategies	Positive problem solving	75 (13.9%)	-
	Conflict engagement	18 (3.3%)	-
	Withdrawal	16 (3%)	-
	Compliance	69 (12.8%)	-
Cohabitation strategies	Temporal strategies	59 (11%)	-
	Spatial strategies	69 (12.8%)	-
	Substitutions	89 (16.5%)	-

Support. The majority of diary entries indicated that participants were experiencing support from their family during their dietary transition. Of the 540 data points that were collected, coders agreed on 294 (54.4%) instances whereby participant explicitly identified receiving support (e.g., *"I felt supported in my dietary goals"*). This was, understandably, a positive experience (e.g., *"It was lovely to feel supported"*). Support came in many forms, and included family members or partners acknowledging or showing a general intrigue in the participants dietary preference, to physical displays of support, including the trying of the participants foods (e.g., "*Some members of my household are becoming interested in some of the items I bought as vegan alternatives to animal products (e.g. oat milk) and seem to be open to including it in their diet as well. This is really nice to hear!")* and the provision of food (e.g., "*My mum got me vegan croissants for breakfast which was very kind*"). Given that our sample were mostly undergraduate students, who outside of term-time are often financially dependent upon their parent or guardian, the provision of diet-appropriate foods was a particularly valued display of support. There was also particular value placed on receiving support from other vegetarian or vegans in one's social network, which we suspect provides participants with understanding and feelings of acceptance (e.g., *"Tonight I ate dinner with my sisters…one of which is vegetarian and the other who is vegan…I did like the fact that here it was just 'the norm' to have meals without animal products, and felt very supported in my goal"*).

Supportive environments served as a facilitator of plant-forward dietary transitions, making them more attainable and enjoyable. We found that the experience of support from one's family member's helped to boost motivation (e.g., *"It's encouraging when family members want to try out some of your stuff too, and it's a boost to your own motivation"*) and made one's transition feel easier (e.g., *"It's really helpful having a supportive family when attempting to reduce meat consumption because it makes it easier to commit to the idea"*).

Some entries alluded to an increase of felt support over time, possibly due to family member's growing increasingly familiar and comfortable with the transition (e.g., *"it's been a few days now and it seems as though finally everyone in my family friends and family alike have gotten used to my lifestyle diet change and are a lot more supportive"* and *"I feel it is becoming more socially accepted"*). Participants in supportive environments often reported a willingness or openness from members of their family system to try plant-based foods and engage in a similar dietary transition. In many entries, we found evidence of a minority influence; participants influencing the majority in their household to consider reductions in their own consumption (e.g., *"I talked today with my mother about…what I was planning on achieving…she seemed pretty supportive and wanted to do the same, and it made me feel better"*).

Tension. Entries whereby participants identified an incidence of tension were much less prevalent. Of the 540 data points that were collected, coders agreed on 137 (25.4%) instances whereby participant explicitly identified a point of tension (e.g., *"Today it was a tense day. Lots of negative comments about my food"*). Where participants reported tension, we found that in most cases, this related to concerns over the individual's wellbeing and the logistics of catering for plant-forward diets. Members of the individual's family system expressed concern over abstaining from animal products, which were seen as essential for a nutritional and balanced diet. Most concerns hinged around the access to essential nutrients, which are commonly perceived to be most readily available in animal derived food products (e.g., protein from meat, and calcium from dairy). Family members would express concern that plant-based alternatives were insufficient in providing these nutrients (e.g., *"My father was worried about me getting protein deficit"*), particularly in cases where the participant reported a pre-existing health issue (e.g., B12 deficiency, anaemia). Though many participants recognised that their family's concern were well-meaning, comments about their

wellbeing were perceived as demeaning, and led to discomfort. We found evidence that such discomfort may cause individuals who are reducing or abstaining from animal products to be less open with their family about health issues they may be facing, for fear of a dismissive response (e.g., *"I feel like I can't even fully talk to her about it or tell her how much me losing hair worries me or even ask for help on what to do because she'd just blame it on me being vegetarian, as everyone's done in the past"*).

Concerns around the logistics of catering for an individual seeking to reduce or eliminate their consumption of animal foods, were also prevalent. These concerns centred around the added financial cost of sourcing alternative products (e.g., *"they continued to suggest that being veggie and/or vegan was so much more expensive"*), and the additional time and energy required to source alternative products and prepare extra meals. Family members would express that it would be easier if the individual transitioning just complied with the norm (e.g., *"discussions about dinner plans did include throwaway comments that it would be easiest if I just joined the family"*) requests which can be particularly damaging to one's goals (e.g., *"I was told that if I wanted a vegetarian option, I had to do it separately…so to make life easier, I just ate with them instead."*). These requests for compliance were often paired with antagonistic remarks, and questions over the reasons for the individuals' transitions (e.g., "*My family made some comments about my change as today they had to mix in my meat alternative separately. They commented on their annoyance about having to do this and that they didn't really understand why I wanted to be veggie. They also asked if I could just eat meat when we do group meals"*). Such concerns were often averted with careful planning (e.g., *"My parents are happy to eat some vegetarian meals however it is usually more helpful for us to have thought of alternatives in advance"*), the onus of which was often placed on the transitioning individual (e.g., *"My parents will buy vegetarian foods for me…as long I organize it"*).

In a minority of cases, tension related to out-right antagonism (e.g., "*today we were invited to my aunts, they didn't include any vegan or vegetarian options and they questioned my eating"*). Antagonistic reactions were typically less common amongst flexible relation systems, $r_{pb}(520) = -.104$, $p = .018$, and more common amongst unbalanced relational systems, for example, those with disengaged, $r_{pb}(520) = .09$, $p = .044$, and chaotic, $r_{pb}(520) = .09$, $p = .039$, relational styles. Many of these instances included family members, typically male-family members, siblings or extended family members, teasing the individual for their dietary choices (e.g., *"remarks about eating differently as a joke are very common"*). Some participants made light of the teasing (e.g., *"It's not a big deal. The jokes don't bother me"*), however, in others this caused feelings of anger (e.g., *"I felt irritated"*), sadness (e.g., *"I was upset and felt judged"*) and guilt (e.g., *"it makes me feel like I should feel guilty about my own food choices"*). And, although it was uncommon, there were a few instances where the transitioning individual reported engaging in direct conflict (e.g., *"we fought about food today"* and *"had a debate with my uncle… the conversation was hostile"*). Instances of conflict engagement were negatively associated with flexible family systems, $r_{pb}(520) = -.114$, $p = .009$.

Dismissive reactions to the individual's dietary preferences were made most apparent with the provision of inappropriate foods (e.g., *"It was revealed today that I was unknowingly given a meal with meat in"*). This created a particularly tense situation when the food provided was considered a "family-favourite" or of cultural significance (e.g., *"a traditional pork dish"*). In these instances, individuals reported facing a moral dilemma, a situation in which they felt able to honour just one of the following moral duties: 1) upholding their vow to reduce their consumption of animal products, or 2) displaying loyalty and allegiance with their loved ones (e.g., *"felt guilty for wanting to eat it, felt guilty at the thought of not eating it since he made all this effort"*). Oftentimes, in these situations, the

individual reported succumbing to the social pressure and compromising their moral values pertaining to food (e.g., *"I ended up eating it and feeling even guiltier"*).

Conflict resolution. Participants were clearly mindful of the benefits of achieving harmonious co-ordination with their families, and as such, actively sought to avoid tension. Hence, we found evidence of participants engaging with conflict resolution or cohabitation strategies, even in the *absence* of tension. For example, many reported complying with the wider social norm (i.e., to consume animal products) in order to appease any *potential* tensions (e.g., *"I cannot in good conscience try and ask my family to make a completely different set of meals with restricted ingredients just for myself, which would not only disrupt the process of obtaining/cooking the food but also the eating experience"*). Note here that the perceived disruption is twofold: a disruption to the physical act of preparing food, and to the experience of sharing food. This anticipation of social tension and compliance was particularly apparent when eating with others outside of their immediate family system e.g., with extended family, and particularly amongst those reducing their consumption of animal foods as opposed to vegan individuals. Though compliance alleviated any potential social tensions, it was, of course, particularly damaging to one's diet-related goals (e.g., *"it's particular disheartening to know that my own wishes will always be subsumed by the family's larger intentions"*).

Participants employed a range of cohabitation strategies that were used to resolve either *anticipated* or *materialised* tensions. Co-habitation strategies included the strategic use of time and space to cook and/or eat separate from one another. Many participants reported that the experience of eating plant-based meals was easier, in the absence of having to co-ordinate with anyone else in the house (e.g., *"My parents were out at work all day so our mealtimes did not coordinate. This made having plant-based meals slightly easier as I didn't have to substitute anything"*). When others are present, a common approach was to separate

the cooking process, but try to retain time for shared eating (e.g., *"Breakfast and lunch made separately at home today, so no issues with family. For dinner we cooked separate meals but ate together."*). Cooking separately but eating together was clearly aided by the availability of animal product alternatives (e.g., *"I find that easy switches like dairy alternatives tend to make shopping communally a lot easier."*). Though many engaged in these practices, there were concerns over the downsides of such a solution (e.g., *"today I was meant to eat with my family but needed to make my own food. it's annoying to have to make a separate meal considering eating together and cooking is meant to be a social event but sometimes feels like it divides us").* Others actively trying to avoid this approach to eating (e.g., *"Today it was more difficult to agree what to eat with parents because we want to avoid separate cooking"*). Hence, though such temporal and spatial strategies may ease the co-ordination issues faced when a family system is required to cater for varying dietary preferences, this may come at a cost to the very experience of eating together.

Instances of positive problem solving were more commonly reported amongst cohesive relational systems, $r_{pb}(520) = .135$, $p = .002$, and less so amongst those with a disengaged, $r_{pb}(520) = -.109$, $p = .013$, or enmeshed relational style, $r_{pb}(520) = -.177$, $p < .001$. A desire to uphold harmony, encouraged some families to engage in advanced planning of mealtimes (e.g*., "planned some meals together in advance of the weekend"*) which was considered a successful way to avert mealtime conflicts. Typically, advanced mealtime planning was a strategy exercised by individuals who were solely responsible for food provision and preparation (e.g., partners, or parents). On the contrary, when the divergent individual was passive in the food preparation process, they were often reliant upon a supportive family member accommodating them in their mealtime preparations. In these cases, positive problem solving entailed a high degree of consideration and compromise on the families behalf (e.g., *"they* [parents] *accommodate different food preferences for different*

family members"). Commonly this resulted in families either mimicking the eating habits of the divergent individual (e.g., *"my parents were supportive…and said they would also try eating vegetarian five days a week"*) or preparing a dish that was centred around a vegetarian or vegan-friendly core, to which individuals could optionally add animal-derived or plant-based alternative products (e.g., *"we had fajitas for tea, which can be easily made veggie, my family had chicken and I had veg"*). Such an adaptive response is further evidence of families' effort to achieve harmony and accommodate diverse eating practices.

RQ1 Interim conclusion. Our qualitative analysis suggests that the majority of social interactions between the participant and their family were overtly positive. Participants reported experiencing support in many forms, including social validation (i.e., acknowledgement) and enactment (i.e., tangible assistance). The experience of being supported by one's family had clear facilitative effects on one's dietary transition, including feelings of elevated motivation and ease. Active conflict was much less common and mostly related to logistic and wellbeing concerns, though the dismissal of the divergent member's dietary preferences was a clear issue too. Unbalanced relational systems (i.e., disengaged, chaotic and rigid) were implicated in the small minority of antagonistic scenarios that were reported. However, it could be argued that the relative lack of conflict interactions reflects participants' preoccupation with managing the *potential* disruption that their dietary transition could generate. Indeed, the results suggest that participants were engaged with conflict resolution (i.e., compliance) and/or cohabitation strategies (e.g., temporal, and spatial) even in the *absence* of tension. Family systems were clearly engaged in managing tension to uphold harmony, with compromises and accommodations made on both sides.

RQ2: How does *relational climate* and dietary harmony relate to a transitioning individual's experience of support?

The results of our exploratory correlation analysis (see Table 3.3), revealed that more cohesive and flexible family environments, reported greater dietary harmony. Specifically, more balanced relational systems, both in terms of cohesion and flexibility reported significantly greater dietary harmony. In contrast, systems higher in *disengaged* cohesion and *chaotic* flexibility report significantly lower dietary harmony. Hence, Hypothesis 1a-b, the prediction that that *balanced* relational systems (i.e., moderately cohesive, and flexible family units) would foster greater dietary harmony, was upheld. As such, we were assured of the applicability of family systems theory to the study of shared food practices.

Table 3.3. *Correlation analysis observing the relationship between relational climate, dietary harmony and outcome variables measured during the experience sampling phase of the study (i.e., social support, dietary coordination and dietary tension).*

	1.	1a.	1b.	1c.	2.	2a.	2b.	2c.	3.	4.	5.	6.
1. Cohesion	-	.74**	-.32**	-.38**	.26**	.39**	-.14**	-.06	.33**	.26**	.08*	-.06
1a. Balanced		-	-.75**	.15**	.45**	.54**	-.00	-.16**	.57**	.19**	.24**	-.07*
1b. Disengaged			-	.02	-.47**	-.51**	.03	.30**	-.59**	-.18**	-.30**	.13**
1c. Enmeshed				-	.03	-.03	.26**	.08*	.04	-.16**	.06*	.09**
2. Flexibility					-	.83**	.42**	-.70**	.41**	.04	.21**	-.01
2a. Balanced						-	.02	-.30**	.47**	.19**	.28**	-.06*
2b. Rigid							-	-.26**	-.07*	-.22**	-.08*	.15**
2c. Chaotic								-	-.23**	.06	-.08*	.04
3. Dietary Harmony									-	.23**	.36**	-.17**
4. Support										-	.44**	-.27**
5. Coordination											-	-.19**
6. Tension												-

Notes. **correlation is sig at .01 level, *correlation is sig at .05 level. Df=1042.

Social support. When modelling social support, the model which included Subject as a random effect outperformed a model without this random effect, $X^2(1) = 488.23$, $p < .001$, thus justifying its inclusion. The inclusion of Day failed to improve fit, and thus was not included, $X^2(1) = .0586$, $p = .04$. The full model showed improvement on the Intercept-only model, $X^2(3) = 11.60$, $p < .001$. However, disconfirming Hypothesis 2b, Flexibility did not contribute significantly to the full model and was thus removed, $\beta = 0.04$, SE = -0.01, $t = -0.99$, $p = .32$, 95% CI [-0.03, 0.01]. We subsequently ran a simpler model without the inclusion of Flexibility, which in turn, reduced the effect of Harmony, $\beta = 0.12$, SE = 0.07, $t = 1.83$, $p = .07$, 95% CI [-0.01, 0.26]. Thus, we ran a simpler model which included the fixed effect of Cohesion only, and this improved fit, $X^2(1) = 7.17$, $p < .001$. Table 3.4 presents the estimate for the Intercept-only model and the best-fit model. The best-fit model indicated that, participants from more cohesive families, felt more supported during their dietary transition, $\beta = 0.04$, SE = 0.02, $t = 2.70$, $p = .01$, 95% CI [0.01, 0.07], thus, confirming Hypothesis 2a. Hypotheses 2b and 2c were not upheld.

Table 3.4. *Estimates for the Intercept-only and best-fit model of social support.*

	Intercept-only				Best-fit model			
Fixed Effects	Estimate	*SE*	t	*p*	Estimate	*SE*	*t*	*p*
Intercept	4.07	.08	48.56	<.001	2.41	.62	3.89	<.001
Cohesion					.04	.02	2.70	.01
Random Effects	Variance	*SD*			Variance	*SD*		
Subject	.55	.74			.51	.71		

Notes. 1042 observations, 84 Subjects. *Pseudo-R^2* (Best-fit model) = .55. The random effect had an ICC of .52.

Given that Hypothesis 2a had been upheld, we decided to further explore the relationship between cohesion and social support and engaged in an exploratory analysis investigating the relationship between the three subscales of cohesion (i.e., balanced, disengaged and enmeshed) and social support. Furthermore, results from an earlier correlation analysis (See Table 3) had revealed a significant positive relationship between balanced cohesion and social support, and a significant negative relationship between disengaged, and enmeshed cohesion and social support. Accordingly, we followed up with further mixed-effects modelling. The full model included fixed effects of: Balanced, Disengaged and Enmeshed Cohesion. We additionally added Subject and Day as random effects. The model which included Subject as a random effect outperformed a model without this random effect, $X^2(1) = 496.59$, $p < .001$, thus justifying its inclusion. However, the inclusion of Day failed to improve fit, and thus was not included, $X^2(1) = .059$, $p = .04$.

The full model showed improvement on the Intercept-only model, $X^2(3) = 9.75$, $p = .02$. However, Disengaged, $\beta = -0.00$, SE = 0.02, $t = -0.04$, $p = .97$, 95% CI [-0.03, 0.03], and Balanced Cohesion, $\beta = 0.03$, SE = -0.02, $t = 1.58$, $p = .12$, 95% CI [-0.01, 0.61], did not contribute significantly to the model. Dropping Disengaged Cohesion, resulted in the effect of Balanced Cohesion reaching a threshold of significance, and an improved model fit, $X^2(2) = 9.75$, $p < .001$. We ran a simpler model, dropping Balanced Cohesion and retaining the fixed effect of Enmeshed Cohesion only, however, this did not improve fit, $X^2(1) = 5.143$, $p = .02$. Hence, the best-fit model retained both Balanced and Enmeshed Cohesion and indicated that, balanced cohesion fosters greater social support, $\beta = 0.03$, SE = 0.01, $t = 2.54$, $p = .01$, 95% CI [0.01, 0.05], where enmeshed cohesion hampers support, $\beta = -0.03$, SE = 0.01, $t = -2.26$, $p = .03$, 95% CI [-0.05, 0.00].

Dietary coordination. When modelling dietary coordination, the model which included Subject as a random effect outperformed a model without this random effect, $X^2(1)$

= 306.226, p <.001, thus justifying its inclusion. The inclusion of Day failed to improve fit, and thus was not included, $X^2(1) = 2.66$, $p = .01$. The full model showed improvement on the Intercept-only model, $X^2(3) = 24.11$, p <.001. However, Flexibility, β = 0.01, SE = 0.01, t = 1.12, p = .26, 95% CI [-0.01, 0.03], and Cohesion, β = -0.01, SE = 0.02, t = -0.99, p = .32, 95% CI [-0.04, 0.02], did not contribute significantly to the model and were removed. Thus, we ran a simpler model which included the fixed effect of Harmony only and this improved fit, $X^2(1) = 22.07$, p < .001. Table 3.5 presents the estimate for the Intercept-only model and the best-fit model. The best-fit model indicated that, participants from more harmonious families, report greater coordination during their dietary transition, β = 0.04, SE = 0.02, t = 2.70, p = .01, 95% CI [0.18, 0.42]. Hence, Hypothesis 3c, that families who report greater levels of dietary harmony would also report greater coordination, was upheld. Hypotheses 3a and 3b were not supported.

Table 3.5. *Estimates for the Intercept-only and best-fit model of coordination.*

	Intercept-only				Best-fit model			
Fixed Effects	Estimate	*SE*	t	*p*	Estimate	*SE*	*t*	*p*
Intercept	3.83	.09	44.86	<.001	2.32	.31	7.39	<.001
Harmony					.30	.06	4.98	<.001
Random Effects	Variance	*SD*			Variance	*SD*		
Subject	.56	.74			.42	.64		

Notes. 1042 observations, 84 Subjects. *Pseudo-R^2* (Best-fit model) = .46. The random effect had an ICC of .39.

Dietary tension. When modelling dietary tension, the model which included Subject as a random effect outperformed a model without this random effect, $X^2(1) = 158.75$, p <.001,

thus justifying its inclusion. The inclusion of Day failed to improve fit, and thus was not included, $X^2(1) = 0.28$, $p = .60$. The full model showed improvement on the Intercept-only model, $X^2(3) = 7.62$, $p = .05$. However, Flexibility, β = 0.01, SE = 0.01, $t = 0.99$, $p = .33$, 95% CI [-0.01, 0.02], and Cohesion, β = -0.00, SE = 0.01, $t = -0.33$, $p = .74$, 95% CI [-0.03, 0.02], did not contribute significantly to the model and were removed. Thus, we ran a simpler model which included the fixed effect of Harmony only and this improved fit, $X^2(1) = 6.57$, $p < .001$. Table 3.6 presents the estimate for the Intercept-only model and the best-fit model. The best-fit model indicated that, participants from more harmonious families reported lower levels of tension between family members, during their dietary transition, β = -0.13, SE = 0.05, $t = -2.59$, $p = .01$, 95% CI [-0.22, -0.03]. Hence, Hypothesis 4c, that families who report greater levels of dietary harmony would also report lower levels of dietary tension, was upheld. Hypothesis 4a and 4b were not supported.

Table 3.6. *Estimates for the Intercept-only and best-fit model of tension.*

	Intercept-only				Best-fit model			
Fixed Effects	Estimate	*SE*	t	*p*	Estimate	*SE*	*t*	*p*
Intercept	1.52	.06	424.15	<.001	2.15	.25	8.51	<.001
Harmony					-.13	.05	-2.59	.01
Random Effects	Variance	*SD*			Variance	*SD*		
Subject	.27	.52			.25	.50		

Notes. 1042 observations, 84 Subjects. *Pseudo-*R^2 (Best-fit model) = .46. The random effect had an ICC of .26.

RQ3: Does the maintenance of a plant-forward diet depend upon received support?

Correlation analysis (See Table 3.7) revealed a significant negative correlation between social support and daily animal product consumption, suggesting that greater support

is associated with a reduction in the consumption of animal products the individual was seeking to avoid. The relationship between support and animal product consumption held in a regression model, $F(1,1041) = 88.59$, $p < .001$, adj.R^2=.08. In other words, consistent with Hypothesis 5a, increased support from family members was predictive of lower animal product consumption, B= -.29, $t(1041) = -9.41$, $p < .001$, 95% CI [-.34, -.23]. Furthermore, increased social support during the experience sampling phase was also associated with lower animal product consumption at follow up. Again, the relationship between support and animal product consumption held in a regression model, $F(1,966) = 16.59$, $p < .001$, adj.R^2=.02, revealing that increasing support was predictive of lower animal product consumption at follow up, B= -.19, $t(966) = -4.07$, $p < .001$, 95% CI [-.28, -.10].

Table 3.7. *Correlation analysis between experience sampling variables and long-term outcomes.*

	Social support	Coordination	Tension
Daily target product consumption	-.28**	-.06	-.04
SOC Progression (T1-T2)	.08*	.11**	.05
Goal achievement (T2)	.21**	.06*	-.04
Goal commitment (T2)	.09**	.02	-.04
Target product consumption (T3)	-.13**	.04	.25**
Goal achievement (T3)	.23**	.08**	.04
Goal commitment (T3)	.13**	.00	.03

Notes. **correlation is sig at .01 level, *correlation is sig at .05 level.

Increased social support during the experience sampling phase was also associated with greater scores of goal achievement and goal commitment at both outtake and follow up, as well as positive stage progression. Hence, all aspects of Hypothesis 5, that higher felt

social support would be associated with (a) lower animal product consumption, (b) greater dietary goal achievement, (c) greater dietary goal commitment, and (d) greater "stages of change" progression over time, were upheld. Greater coordination during the experience sampling phase was associated with greater scores of goal achievement and positive stage progression, confirming Hypothesis 6b and 6d, but not 6a or 6c. By contrast, greater tension during the experience sampling phase was associated with greater animal product consumption at follow up.

Discussion

Family systems are key sites for change in the strive to achieve sustainable diets (Godin & Langlois, 2021). Yet, psychological research into sustainable diets has most often been studied from an individual decision-making perspective. Accordingly, the present study adopted a family systems approach to identify, in an exploratory manner, the patterns of reactions families have towards divergent members, how the relational climate and dietary harmony of the family modulate this response, and the influence of familial support on long-term maintenance of plant-forward diets. This work advances current knowledge of the social and relational barriers to plant-forward diets in a number of ways. We advanced current knowledge by probing the relational dynamics that modulate how family systems navigate dietary change, and specifically, plant-forward dietary transitions. We adopted a longitudinal design and experience sampling methodology, which allowed for behavioural insights closer to the moment of enactment and over time. This work revealed a number of key findings pertaining to the variable reactions and strategies families utilise to manage the disruption to their shared eating practices when a member makes the decision to eat plant-forward. Additionally, the findings underscore the value of social support and relational cohesion in the maintenance of plant forward diets. Below, we discuss our key findings and their practical application.

Family reactions: Managing disruption and upholding harmony

The fear of negative social consequences (e.g., stigmatisation and exclusion), particularly at the hands of one's primary social unit (e.g., family members and romantic partners), is a well-established barrier to the adoption of plant-forward diets (Markowski & Roxburgh, 2019). Contrary to the dominant literature, the present study found that average daily scores of tensions were low, and instances of conflict were not as commonly reported as one might have anticipated (25.4%). We hope that, for individuals contemplating a plant-forward dietary transition, these findings might, to some degree, help allay concerns about family-based conflict. Of course, individuals who transition to a plant-forward diet may still experience pushback from their primary social groups. The current study suggests that, the degree to which this occurs, is modulated by the relational climate of one's family system. Indeed, tension was more commonly reported by plant-forward dieters from *unbalanced* family systems, specifically those which reported a disengaged or enmeshed social unit, or a family unit with rigid flexibility. This finding coincides with the wider theoretical framework of family systems theory, which posits that balanced, as opposed to unbalanced family systems, make for optimal relational functioning (Olson, 2000) – specifically, with regards to psychological wellbeing and life satisfaction (Szcześniak & Tułecka, 2020).

Family cohesion is defined as the emotional bonding that family members have towards one another. When cohesion levels are too high (i.e., enmeshed) family members are thought to be too dependent on one another, and when too low (i.e., disengaged), attachment or commitment to the family is absent (Olson, 2000). Enmeshed systems restrict personal boundaries and are characterised by an extreme level of emotional closeness. Individuals are thus very dependent on one another and can be reactive to signs of change. As such, in enmeshed family systems, attempting to achieve autonomy over one's eating habits could be taken as a sign of disloyalty and there may be increased pressure to comply with the status

quo. In comparison, disengaged systems are characterised by extreme emotional separateness and an absent sense of togetherness. As such, individuals from *disengaged* relational systems who seek to pursue a plant-forward diet may find that the emotional separateness of their family system means that they are unable to turn to others at home for support. Given the interdependent nature of shared eating habits, this is likely to arouse feelings of exclusion and spark potential tensions at mealtimes.

Family flexibility is the amount of change in its leadership, roles and rules. Flexible relational styles are thus characterized by egalitarian leadership, and a democratic approach to decision-making. When flexibility levels are too high (i.e., chaotic) there may be an absence of family leadership and when too low (i.e., rigid) strict rules may be imposed by a leader (Olson, 2000). Rigid relationships often involve one individual who is in charge and highly controlling (Olson, 2000). In the context of shared eating behaviours, this may be the household's key decision maker when it comes to meal-time preparations and provisions (e.g., a parent). Amidst this relational climate, there tends to be limited negotiation, meaning that there is little to no scope for change in the day-to-day goings on of the family. Hence, amongst rigid family systems, change, including transitions toward plant-forward diets is likely to be uncommon, or met with dismissal and challenge over their decision. Indeed, the need to incorporate deviations from the eating norms of the household undermines the idea that the balance of power, or the food provision responsibilities, reside with one party (Brannen & O'Connell, 2016).

In the present research, we found some evidence of dismissive and even antagonistic responses, as has been reported in previous research (e.g., Twine, 2014). These instances of active conflict engagement often coming from male family members, but also siblings, and members of one's extended family. Male family members, and fathers specifically, are often considered a threat to the dietary aspirations of the family (e.g., see Fielding-Singh, 2017).

This may be especially the case when it comes to reductions of animal products, given that male-identified individuals are more hedonically attached to consuming such foods (Graça et al., 2015; Rothgerber, 2013) and the symbolic potency of meat as masculine (e.g., see Rozin et al., 2012; Salmen & Dhont, 2022; Sobal, 2005). Indeed, in earlier work, hostility, mockery and condemnation is unique to the response of male family members (Merriman, 2010) and male partners have been identified as a particular obstacle to plant-forward dietary transitions in heterosexual cohabiting couples (Gregson & Piazza, 2023 – study 2). Though many of the instances of conflict reported in the present study were described as manageable forms of teasing and innocuous remarks from family members, some instances involved more inflammatory remarks, serious concerns over the individual's wellbeing or challenges to the rationale behind plant-forward diets. This might suggest that individuals considering a plant-forward transition should be prepared to face such comments and be confident in the motivations guiding their decision.

Nevertheless, active conflict was not a common experience amongst our sample. Instead, because participants were preoccupied with managing the *potential* disruption that their dietary transition could have on the family foodways, conflict did not often materialise. This might be because, as revealed in the data, many participants had an underlying goal to limit disruption of the established dietary harmony within the household. In their diary entries, participants reported battling internal conflicts - a moral dilemma in which the individual felt able to honour only one of two moral duties: 1) upholding their vow to reduce their consumption of animal products, or 2) displaying loyalty and allegiance with one's loved ones. Accordingly, participants adopted conflict resolution and/or co-habitation strategies even in the *absence* of active conflict. In terms of conflict resolution, many participants, particularly those who were engaged in a reduction of their consumption of animal products, reported compliance – adhering to the social norms or wishes of the family

system and breaking one's vow to forgo animal products. This ran counter to one's goals and suggests that individuals may worry that asserting their dietary preferences might lead to unwanted conflicts that they feel unable to navigate.

Previous research corroborates this muting of one's plant-based preferences for fear of the social consequences. Bolderdijk and Cornelissen (2021) reported on the *self-silencing* of vegetarian and vegan individuals who concealed their meat-free preferences during social interactions with meat-eaters in order to avoid conflict. They theorised that this intergroup self-silencing by meat avoiders perpetuates the view that vegetarian and vegan diets are niche and represent a minority of individuals – a view which helps to reinforce the stigma associated with such diets. In their paper, Bolderdijk and Cornelissen (2021) discussed the importance of *visible* frontrunners, who challenge the status quo and make like-minded individuals feel comfortable to pursue their own plant-forward transition, thus, paving the wave for others to join in. In this same vein, in the present study, it was found that in some situations, participants who resisted family pressures to comply, at times, encouraged others to consider their own reduction of animal products (see discussion below). As such, frontrunners may be essential for bringing about social change, by gaining momentum for a cause and pushing society closer to crucial tipping points (Nyborg et al., 2016).

When an individual is unwilling to comply with the eating habits of their family, they may develop strategies to ensure separation of eating practices. In the present study, individuals reported adopting cohabitation strategies – manipulating their micro-geographies to ensure the separation of their eating habits from that of their family. This strategic use of time and space to ensure separation was also reported by Twine (2014). Though, different from previous research, participants in the present study reported an appreciation for the negative consequences of withdrawal. Though withdrawal helped participants to facilitate a seamless transition and avoid tension, many respondents recognised it as relationally

maladaptive for it tainted the eating experience and contributed to division. In other words, participants recognised that using separation strategies to avert tension during shared eating practices can be relationally counterproductive. As such, many participants reported trying to avoid withdrawal and disengagement, and wished to adopt a more integrative strategy that would allow for the whole family to eat together in harmony. Thus, it might be argued that, at least in the short-term, withdrawal may be helpful in the face of active antagonism or hostility, and certainly more conducive to a person's goals than compliance. However, it may have its limits as a long-term strategy relative to bolder strategies such as "lead by example", and positive problem solving which engage the family system in careful planning of mealtime preparations.

We found evidence to suggest that social barriers often go hand-in-hand with practical barriers perceived among consumers contemplating a plant-forward transition. These practical barriers concern the *anticipated logistics* of transitioning to a plant-forward diet, including the perceived additional time, energy and cost entailed by preparing plant-based foods (see also Anderson & Milyavskaya, 2022). Such interactions were more commonly reported with the sole food provider of the household, typically a mother-figure (Asher & Cherry, 2015). In the present study, we observed that such social tensions were eased by the availability and convenience of plant-based alternatives. Plant-based alternatives to animal products (e.g., Quorn products) were extremely helpful in mealtime preparations as they provided the individual the opportunity to co-exist with their meat-eating family members at minimal additional cost or energy. Hence, we anticipate that the increasing availability of plant-based alternatives to animal products will allow individuals to assert themselves, which will have positive knock-on effects for how the family respond and for shaping the eating habits of the entire family unit. This further evidence to suggest that the transition to a plant-

based food system will be battle of both *psychological* and *technological* sorts (Bryant, 2022).

The value of social support

A wealth of previous research has painted a rich, descriptive picture of the barriers that may inhibit an individual from adopting plant-forward diets (e.g., see Bryant et al., 2022; Graça et al., 2019 for reviews). Until recently, the literature on meat reduction barriers has been preoccupied with measures of intentions and hypothetical behaviours (Graça et al., 2019). Such an approach may be problematic, given that intentions to change one's behaviour often correlate weakly with measurable behaviour change (Loy et al., 2016; Webb & Sheeran, 2006). Accordingly, a small number of studies have begun adopting experimental designs which allowing for rich behavioural and longitudinal insights (e.g., Piazza et al., 2021; Dakin et al., 2021). In the current study, we adopted smartphone-based experience sampling, an advanced methodological design which allows for longitudinal assessments and rich behavioral insights, closer to the moment of enactment (Wrzus & Neubauer, 2023).

Using these advanced methods, the present study was the first to demonstrate the direct value of daily social support on supporting *real behavioral outcomes* during plant-forward dietary transitions. Specifically, participants who reported greater social support within their daily experiential reports tended to report more positive outcomes during the testing phase, including: lower consumption of the products they were seeking to reduce or abstain from, enhanced coordination of their diet within their family unit, and reduced dietary tension. They also reported more positive outcomes *over time*: greater stage of change progression, dietary goal achievement and commitment, and lower animal-product consumption, two weeks beyond the initial testing phase. Of note, perceived social support was a stronger correlate of these outcomes than reported coordination and tension. This likely

underscores the value of *feeling* socially supported for dietary transitions – since our measurement of social support in the present study is not just about the receiving of tangible help, but the emotional experience of feeling supported.

Although a wealth of previous research has alluded to the value of social support in the context of plant-forward dietary transitions (e.g., Menzies & Sheeska, 2012; Twine, 2014), our qualitative data was revealing of what constitutes support and its influence. In participants' daily entries, support was commonly reported, and a motivating factor for the maintenance of plant-forward diets. Support came in many forms, including social validation - *basic acknowledgement of the individuals' dietary preferences*. Support of this kind may be an overlooked but highly valued gesture, allowing the individual to assert themselves and their eating habits, having downstream effects on mealtime preparations, the maintenance of one's dietary goals, and their influence on that of their family members. We also find evidence of enacted support - *the provision of supportive behaviours* (e.g., tangible assistance and/or advice; Hogan et al., 2002). For example, the provision of appropriate foods was particularly valuable for our student sample who admitted financial dependencies on their family system, but also as a signal of acknowledgement and inclusion. We found evidence that support may grow over time, perhaps as individuals are able to appease the logistical and wellbeing concerns of their family system, and as the family becomes more familiar with their preferences and is able to establish a new eating routine that accommodates the individual.

Not only was social support conducive to the individuals' own goals, but in such supportive environments, many participants had an influential impact on the eating patterns of their family members, causing them to reduce their own consumption of animal foods. Previous research, for example, Menzies and Sheeska (2012) has also reported on the potential influence that vegetarian individuals may have on changing norm perceptions and

subsequently the eating habits of their family members. This suggests that when an individual feels able to assert their dietary preferences, they may influence their family system to adopt a similar dietary habit. This fits with the broader psychological literature on minority influence – the ability of individuals, or social minorities to alter norm perceptions and prompt widespread change (Moscovici, 1976). It challenges the current dominant and rather pessimistic view that change at the individual-level, for example by social minorities like vegetarians and vegans, is unlikely to spark large-scale change (Bolderdijk & Cornelissen, 2021) or may even be damaging to such efforts (e.g., see Kurz et al, 2020). Instead, our findings are consistent with the more optimistic view that individuals who assert their dietary preference not to consume animal products have the ability to alter norm perceptions by signalling to their immediate social networks that alternative foodways are possible. Scholars argue that as members of one's immediate family begin to adopt a reduced meat diet, change cascades throughout individuals' social networks and beyond, eventually sparking widespread social change and leading to a tipping point in global food consumption norms (e.g., see Nardini et al., 2020).

However, the experience of allyship is an integral first step for individuals to have such a cascading effect on the eating habits of their family. That is, for an individual to influence the eating habits of their social networks, they must feel able to establish themselves as a frontrunner, which, in part, depends on feeling acknowledged and validated. Our research suggests that such displays of social support and positive problem solving, may be a function of *relational climate*, and cohesion (i.e., emotional bonding), specifically. Family systems that report balanced cohesion are those which are able to balance togetherness and separateness. Theoretically, the ability to balance emotional bonding is thought to be optimal for family functioning, as individuals are able to be both independent from and connected to their families (Olson, 2000). Something essential when attempting to

achieve autonomy over one's eating habits while maintaining a sense of togetherness at mealtimes. Indeed, in the present study, we found that balanced cohesion experienced within family units lends itself to greater social support and higher instances of positive problem solving.

Limitations

The present study is not without its limitations. Notably, this work did not sample all members of any one family system. Instead, we sampled individuals who were attempting a plant-forward dietary transition and had them report on their family's relational climate and behaviours. Thus, we were not able to model this unfolding transition from all perspectives to form a complete picture of how, as a system, a family navigates such change. Our work points to there being unique conflicts or barriers with different members of the family, for example, conflicts pertaining to the logistics of eating plant-based specifically being relevant in interactions with the sole food provider. Future work ought to probe these intra-familial nuances, by considering recruitment and analysis at the interpersonal or bi-directional level.

Though this research has many practical implications for individuals and their families who are currently undergoing a plant-forward dietary transition, our approach to participant recruitment may mean that there will be limitations when attempting to extrapolate our findings out to the general population. That is, our findings are derived from a sample of university students, who at the time of participation, were cohabiting with their parents. Hence, our insights are limited to the perspective of individual who typically, and as confirmed in our own findings, is not responsible for the food provision of the family unit. Thus, we may expect that research of this kind when conducted with a sample of individuals responsible for food provision within the household (e.g., parents), may produce unique insights. This not only because of their unique role within the family system, but also the

different demographic profiles of parents compared to students (e.g., as measured by age, class, and employment status). Moreover, the present research was conducted in a western society, hence, whether our results would replicate among individuals embedded in collectivist family structures is a line of inquiry that warrants further study.

Further, our research aims were largely exploratory rather than designed to establish causal direction. We did not experimentally manipulate social support or aspects of the family environment. Experimental tests of the role social support plays in plant-forward dietary transitions remain understudied – likely because of the logistical challenges involved in artificially inducing such a complex and emergent social construct. Future work ought to address these limitations, considering the efficacy of the strategies employed by transitioning individuals to further inform advocates and stakeholders as to how to inspire a transformation in the global food system.

Last, several of our analyses, though well powered and returning significant effects, were associated with small effect sizes. While assured by recent discussions amongst the scientific communit that small effects ought not to be considered a limitation of significant findings (e.g., see Götz et al., 2021), we acknowledge that small effects are often produced when the particular construct under investigation is determined by a multitude of factors. Hence, while we argue that the role of relational climate and dietary harmony play a significant part in how family systems navigate dietary change, we also appreciate that other factors are likely at play in these processes. This could include other key metrics of relational health, for example communication-styles and relational satisfaction, which may warrant further investigation with the use of FACES-IV (Olson, 2000, 2011). Alternatively, this could relate to factors that are determined outside of the household, at the distal-level, for example the relative availability of plant-based foods, as hinted at in our qualitative analyses.

Conclusion

The present study yielded novel insights regarding how individuals and their wider family systems navigate the transition to a plant-forward diet, and the value of social support in this context. While out-right antagonism was not commonly reported, transitioning individuals were clearly cognisant of the need to manage the disruption (perceived, or materialised) they caused during shared mealtimes. Oftentimes, this resulted in compliance with the wider eating norms of the family, or the manipulation of time and space to ensure a separation in eating behaviours. Yet, participants recognised that such strategizing was not conducive to their dietary goals, nor relationally adaptive. Rather, positive problem solving may depend upon the willingness of families to accommodate and make compromises for the divergent individual. Plant-based alternatives to animal products helped to ease these difficulties and created space for family members to show their support. The provision of social support depended measurably upon relational climate. Specifically, families that were more balanced in their emotional bonding offered up an environment that was more conducive to feelings of support. We show that the supportive family environments are integral for the long-term maintenance of plant-forward diets. Furthermore, individuals who are able to assert themselves and their dietary preferences within their social units may play an important role as a visible frontrunner and influential force in the transition towards a more secure and stable food system. As such, advocates and stakeholders ought to harness the insights of family food decision-making as a lever for facilitating a green transformation of the global food system.

Study 4: ‘Against the Cult of Veganism’: Unpacking the Social Psychology and Ideology of Anti-Vegans

Rebecca Gregson, Dr. Jared Piazza & Dr. Ryan L. Boyd

Abstract

Despite the established health and ecological benefits of a well-planned plant-based diet, the decision to eschew meat and other animal-derived food products remains controversial. So polarising is this topic that anti-vegan communities — groups of individuals who stand vehemently against veganism — have sprung up across the internet. Much scholarship on veganism characterizes anti-vegans in passing, painting them as ill-informed, uneducated, or simply obstinate. However, little empirical work has investigated these communities and the individuals within them. Accordingly, we conducted a study using social media data from the popular platform, Reddit. Specifically, we collected all available submissions (~3,523) and comments (~45,528) from *r/AntiVegan* subreddit users (*N*=3,819) over a five-year period. Using a battery of computerized text analytic tools, we examined the psychosocial characteristics of Reddit users who publicly identify as anti-vegan, how *r/AntiVegan* users discuss their beliefs, and how the individual user changes as a function of community membership. Results from our analyses suggest several individual differences that align *r/AntiVegan* users with the community, including dark entertainment, ex-veganism, and science denial. Several topics were extensively discussed by *r/AntiVegan* members, including nuanced discourse on the ethicality and health implications of vegan diets, and the naturalness of animal death, which ran counter to our expectations and lay stereotypes of *r/AntiVegan* users. Finally, several longitudinal changes in language use were observed within the community, reflecting enhanced group commitment over time, including an increase in group-focused language and a decrease in cognitive processing. Implications for vegan-nonvegan relations are discussed.

Keywords: Text analysis, social media, Reddit, group identification, veganism.

Introduction

Despite the established health and ecological benefits of a well-planned plant-based diet (Willett et al., 2019), the decision to eschew meat and other animal-derived food products remains controversial. So polarising is this topic that anti-vegan communities, groups of individuals who stand vehemently against veganism, have sprung up across the internet. To date, very little is known about these communities and the individuals who join them. Accordingly, in this study, we take a close look at the *r/AntiVegan* community on the popular platform, Reddit, and the social psychology of its members publicly identifying as anti-vegan. We use anti-vegans' own words to understand their beliefs and motives and establish some implications for vegan-nonvegan relations.

Veganism

Veganism is a term coined by Donald Watson in 1944 to describe the voluntary abstention from animal derived food-products and a lifestyle governed by non-violent philosophy (The Vegan Society, 2021). In recent years, veganism has become increasingly mainstream in western societies, with the Economist declaring 2019 the "year of the vegan" (Parker, 2018). This increasing popularity of vegan diets has paralleled a rise in selective eating habits (Fischler, 2015), leading to the common misperception that veganism is a new-age fad diet (Cole & Morgan, 2011). Far from short-lived, the concept of abstaining from animal-derived food products for ethical reasons is said to date back some 5,000 years to Ancient Egypt, was later popularised by Greek philosopher Pythagoras in around 500 BCE (Zaraska, 2016) and has a rich tradition among several world religions, including Jainism, Hinduism, and Buddhism (Kumar, 2021).

A recent study which sampled 28 countries from all six inhabited continents, estimated that the average global prevalence of vegan diets is approximately 3%, with a range

of 0-19% (IPSOS Mori, 2018). As such, vegans represent a minority who deviate from the social norm, which is to consume animal products. Particularly in the West, vegans are demographically more likely to be female, younger, highly educated and politically left-leaning individuals (Asher et al., 2014). Their motivations for following a diet free from animal products are numerous, typically incorporating moral, health and environmental considerations (Zur & Klöckner, 2014). Relative to other groups who eschew meat, such as vegetarians and pescatarians, vegans hold stronger personal, prosocial, and moral motivations (Rosenfeld, 2019). Vegans also consider their dietary choices as more central to their identity and tend to be more critical of people who, unlike themselves, do not abstain from animal products (Rosenfeld, 2019).

Anti-veganism

Recent western history offers abundant evidence that people strongly dislike those who eschew meat (Chiles & Fitzgerald, 2018). In the 19th century, people who refrained from meat were ridiculed and ostracized from mainstream culture for being *'odd'*, *'eccentric'* and *'half-crazed'* (Iacobbo & Iacobbo, 2004). In the counterculture era, spanning the 1960-70s, vegetarians were readily viewed as an absurd and socially problematic movement, synonymous with the views that the mainstream public held for hippies (Iacobbo & Iacobbo, 2004). Such sentiments which we see documented throughout Western history have since been echoed in the discourse analyses of news outlets in Australia (Ragusa & Crampton, 2015) and the United Kingdom (Cole & Morgan, 2010).

Today, with the growing popularity of meat-free diets (The Vegan Society, 2016), anti-vegan sentiments have become increasingly apparent (Dhont & Stober, 2020). This has led scholars and legal bodies to recognise anti-veganism as a prejudice (MacInnis & Hodson, 2015), resulting in the protection of "ethical veganism" under the UK Equality Act 2010

(Casamitjana *v*. League Against Cruel Sport, 2020). Some evidence, reported by *The Times*, even suggests that vegan-related hate crimes may be on the rise in the UK (Nachiappan, 2020). According to the article, there were 172 instances of vegan hate crimes between the years 2015-2020, one-third of which occurred in 2020 alone.

Anti-veganism and social media

Social media has transformed the way humans communicate and interact, which has attracted the attention of psychologists (Wallace, 2015). Although social media may be lauded as an essential tool for social interaction, some researchers suggest that it supports particularly *antisocial* behaviour (Trindade, 2020), including cyberbullying (Whittaker & Kowalski, 2014) and the dissemination of hate speech (Castaño-Pulgarín et al., 2021). Online communication at times lends itself to the expression of extreme behaviour because of the anonymity it offers the perpetrator (Branscomb, 1995), the invisibility of the victim (Lapidot-Lefler & Barak, 2012) and the instantaneous nature of posting (Brown, 2017), which can disinhibit an individual to convey thoughts they might not express in person (Suler, 2004).

Social media has provided a platform for those who stand against veganism to connect and identify with others who share in their opposition. Since early 2000, pockets of anti-vegan communities have begun to spring up across the internet, from Reddit's *r/AntiVegan* to Facebook's *Anti-Vegan Club* and Flickr's *Anti-Vegan League*. It is possible that these communities have become intertwined with alt-right ideology and discourse (Gambert & Linné, 2018; Reynolds, 2019). For example, the slang term "soy boy" which is said to have originated from alt-right online discourse on 4chan, is used to describe men who lack *traditionally* masculine qualities (Gambert & Linné, 2018). Alt-right community members have also been active in organising anti-vegan demonstrations at vegan food

festivals and privately owned vegan cafes, which involve activities such as performatively consuming raw meat on the premises (Reynolds, 2019).

Existing lines of research on anti-veganism

Given that plant-based diets offer a potential solution to the health and ecological challenges posed by our current food system (Willett et al., 2019), there has been a considerable amount of research conducted to understand why people denigrate those who eschew meat (e.g., see De Groeve & Rosenfeld, 2021). Research in this area has largely focused on the form and content of anti-vegan prejudice. Characteristic of such attitudes is the perception that people who identify as vegans tend to be militant, hostile, overly sensitive, hypocritical, annoying, self-righteous, opinionated, inflexible, and judgmental (Cole & Morgan, 2011; De Groeve et al., 2021; Markowski & Roxburgh, 2019; Minson & Monin, 2011). Generally, this arm of research converges on the conclusion that moralistic impressions of vegans seem to account for the bulk of antipathy and discrimination against them (see De Groeve et al., 2021).

A second arm of this research has sought to understand the psychosocial and demographic characteristics of those most likely to express anti-vegan sentiments. This largely survey-based body of research has found that those more willing to denigrate vegans are typically male (Vandermoere et al., 2019) and lower-educated individuals who hold traditional views on gender (Earle & Hodson, 2017) and politics (Dhont & Hodson, 2014). The degree of hedonic pleasure that people derive from eating meat, particularly red meat, has also been shown to predict prejudice toward vegetarians across several countries (Earle & Hodson, 2017; Ruby et al., 2016), suggesting that prejudice toward those who abstain from animal food products may be a reactive expression aimed at defending traditional cultural values linked to food choice.

The research conducted to date has been invaluable in advancing scientific understanding of anti-vegan sentiment. However, this research has largely focused on the nature of anti-vegan sentiments expressed by members of the general public when solicited by questions or measures within a study or experiment. Thus, much of what we know about anti-veganism has come from those who express anti-vegan sentiment, *reactively*, when solicited under experimental conditions.

As such, the research in this area has moved toward studying anti-vegan ideology organically, using samples of people who *actively* identify as anti-vegan and chose to participate in the relevant anti-vegan behaviour. In new research by Aguilera-Carnerero and Carretero-González (2021), anti-vegan sentiments were studied across three anti-vegan Spanish Facebook pages (namely; *El mito del veganismo, Reich Animalista* and *Vida Naturopatética*). The authors acquired a multimodal dataset, containing language, image, and video data for their discourse analysis. Their findings were confirmatory of the findings from previous controlled experimental and self-report research in English speaking samples. For example, it was confirmed that in Spanish culture, typical anti-vegan expressions share in the perception of vegans as *fanatic*, *radical* and *crazy*. However, their unique approach to the study of anti-vegan attitudes via the medium of social media allowed for novel insights. For example, the finding that members of these communities often draw on the lived experiences of ex-vegans as shared on YouTube and public figures, including academics and television presenters, to legitimize their anti-vegan sentiments. In addition, the view of veganism as cult-like (both in a literal and metaphoric terms) and vegans as misanthropic.

Current study and research questions

In the current study, we sought to move away from traditional methods of study and adopt a novel approach to understanding anti-vegan sentiment. Accordingly, we take a "big

picture" look at the social psychology of those publicly identifying as anti-vegan. We use the public discourse of anti-vegans to better understand why they believe what they believe, and to try to establish some implications for vegan-nonvegan relations. We apply methods of computerized text analysis to language data derived from a social media community of self-identified anti-vegans.

Specifically, we analyse social media data from Reddit, a popular, anonymous online discussion forum comprised of sub-forums ("subreddits") within which users communicate through submissions and comments. We chose Reddit because of the anonymity it offers its users and its relative popularity in the world of social media. At the time of writing, Reddit reports over 52 million daily active Reddit users worldwide, ranking as one of the ten most popular and widely-used websites on earth (Pew Research Centre, 2021).

Here, we collect data from the subreddit *r/AntiVegan,* a community with over 18,700 members. According to their strapline, *r/AntiVegan* is a community of people '*Against the cult of veganism'*. More descriptively, the community define themselves as:

> *…a place to share and discuss content that opposes the ideology of veganism. We are a community of omnivores, carnivores, ex-vegans, vegetarians, and pescatarians. Food porn, recipes, news and nutrition articles, stories, rants, and humor are all welcome.*

Such an approach affords the opportunity to understand (a) the profile of individuals who participate in online anti-vegan groups, and (b) the nature of the commentary that occurs within such groups, and (c) the long-term, motivational consequences of participating in such groups. Thus, our three research questions are as follows:

- RQ1: How do *r/AntiVegan* users differ from the general population on Reddit?

- RQ2: What are the most prominent topics of discussion among users of the *r/AntiVegan* community?
- RQ3: Does engagement with the *r/AntiVegan* community precipitate social psychological change, as evidenced by changes in users' language use?

RQ1: How do *r/AntiVegan* users differ from the general population on Reddit?

We pose our first research question with the aim of understanding more about the psychosocial characteristics of individuals who actively engage in a group organised around anti-vegan discussion: the *r/AntiVegan* community. Treating Reddit as the baseline population (the closest approximation to a 'general population' available within this online context), we want to know what, if any, psychosocial characteristics differentiate *r/AntiVegan* users from the general population on Reddit.

RQ2: What are the most prominent topics of discussion among users of the *r/AntiVegan* community?

It is unknown whether anti-vegan impressions, uncovered in survey studies, will be shared among individuals who actively participate in anti-vegan behaviour. It is also unclear what sorts of ideas and modes of thinking typify the discourse of such communities. Accordingly, we pose our second research question with the aim of understanding what the *r/AntiVegan* community discusses as a window into the beliefs and motives characteristic of anti-vegan identifiers. In doing so, we seek to understand anti-vegan beliefs and opinions as *they* choose to discuss and enact them.

RQ3: Does engagement with the *r/AntiVegan* community precipitate social psychological change, as evidenced by changes in users' language use?

Despite anti-vegan sentiment being commonplace across the internet, anti-veganism phenomena have yet to be studied through the lens of group processes. Past research has

shown that interaction with an online community strengthens group-identification and, once a social identity is formed amongst an online group, its members may be increasingly susceptible to group influence, stereotyping and discriminating against outgroup members (Postmes, Spears & Lea, 1998). Accordingly, we pose our third question with the aim of understanding the social psychological effects of *r/AntiVegan* membership by examining longitudinal changes in language-based measures of group members' traits (e.g., Lam, 2008; see also: Boyd & Pennebaker, 2017). In line with past work on group members aligning their linguistic styles, goals, and norms, we explore whether *r/AntiVegan* users experience something of a group acculturation process, exhibiting more group-identification signatures over time, and whether the community itself develops more group-like qualities, for example, more hierarchical structures or leadership-followership distinctions.

Method

Sample Overview

For this research, we used a custom pipeline, built around the Pushshift database (Baumgartner et al., 2020), to collect data from the subreddit *r/AntiVegan.* We collected all available posts, including both "submissions" (i.e., posts users made to the forum containing a link, text, or other content) and "comments" (i.e., posts made in response to other users' posts) made in the *r/AntiVegan* subreddit between March 2014 – December 2019. The final database included a total of 48,909 posts, comprised of 3,523 submissions and 45,386 comments produced by 3,819 unique users. Each post represented a unique data point and was associated with the language content of the post, the date and time the post was made and the username of the account which made the post. To better understand *r/AntiVegan* users and their wider interest, we additionally tallied the frequency of posts that each user made across all other publicly visible subreddits.

Text Analytic Approach

We adopted multiple text analysis methods for quantifying the content of posts made to the *r/AntiVegan* subreddit, ranging from well-established word counting methods to topic modelling and corpus linguistics. Below, we briefly describe each method and outline the measures provided by each. In the Results section, we included details of the question-specific analysis to help illuminate the results.

Meaning Extraction Method. To understand what motivates Reddit users to participate in *r/AntiVegan*, we used topic modelling to objectively extract and quantify the central topics discussed within the *r/AntiVegan* community. For this task, we employed the Meaning Extraction Method (MEM; Chung & Pennebaker, 2008), a topic modelling technique which statistically identifies, from a list of high frequency words, those that tend to co-occur into psychologically meaningful themes. This method is well suited to addressing social scientific research questions and has been used to understand the content of discourse in a wide range of topics, including relationship problems (Entwistle et al., 2021), food cognition (Blackburn et al., 2020), dehumanization (Markowitz & Slovic, 2021), and climate change denialism (Shah et al., 2021), to name a few.

Briefly described, the MEM is conducted in a series of steps: first, high frequency words within a corpus of text are identified and each text is then scored (in either binary or relative frequency fashion) for the presence or absence of each high frequency word. This part of the procedure has, more recently, been automated by the development of the Meaning Extraction Helper (MEH; v2.2.03; Boyd, 2020). The final step is to perform a Principal Components Analysis (PCA) with the data, conceptually a method for finding groups of correlations, here a method for finding groups of words that tend to co-occur. For in-depth

treatments of common MEM procedures, we refer readers to Boyd and Pennebaker (2016) and Markowitz (2021).

Linguistic Inquiry and Word Count. To explore the psychological consequences of *r/AntiVegan* membership, we quantified longitudinal changes in users' linguistic markers of psychosocial traits. We employed Linguistic Inquiry Word Count (LIWC; Pennebaker et al., 2015), a well-validated tool in computerized text analysis, underpinned by the extensive research demonstrating that the high occurrence of certain words is reliably indicative of corresponding psychological processes (Boyd & Schwartz, 2021). LIWC consists of two parts: a dictionary and a software program. The dictionary is comprised of word-to-category mappings for 82 categories, including common content (e.g., related to biology, power, family) and function words (e.g., pronouns, conjunctions, articles). The program itself calculates the percentage of words that belong to each of the dictionary categories, hence, scores for each variable (excluding word count) range from 0-100. This method of text analysis has been applied to a wide range of psychological research including personality, patterns of thought and social processes (Tausczik & Pennebaker, 2010).

Results

RQ1: How do *r/AntiVegan* users differ from the general population on Reddit?

Without standard demographic information (e.g., age and gender) at our disposal, we adopted a behavioral approach to identify those posting characteristics that were more prevalent in *r/AntiVegan* users relative to the overall population of Reddit users. We investigated the wider Reddit activity of *r/AntiVegan* users, with the assumption that the kinds of subreddits frequented by such users would be revealing of their psychosocial

characteristics[10]. Our approach to analysing these data was thus twofold. First, we sought to understand how the posting activity of *r/AntiVegan* users differed from that of the general population on Reddit. Secondly, we sought to make a qualitative interpretation of the nature of those subreddits highly frequented by *r/AntiVegan* users.

To address the first aim, we compared the wider Reddit activity of *r/AntiVegan* users against that of a sample of *r/askreddit* users (*N*=9,500). With over 33 million users, *r/askreddit* is one of the most popular subreddits on Reddit. Given its popularity and the neutrality of its content, this subreddit has often been used as something of a "control group" for group-based comparisons (see, e.g., Bagroy et al., 2017). To determine which subreddits were more associated with r/*AntiVegan* users, we used the Basic Unit Transposable Text Experimentation Resource (BUTTER; Boyd, 2020) an open-source software and text analytic system that performs several text analytic and statistical functions. Specifically, we used the "compare frequencies" tool, which allows the user to calculate a series of pairwise comparison statistics.

Here, we report the %DIFF values (Gabrielatos & Marchi, 2011), an effect-size metric which indicates the proportion (%) of the difference between the normalised frequencies of any one subreddit, across two samples; the study sample of interest (here: *r/AntiVegan)* versus the reference sample (here: *r/askreddit*). The formula for %DIFF is as follows, where NF refers to *normalised frequency*, SS *study sample* and RS *reference sample*:

$$\%DIFF = \frac{(NF\ in\ SS - NF\ in\ RS)\ \times 100}{(NF\ in\ RS) + .0001}$$

[10] In addition to the analysis described here, we ran a separate, complementary analysis detailed in Supplementary Materials A that approached the question from a factor analytic perspective. Results from both sets of analyses led us to similar conclusions; we report both for the sake of completeness.

In our case, positive %DIFF values indicate that a particular subreddit has a higher normalised frequency in the study sample (*r/AntiVegan*) and negative values a higher normalised frequency in the reference sample (*r/askreddit*). Large values indicate that the subreddit is more highly representative of the sample, relative to the other. These values are not associated with a significance outcome and so to make an inference of the statistical significance of the observed difference, we draw on log-likelihood (LL) and employ the following threshold: LL ≥ 15.13, $p < .0001$ (see, e.g., Rayson & Garside, 2000).

Our analysis revealed meaningful differences in the wider Reddit activity of *r/AntiVegan* and *r/askreddit* users. Table 4.1 displays the 10 subreddits with the highest normalised frequency amongst *r/AntiVegan* users, relative to *r/askreddit* users and vice versa.

Table 4.1. *The ten subreddits with the highest normalised frequency amongst r/AntiVegan and r/askreddit users.*

Subreddit (r/*AntiVegan*)	*r/AntiVegan* frequency	*r/askreddit* frequency	%DIFF	Log Liklihood
DebateAVegan	46872	1	626044.90	11734.97***
carnivore	7094	3	31488.67	1739.20***
AntiVegan	46902	61	10171.24	11089.85***
darkjokes	120146	174	9124.05	28250.19***
youtube	240237	432	7328.78	55766.29***
vegancirclejerk	23636	52	5972.00	5409.13***
AskDocs	202089	450	5899.17	46205.39***
suicidebywords	36311	104	4564.08	8124.34***
MakeMeSuffer	94436	299	4119.18	20920.12***
AccidentalRacism	32923	157	2701.31	6934.34***

Subreddit (*r/askreddit)*	*r/AntiVegan* frequency	*r/askreddit* frequency	%DIFF	Log Liklihood
CFB	0	38634	-99.99	165217.38***
nfl	0	33009	-99.99	141160.59***
reddevils	0	21747	-99.99	92995.80***
counting	0	21065	-99.99	90079.06***
hockey	0	20797	-99.99	88932.89***
SquaredCircle	0	19577	-99.99	83715.27***
BattlefieldV	0	18627	-99.99	79652.37***
GlobalOffensive	0	17285	-99.99	73912.99***
DestinyTheGame	0	15938	-99.99	68152.24***
Gunners	0	14762	-99.99	63122.81***

A qualitative inspection of the way in which the subreddits, most strongly associated with *r/AntiVegan* users, describe themselves revealed several insights (see Table 4.2 for the community descriptions of each of the ten subreddits with the highest normalised frequency amongst *r/AntiVegan* users). First, r/AntiVegan users extend their discussions around veganism to other areas on Reddit, including *r/DebateAVegan* and *r/vegancirclejerk*. This suggests that vegan opposition is a key social motive for many *r/AntiVegan* users. *r/AntiVegan* users also frequent *r/carnivore*, a subreddit dedicated to discussion around the carnivore diet, a diet entirely reliant upon animal-derived products, and one which excludes all other food groups, including vegetables and carbohydrates. These users find entertainment in shocking (*r/MakeMeSuffer*) and socially taboo topics (e.g., *r/AccidentalRacism*). They adopt a style of humour which is both self- (*r/suicidebywords*) and other deprecating (*r/darkjokes*). Taboo topics represented within these frequented subreddits include rape, miscarriage, suicide, and racism. Oppressed minority groups like women and people of colour feature heavily in both *r/AccidentalRacism* and *r/darkjokes*. Lastly, the activity featured in *r/AskDocs* and *r/youtube* suggests that *r/AntiVegan* users appreciate both rational and anecdotal argumentation, respectively.

Table 4.2. *The community descriptions of each of the ten subreddits with the highest normalised frequency amongst r/AntiVegan users.*

Subreddit	Community description
r/DebateAVegan	A place for open discussion about veganism and vegan issues, focusing on intellectual debate about animal rights and welfare, health, the environment, nutrition, philosophy or any topic related to veganism.
r/carnivore	A subreddit about the elimination and way of eating known as the carnivore diet.

r/AntiVegan	/r/AntiVegan is a place to share and discuss content that opposes the ideology of veganism. We are a community of omnivores, carnivores, ex-vegans, vegetarians, and pescatarians. Food porn, recipes, news and nutrition articles, stories, rants, and humor are all welcome.
r/darkjokes	#BLM Chapo Reddit Takeover: Guess Which Sub Is Next
r/youtube	r/YouTube is for meta-discussion about YouTube as a platform - its features, bugs, business decisions, etc. This is a fan sub, not run or owned by YouTube!
r/vegancirclejerk	Veganism is a way of living that is just awesome, plus we totally get enough protein! Also, we totally get enough oral sex. Probably more than you, to be honest. Not bragging, just stating facts." - The Vegan Society
r/AskDocs	Having a medical issue? Ask a doctor or medical professional on Reddit! All flaired medical professionals on this subreddit are verified by the mods.
r/suicidebywords	A sub about self-inflicted insults.
r/MakeMeSuffer	If it hurts to look at, post it.
r/AccidentalRacism	This is where you can post all the accidental racism pictures.

RQ2: What are the most prominent topics of discussion among users of the *r/AntiVegan* community?

To better understand the topics that *r/AntiVegan* users discuss within their community, we conducted a MEM analysis on the language data generated within the *r/AntiVegan* subreddit. Specifically, we used the MEH to analyse the *r/AntiVegan* posts with a word count ≥100 (N = 3,253). Following standard MEM procedures, we then performed a PCA with varimax rotation on the binary word output generated using the MEH, to extract common themes of *r/AntiVegan* discussion. The diagnostic Bartlett's Sphericity Test (χ^2 = 50796.805, $p < .001$) and the Kaiser-Meyer-Olkin measure (KMO = 0.807) indicated that a component type model was an acceptable fit for these data. A 5-component solution was selected as the best fit for our data, considering a trade-off between breadth and depth of coverage; each component had an eigenvalue ≥ 2 and together the 5-component explained

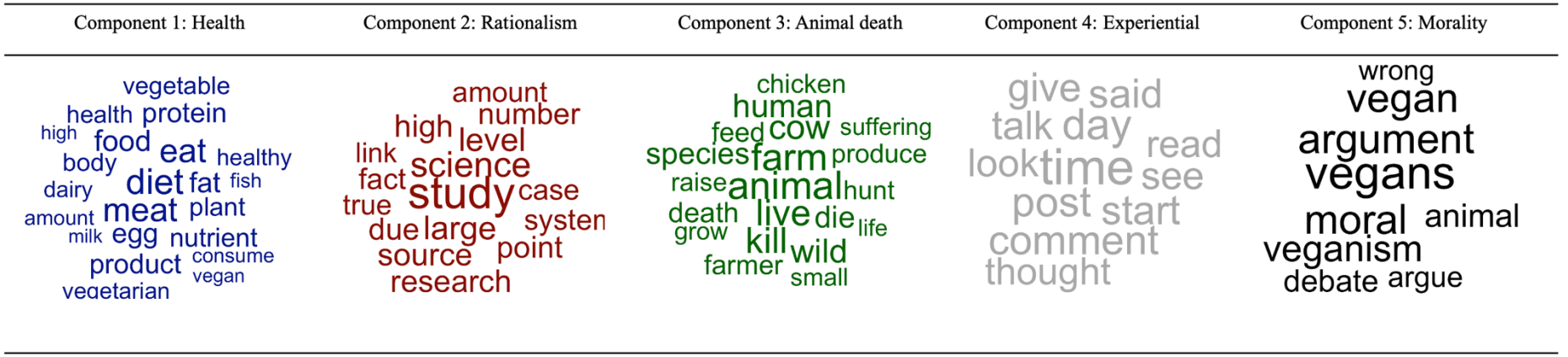
10.82% of variance in the data, well within the expected range for a PCA on language data (see, e.g., Ikizer et al., 2019; Kilimnik et al., 2018). Thus, a 5-component solution, with factor loadings of ≥ 2.5 was retained for further inspection.

In order to further inspect the 5 components of our PCA, we selected a sample of the 10 highest-scoring comments on each component. Where interpretations were more difficult, we additionally looked at the ten lowest-scoring comments for comparison. The MEM-derived word clusters revealed five distinct themes of discussion: 1) health, 2) rationalism, 3) animal death, 4) experiential accounts, and 5) morality (see Table 4.3 and Figure 4.1). The verbatim quotes that we present in the following subsections were taken from these samples and are intended to be most representative of the component.

Table 4.3. *Topic modelling themes of r/AntiVegan submissions.*

Component 1		Component 2		Component 3		Component 4		Component 5	
Health		Rationalism		Animal death		Experiential accounts		Morality	
diet	.560	study	.451	animal	.467	time	.352	vegans	.476
meat	.521	science	.344	farm	.454	day	.294	argument	.419
eat	.521	large	.312	live	.434	post	.285	moral	.414
food	.446	level	.311	kill	.428	comment	.280	vegan	.412
fat	.426	source	.297	cow	.406	start	.275	veganism	.367
egg	.420	high	.293	wild	.389	said	.272	animal	.310
protein	.417	research	.292	human	.379	give	.271	debate	.295
product	.412	due	.286	species	.351	talk	.266	argue	.275
nutrient	.391	point	.284	die	.349	see	.264	wrong	.257
plant	.381	number	.280	death	.319	look	.260		
body	.368	fact	.273	feed	.309	read	.256		
vegetable	.363	system	.270	farmer	.306	thought	.251		
health	.357	case	.269	produce	.295				
healthy	.337	true	.262	chicken	.293				
vegetarian	.332	amount	.262	hunt	.292				
dairy	.324	link	.253	raise	.287				
amount	.294			grow	.273				
fish	.283			small	.272				
consume	.282			suffering	.261				
milk	.265			life	.251				
high	.265								
vegan	.263								

Figure 4.1. *Word clouds of the topic modelling analysis*



Health. The first theme captured discussion around the negative health consequences of a vegan diet, relative to a meat-based diet. Hence, emergent word loadings included: *protein, nutrient, health, fat,* and *body*. Many *r/AntiVegan* users see veganism as nutritionally inadequate, a *"slow form of starvation"* and vegans themselves as being *"sick all the time"*, having weak bones, poor memory, and a low libido. Some users saw veganism as disguising a disordered relationships with food, namely eating disorders like orthorexia nervosa*: "We* [*r/AntiVegan* users] *look at it* [veganism] *like an eating disorder, like anorexia".* As a result of these perceived nutritional deficiencies and the subsequent need to supplement, a vegan diet is also seen as unnatural. *r/AntiVegan* users are of the opinion that were veganism a natural diet for humans, it would *"…not have to be monitored, adhered to or supplemented".*

The discussion around the negative health consequences of a vegan diet takes a holistic and sophisticated look at the absence of essential nutrients, the complex interplay between certain nutrients, their metabolic profiles and absorption. *r/AntiVegan* users see a vegan diet as "*deficient in a lot more than just b12"* and introduce into their discussion nutritional elements such as omega3, carnitine, taurine, iron, Vitamin A, and Coenzyme Q10. Some *r/AntiVegan* users explain that because of the complex metabolic profiles of certain nutrients, the body is more heavily taxed when trying to convert plant sources: *"there is additional conversion needed within the body to metabolize many nutrients from their plant form to animal form. The body has a limited capacity to do this".* In this way, *r/AntiVegans* see meat-based diets as *conveniently* healthy; both nutritionally superior to a vegan diet and able to provide equal or better nutrition at a smaller density of food intake: *"Plants don't have the same bioavailability as animal products do, so you would have to eat far more whole plants than you would animal products".*

The *Health* discussion theme was heavily populated with ex-vegans. An analysis of the posts made by ex-vegans that fall under this theme implicate the motivation to both *share*

and *seek* advice about the negative health consequences of a vegan diet: *"Would love to hear advice or similar experiences... And happy to answer any questions"*. Common health-related reasons for leaving veganism include both physical and mental health issues, namely: a lack of energy or fatigue, racing heart, high blood pressure, anaemia, iron deficiencies, anxiety depression, and recovery from disordered eating. Many advice-seeking ex-vegans were looking to validate their own personal health concerns and to understand how to re-introduce animal-derived food products into their diets. Both advice-seeking and advice-giving ex-vegans used *r/AntiVegan* as a social support forum and as a personal diary of the process involved in returning to their omnivorous diet: *"Checking in after two months of ex-veganism… I have gained weight…Oh, I also got my period"*.

Rationalism. The second theme captures discussion around logic-driven arguments, underpinned by scientific research and reason. Hence, the words *study, science, research*, *fact,* and *true* emerged as key word loadings here. Discussion around logic-driven arguments occurred in two unique ways. First, the reference to scientific research can be understood as a tool used in anti-vegan argumentation; *r/AntiVegan* users appealed to the authority of scientific research to support their claims: *"You can literally find all I've said on Wikipedia and you can find there all the sources linked to studies by experts".* Second, *r/AntiVegan* users denigrated vegans for their use of scientific research. For instance, some users accused vegans of committing the fallacy of incomplete evidence — *"Idiot vegans that cherry-pick sources to push propaganda"* — or drawing on research with flawed assumptions or methods — "*trusting groups like the AHA who still spout the thoroughly debunked 'high cholesterol causes heat disease' nonsense for health recommendations is a recipe for suicide."* *r/AntiVegan* users also criticise prominent vegan advocates, like YouTube personality Mic The Vegan and American physician Dr. Greger, founder of NutritionFacts.org, questioning their expertise and objectivity on the subject.

Though *r/AntiVegan* users might be criticised for engaging in "myside bias", the evaluation of evidence in a manner biased toward one's own opinions (Baron, 1995; Stanovich et al., 2013), they nonetheless present relatively well-reasoned critiques of scientific research. For example, those that call attention to the issues associated with the use of non-comparative control groups, the over-generalising of findings from small samples, and averaging data while neglecting individual differences and outliers. Where meta-analyses can often overcome these types of issues, *r/AntiVegan* users often make the valid claim that aggregating flawed research only leads to flawed conclusions: *"if a meta study compiles data from flawed studies, then it's also just as flawed".* Discussions also touch on the recent crisis of reproducibility through talk of publication bias (*"Who funds the studies can and does very often determine what we end up learning")* and scandals of data fabrication which suggest that *r/AntiVegan* users remain on the pulse of the most recent goings on in scientific culture.

Talk on this theme is not restricted to vegan-related content and merges into discussion around other topics, for example, vaccine research. While anti-vaccination views are said to occupy a small space online, research has shown that such discussion has seen recent explosive growth, which at times spills into adjacent topics (Johnson et al., 2020). Here *r/AntiVegan* users critically discuss vaccination, in particular the risk-benefit approach taken in vaccination research *("The very science of vaccination requires there to be a trade-off between safety and effectiveness")* and the issues around defining risk specifically *("If you can't properly define the risk, then that calculation cannot be made").* Much of the same evaluations that are used to critique the science in support of plant-based diets (e.g., non-comparative controls, here 'placebos') are applied here. Though, it is important for us to note that, elsewhere in the discourse on vaccination, some *r/AntiVegan* users can be seen holding more favourable views on vaccination and equating vegans with *"anti-vaxxers"* about whom

they hold particularly negative views. This critical and nuanced discourse suggests that *r/AntiVegan* users' may be well versed in scientific inquiry and critical evaluation.

Animal death. The discussion that underpins theme three takes a matter-of-fact approach to animal death, and argues that regardless of an individual's dietary choice, animal suffering and death is inevitable: *"Death is certain. Suffering is part of life".* Hence, prominent word loadings include: *animal, kill, death, suffering* and *life.* Construing animal death in such a way may be intended to rebuff the belief commonly attributed to vegans that killing an animal is *always* wrong. Put another way, the argument that death is inevitable builds upon the belief that loss of life is ultimately unavoidable and, particularly in the case of food, necessary. In this vein, veganism is portrayed as naïvely idealistic; *"you have to understand that 'no suffering' is never going to be possible"* and vegans are viewed as disconnected from the natural world: *"They have no hands-on experience with how their existence fits into the food chain, or indeed how life on earth itself works".* Tied to this, many *r/AntiVegan* users find inconsistencies in the vegan message, as they claim that even non-animal agriculture kills animals as a by-product of production: *"The number of animals that die to produce vegan food is astonishing".* Though some *r/AntiVegan* contributors recognise that with meat there is greater intention to kill than with plant cultivation, ultimately they feel that *"A death is a death. Suffering is suffering".* For these reasons, vegans can be painted as *"ignorant and hypocritical"*.

Importantly, when talking about animal agriculture, many *r/AntiVegan* users discriminate between killing animals for meat and factory farming. Indeed, there is fair amount of consensus within *r/AntiVegan* that factory farming is wrong: *"I'm not talking about factory farming here. I don't think anyone truly disputes that factory farms are unfathomably and heart-wrenchingly cruel, as well as environmentally catastrophic".* There is also the strong belief that, outside of factory farming, the killing practises of the animal

agriculture industry are far more humane ("*a swift bolt to the head*") than an animal might expect to endure in the wild (*"torn apart by a predatory wild animal"*), and that, in farming animals, humans provide them a service: "*I'd much rather a caged catered life over being a roaming scrounger".*

As a result of a matter-of-fact approach to animal death, many *r/AntiVegan* users feel that their role as animal consumers is to shop responsibly for high-welfare, environmentally sustainable food products. Many users express the fatalistic, pragmatic belief that, ultimately, animals are going to die and so the best they can do for animals is to support an agricultural system that minimises harm and waste: *"I believe it is every omnivore's duty to make sure that animal life is not taken in an inhumane manner and that none of the products from a slaughtered animal are wasted".* For many *r/AntiVegan* users, high-welfare farming *is "family-owned, small-scale, organic farms with pasture-raised livestock".* This preference for purchasing *better* meat, leads many *r/AntiVegan* users to abhor so-called *militant* vegans, those who hold a rigid view that *"all meat is murder"* and do not respect people's choice to make better rather than restrictive decisions around food.

Experiential. The words that load onto this factor are indicative of storytelling semantics: *time, day, start*, *thought,* and *said*. Indeed, this theme relates to the *anecdotal* evidence that *r/AntiVegan* users draw on when discussing their motivations for identifying as anti-vegan, or for turning to this community for support. It is striking that this theme is contrasted with the second theme, a logic-driven argumentation style. Unlike the logic-driven theme where *r/AntiVegan* users can be seen as drawing on scientific research to evidence their points, these users draw more on their own personal experience with veganism. For example, sharing personal narratives (*"I lived and grew up on…"*), relational experiences, conversations they have had, videos they have seen and *r/AntiVegan* discourse itself. As a result, much of the content seems to be born out of intuition (e.g., *I think, I know, I wonder*)

and reads like hearsay (e.g., *"I hear that people", "some people say"*). The general tone of this content in relation to that under theme two is less analytic and less cognitively rigid (e.g., *should, maybe, might, suppose*).

In an experiential fashion, *r/AntiVegan* users share their stories of the negative personal experiences with vegans ranging from personal relationships that have been destroyed as a result of veganism and interactions with the general public. The highest scoring submission on this factor, a 2,291-word story which explores how the user's relationship was destroyed when their ex-fiancé made the decision to become vegan overnight. Not alone, another user explains: *"Over a year ago, my husband watched some documentary on Netflix and decided to go Vegan. We had a blow up fight about it".* In another post, the user, a pet-shop assistant, narrates a conflict with a vegan member of the public who was insisted on feeding their newly adopted cat a vegan diet.

Morality. The last theme reflected discussion of the moral arguments that underpin veganism. Hence, emergent word loadings included: *argument, moral, animal, debate* and *wrong.* Needless to say, *r/AntiVegan* users are opposed to the moral arguments that vegans present. Instead, they believe that "*it is morally permissible to humanely slaughter a non-person animal for its products".* For this reason, they see the moral message as being ineffective for encouraging people to go vegan: *"moral arguments for veganism will never compel me to go vegan".* We have summarised the arguments within this theme into three strands.

First, many *r/AntiVegans* view vegans as making indefensible, absolutist moral claims. One user explains: *"I'm not anti-vegan per se, but I'm highly intolerant to people who think they have the ultimate wisdom because of their belief and dictates their way of life (vehemently) on others".* By contrast, many *r/AntiVegans* see morality as a relative construct which "*differs from person to person"* believing that not everyone shares the same moral

convictions, nor should they feel compelled to act contrary to their own convictions: *"everyone has different moral values there aren't a set of defined rules we must ad-hear to").* The issue of militant vegans re-occurs in this theme, with "*radical*" vegans criticised for their inflexible moral absolutism: *"Those animals do need to live in better conditions but for their radical minds, they just can't compromise".*

Second, *r/AntiVegan* users strongly dislike the ways in which vegan advocates use the moral message in their campaigns, specifically when drawing comparisons between non-human animals and humans who represent social minorities. Oftentimes, in their advocacy, vegans can draw on human examples of rape, slavery, and murder to explain animal agriculture practises like artificial insemination, confinement and slaughter. These comparisons are particularly vexing. One user explains: *"I adopt an anti-vegan stance purely to reject the stream of accusations of murder, rape, holocaust etc".* The *r/AntiVegan* community believe that these so-called *"emotional shock tactics"* are designed to catch non-vegans acting morally inconsistent *("gotcha type questions")* and are thus met with particular reproach. Words like 'murder' and 'rape' are seen as extreme and this adds to the perception of vegans as being militant and overly zealous: *"Many vegans, like yourself, are overly aggressive when making your point… You attack people verbally and use extreme words like 'murder' and imply someone is 'evil".*

Furthermore, many *r/AntiVegan* users expressed offense at these comparisons because they see certain animals as distinctly different from humans due to their lower sapience and inability to conceptualize abstract concepts like freedom and morality. This explains the final strand of argumentation that *r/AntiVegans* present for opposing the vegan moral message: they proudly hold speciesist views. Thus, by comparing the lives of farmed animals to that of humans, vegans are seen as belittling the plight of many people in society. The vegan movement is seen as a *"cult"* that *"discriminates a variety of people".* Vegans themselves

are seen putting *"animals above people"* and as such are viewed as misanthropists who: *"are so far up their misanthropy and, hilariously, projecting Humanity onto animals that they don't realize how absurd comparing slavery to animal domestication is."* Even more extreme views include seeing vegans as attempting to eradicate human life: *"On a psychological level they think humans are generally bad thus the consequence is the eradication of humans is the logical next step".*

RQ3: Does engagement with the *r/AntiVegan* community precipitate social psychological change, as evidenced by changes in users' language use?

To investigate longitudinal changes in the language of *r/AntiVegan* users, we computed a variable reflecting a unique post made by each user in a new calendar week. The variable, which we refer to as '*week'*, worked by scoring each user's first post as week one. Every subsequent post that fell in a new calendar week was assigned an ascending value, by increments of one. All posts made within the same calendar week were assigned the same value. This produced a string variable with a sequence from 1-52. By computing a time variable in this way, we were able to aggregate all posts at the week and user level, holding each user's first post and the year in which it was made, constant.

With these data, we first sought to identify the rate of attrition within the *r/AntiVegan* community and the point at which we lose the majority of our sample. As is typical in online communities (e.g., Wong et al., 2015), most users in *r/AntiVegan* remained active for a relatively short amount of time (see Table 4.4). The majority of the sample (62.2%) made one post in *r/AntiVegan*, while only a minority (7.15%) remained for a prolonged period of time, posting for 10 weeks or more. Just two highly active users consistently posted in *r/AntiVegan* each week for the duration of 52 weeks. Hence, to map longitudinal changes amongst a subset of committed users, an attrition threshold of 80% was employed, which limited the

investigation to the first four weeks of activity, a point at which 18.3% (*N*=700) of the original sample remained.

Table 4.4. *r/AntiVegan user sample attrition across a ten-week period.*

Week	Users (N)	%
1	3819	100
2	1443	38
3	941	25
4	700	18
5	558	15
6	463	12
7	405	11
8	357	9
9	307	8
10	273	7

All posts with a word count ≥ 50 occurring between weeks 1-4 were quantified for analysis using LIWC2015. We conducted an initial exploratory analysis to determine potentially meaningful longitudinal changes in LIWC outcomes. This involved visually inspecting a sample of 18 relevant LIWC outcomes as a guide for later significance testing. The 18 variables that were selected were those deemed to be relevant to the topic of anti-veganism (e.g., "Health", "Body") or group-processes (e.g., "Affiliation", "Power"). All of the 18 variables that were visually inspected can be viewed via our analysis script (https://osf.io/5xs4a/). The six variables – "I", "Cogproc", "Authentic", "Clout", "We", and "Anx" (described in turn, below) - were those which evidenced promising findings upon visual inspection (See Supplementary Materials B) and were thus selected for further significance testing.

The LIWC variable named "I" refers to self-focused language, specifically the use of first-person singular pronouns such as *'I'* and '*me*'. The LIWC variable named "Cogproc" measures language pertaining to cognitive processing, including insight (e.g., *think, know*),

causation (e.g., *because, effect*), discrepancy (e.g., *should, would*), tentativeness (e.g., *maybe, perhaps*), certainty (e.g., *always, never*) and differentiation (e.g., *hasn't, but, else*). The LIWC variable named "Authentic" refers to the use of authentic language, that which represents more honest, unfiltered, and spontaneous speech (Jordan et al., 2018). Dimensions that positively load onto the authenticity index include self-focused language, insight, words, differentiation words (e.g., but, though, versus) and relative terms (e.g., *above, stop, sudden)*; dimensions that negatively load include discrepancies from reality (e.g., *hope, must, ought*) and third-person singular pronouns (e.g., *she, her, himself*). The LIWC variable named "Clout" can be considered a marker of confidence in language (Drouin et al., 2017; Jordan et al., 2019). Dimensions that positively load onto Clout include group-focused language (i.e., *'we'* words) negations (e.g., *no, not, never*) and swear words while dimensions that negatively load onto Clout include self-focused language (i.e., lower use of *'I'*). The LIWC variable "We" reflects the use of group-focused language, specifically the collective pronoun *'we'*. Lastly, the LIWC variable named "Anx" refers to the use of anxious language, including words like "worried" and "fearful".

To determine meaningful differences in each of these six LIWC outcomes, between weeks one and four; we conducted a series of paired-samples t-tests using Welch's Test to control for unequal sample sizes. Five of these six variables returned significant findings, with varying, relatively small effect sizes ("Anx" was not significant; see Table 4.5 for details).

Table 4.5. *Linguistic Inquiry Word Count t-test analysis*

LIWC Category Variable	Mean (*SD*)		Mean Difference (Week 1 - Week 4)	95% Confidence Interval	*t*	*p*	*d*
	Week 1	Week 4					
I	4.06 (3.57)	3.31 (3.13)	-0.75	0.41, 1.08	4.37	0.000	0.21
Cogproc	15.10 (4.73)	14.42 (4.69)	-0.68	-0.18, 1.16	2.69	0.007	0.14
Authentic	39.53 (29.9)	35.77 (27.4)	-3.76	0.86, 6.65	2.54	0.011	0.13
Clout	51.25 (25.7)	54.39 (24.2)	+3.14	-5.68, -0.59	-2.42	0.016	0.12
We	0.57 (1.18)	0.72 (1.36)	+0.15	-0.28, 0.01	-2.09	0.037	0.12

Notes: *p* values were not corrected for multiplicity.

LIWC Category Variables: "I" refers to self-focused language, "Cogproc" cognitive processing, "Authentic" authentic language, "Clout" confident language, and "We" group-focused language.

Degrees of freedom were as follows: I (778.26), Cogproc (703.3), Authentic (748.79), Clout (730.57), We (637.17).

d refers to Cohen's *d*.

Discussion

The present study applied computerized text analytic methods to language data produced by self-identified anti-vegans on the subreddit *r/AntiVegan*. These methods returned novel insights into the psychosocial characteristics and motivations of individuals actively opposed to veganism as a social movement and, how such a community evolves over time. The study represents a novel, large-scale, naturalistic view of anti-vegan attitudes and argumentation, from the first-hand perspective of anti-vegans, within an English-speaking sample. Below we discuss key findings relating to our three guiding research questions.

Who are r/AntiVegans?

Relative to the general Reddit userbase, *r/AntiVegan* users occupy spaces in Reddit pertaining to dark humour, that which finds comedic value in human suffering and topics which are typically considered taboo (Bloom, 2010). Previous research has shown that the appreciation of dark humour is more popular amongst males, those high in rebelliousness and younger people (Aillaud & Piolat, 2012; Oppliger & Zilmann, 1997), which is particularly revealing. Importantly, and in accordance with the desensitization hypothesis, previous research has linked violent media (Carnagey et al., 2007) and internet memes that draw on dark humour (Sanchez, 2020) with psychological desensitization to violence. *r/AntiVegan* users' interest in dark humour appears consistent with an unsentimental attitude towards animal slaughter and death.

Here, dark humour is a tool used to denigrate both the self (*r/MakeMeSuffer*) and others (*r/AccidentalRacism*). We see the use of other-deprecating or disparagement humour as particularly revealing of psychosocial characteristics of *r/AntiVegan* users. Disparagement humour is any attempt to amuse through the denigration of an individual or social group (Janes & Olson, 2000). Disparagement humour can be an opportunity for people who harbour

prejudicial attitudes to express them (Ford & Ferguson, 2004). Many of the subreddits that *r/AntiVegan* users frequent, particularly *r/darkjokes* and *r/AccidentalRacism*, include the expression of prejudicial attitudes towards groups including (but not limited to) women and people of colour. Previous research has found that generalized ethnic prejudice, speciesist attitudes towards animals, and antipathy towards vegetarians share ideological roots, specifically, social dominance orientation (SDO; Dhont & Hodson, 2014; Dhont et al., 2016). Our analysis would thus suggest that *r/AntiVegan* users would score high on measures of SDO relative to the general population of Reddit users.

A prominent demographic amongst *r/AntiVegan* users was a group of ex-vegans seeking health advice and social support from the community, despite ex-vegans having their own home on Reddit (*r/exvegans*). The finding that former vegans are motivated by health concerns and a desire for greater social connectedness is consistent with past research (Asher et al., 2014; Barr & Chapman, 2002; Hodson & Earle, 2018). That these motivations would push former vegans to stand with those advocating against veganism was documented here and in the work by Aguilera-Carnerero and Carretero-González (2021). While these results highlight *why* many ex-vegans join anti-vegan communities, the extent to which ex-vegans endorse anti-vegan sentiments remains unclear. Drawing insights from the wider literature on religion, we know that when an individual leaves a group, they may often continue to exhibit many of the behaviours and cognitions typical of their former group – an effect known as religious residue (Van Tongeren et al., 2021). From this perspective, one might predict that ex-vegans will endorse anti-vegan sentiments to a much lesser extent than those who have never been vegan. Though, these assumptions would require further investigation.

Despite using scientific evidence to support their own arguments, *r/AntiVegan* users denigrate vegans for their supposed *misuse* of scientific evidence and question the research underpinning vegan advocacy. This may be evidence of a motivated cynicism toward, or denial

of, the science in support of veganism. Indeed, the dismissal of well-established scientific evidence for non-scientific motives (Prot & Anderson, 2019) is particularly common when such evidence threatens cherished values (Cofnas et al., 2018) like the consumption of meat (e.g., Dhont et al., 2021). Since meat consumers at times experience dissonance with regards to their meat consumption (Rothgerber, 2020), this raises the provocative question of whether their distrust is partly fuelled by efforts to redress meat-oriented dissonance.

r/AntiVegan beliefs and opinions

Contrary to the common assumption that anti-vegan views are ill-informed and mean-spirited, our analysis suggests that anti-vegans are an interestingly heterogenous group with a varied set of beliefs and opinions. This includes the view that veganism is nutritionally inadequate. Discussion around the negative health consequences of a vegan diet was highly nuanced, extending beyond the mere absence of food-derived nutrients, to talk around bioavailability, metabolic profiles, and nutrient absorption. This aspect of *r/AntiVegan* belief system might be considered an extension of one of the "4Ns" of meat-eating justification (Piazza et al., 2015) – the argument that eating meat is *necessary* for human health. This argument was also highly entangled with a second of the 4Ns, the argument that eating meat is *natural,* as well as arguments around the nutritional convenience of a meat-based diet. Further, we noted some discussion of veganism as having links with disordered eating, which was both an argument against veganism, put forward by *r/AntiVegan* users, and part of the lived experience of ex-vegans active in the subreddit. Although this theme was rare, links between veganism and disordered eating has been reported elsewhere by researchers (e.g., Parra-Fernandez et al., 2020). A potential reason why personal health is such a cardinal line of anti-vegan argumentation is because arguably, nutritional inadequacy is one of the strongest counterarguments against veganism. If meat is *truly* necessary for human health, then it is unavoidable and a vegan diet unsustainable.

Animal death as an unavoidable reality was also central to anti-vegan opinion, as was the notion that veganism is an idealistic view of the natural world. Here, *r/AntiVegan* users argued that, in so far as humans do so responsibly, killing animals for consumption is natural and a service to the animal, whose death would be more brutal in the wild. This line of argumentation has strong parallels with the *less but better* concept, a strategy employed by NGOs (e.g., RSPCA Assured) to promote more sustainable consumption practises, and one which seems to garner a good deal of public support (Pohjolainen et al., 2016). Here, *r/AntiVegan* users can be seen using the *less but better* concept (albeit, with a greater focus on *better*) as a meat-eating justification, to defend their current practises and offer a counter-solution to veganism. *r/AntiVegan* users define *better* meat in terms of opposing factory farming and purchasing meat produced on small, family-owned, organic farms from livestock free from confinement and instead raised on pasture. Given the pervasiveness of factory farmed meat in most countries (Sentience Institute, 2019), this line of argumentation could reflect either an insensitivity to animal suffering, or an attempt to resolve the cognitive dissonance that arises when one acknowledges their role in said suffering (Rothgerber, 2020). Indeed, there is evidence to suggest that meat consumers engage in wishful thinking by overestimating the availability of "humanely" produced meat (Cornish et al., 2016; Rothgerber, 2020). Regardless, what is clear is that vegans and many anti-vegans share the central belief that humans have a responsibility to care for animals, common ground that might be harnessed to facilitate inter-group relations.

The unpleasant, moralistic tone of vegans was a frequent topic of *r/AntiVegan* discussion. This finding is somewhat unsurprising given that the vast majority of anti-vegan research has converged on the conclusion that discrimination of vegans is often motivated by impressions of their “holier than thou” posture (De Groeve et al., 2021; Minson & Monin, 2011; Weiper & Vonk, 2021). Here, the vegan moral argument is rejected for three reasons:

first, *r/AntiVegans* tend to be moral relativists and thus abhor so-called militant vegans who demand that others endorse their own convictions about animals. Second, *r/AntiVegan* users strongly dislike how vegan advocates use moral messages in their campaigns, specifically when drawing comparisons between non-human animals and minority human groups. Finally, they reject the vegan critique of speciesism. Some anti-vegans proudly held speciesist views, which might be additional evidence for profiling *r/AntiVegan* users as high in social dominance orientation, given the strong empirical overlap between speciesism endorsement and SDO (Dhont & Hodson, 2014).

Enhanced group commitments over time

Our final research aim was to explore the social psychological effects of *r/AntiVegan* membership using longitudinal changes in LIWC variables. Amongst a subset of committed users, we observed a small *decrease* in the use of first-person pronoun (i.e., "I"), cognitive processing (i.e., "Cogproc"), and authentic language (i.e., "Authentic") over time. In addition, there was a small *increase* in group-focused language use (i.e., "We") and confident language (i.e., "Clout"). Taken together, we see these findings as indicative of a strengthening of group processes and increased group socialisation. As an individual user becomes integrated with the group they rely less on the first-person *'I'* and increasingly the collective *'we'* (Lee et al., 2020). Not only do these users reference themselves less, but over time the authenticity in their speech is reduced suggesting a move away from valuing what is individual and original and a move towards group conformity. Users' persistent activity on *r/AntiVegan* increased their confidence and certainty (i.e., "Clout"). Such linguistic displays are characteristic of people with higher social status or who yield greater influence over a group (Cassell et al., 2006; Dino et al., 2009), possibly suggesting that, as time goes on, a hierarchy of group leadership emerges amongst a subset of highly committed *r/AntiVegan* users.

This pattern of increased clout is inversely related to cognitive processing (i.e., "Cogproc"). Here we saw cognitive processing decreasing somewhat over time, suggesting that persistent activity on *r/AntiVegan* resulted in a reduction of logic-driven, critical thinking around the topic of veganism. Though, this is not to argue that anti-vegan argumentation descends into illogical thought, instead, it is more likely that talk moves away from defending the anti-vegan position as users' certainty of their beliefs in enhanced. Taken together, we see this inverse relationship between clout and cognitive processing as suggestive that, over time, the group processes under *r/AntiVegan* are refined and a hierarchy is established amongst a subset of committed users who are increasingly comfortable with their role within the group and more epistemically certain of their anti-vegan position.

Implications

This research offers rich insights into anti-vegan thinking, motives, and behaviour, which has important implications for vegan-nonvegan relations. While we have predominantly highlighted the ways in which anti-vegan and vegan ideology diverge, it would seem that the two are connected in their shared belief that humans have a responsibility to minimize the harmful impacts that their choices have on animals and the environment. How the two groups seek to achieve this goal is where they diverge. While anti-vegans believe it their role to shop responsibly (i.e., for high-welfare, environmentally sustainable products), vegans believe they should not shop for animal-derived food products at all. All things considered, there may be more common ground to harness between vegans and anti-vegans than one might otherwise assume outside of the present investigation.

Further, many *r/AntiVegan* users confine their antipathy towards vegans to "militants" or the overly zealous (*"I don't hate/dislike vegans"; "But militant veganism makes me want to dig my heels in").* In fact, some avow *"respect"* for the *"admirable"* work that vegans do and even enjoy eating vegan or meatless food themselves (*"I love a good vegan meal and I'm*

really open to eating less meat"). We see this specialised hatred toward so-called *militant* vegans as meaningful in explaining much of the hatred directed towards vegans. Importantly, one of the extreme consequences of militant veganism that we observed from these data is the perception of vegans as misanthropists and veganism as a cult (recall the *r/AntiVegan* strapline *"against the cult of veganism"*). We conducted further exploratory qualitative analyses of the anti-vegan perception of veganism as a cult, which can be viewed in Supplementary Materials C. We recommend that future research examines the underpinnings and accuracy of these judgments, particularly claims about vegans as misanthropes.

Our analysis suggests that *r/AntiVegans* define militant vegans as those who are inflexible and particularly aggressive in their moral thinking. The literature of psychological reactance might help to explain these findings. Spelt et al. (2019) have found that highly controlling language in meat reduction appeals is associated with increased psychological reactance, as measured by scales of anger and perceived threat to freedom, relative to low controlling language. Thus, vegan advocacy that is extreme and unforgiving may be damaging to the progression of the movement insofar as reactance may a barrier to message receptivity.

Limitations and future directions

Despite the many strengths of this research, it is not without its limitations. One such limitation of this work is the inability to differentiate users in our sample who were members of *r/AntiVegan* from those who were active in the space, though not members. Thus, the percentage of users in our sample who do not identify as anti-vegan is unknown. Despite this, we have a number of reasons to believe that these numbers are extremely small and add minimal (if any) noise within our data. First, *r/AntiVegan* list in their community rules that "no vegan may troll, preach, or spread misinformation or propaganda". To police this rule, *r/AntiVegan* employ both human moderators as well as a '*bot'* to filter out vegan

"trolls/brigaders" and remove "pro-vegan submissions" from this space. Hence, we imagine that the number of vegans present in *r/AntiVegan* is small. We also have strong reason to believe that our findings are reflective of the social psychology of anti-vegans, given that we employed steps to sample data from highly committed contributors, for example, employing conservative word count thresholds and for RQ3 specifically, analysing a subset of highly committed users. Qualitatively, our findings also align with this notion. For example, our user base was active in other spaces on Reddit relating to anti-vegan ideology (e.g., *r/DebateAVegan* and *r/carnivore*), suggesting anti-vegan ideology to be central to these users' identity and behaviour on Reddit. Furthermore, several anti-vegan arguments that are recognised here (e.g., the argument that veganism is inadequate for human health) also align with previous sentiments communicated by committed meat consumers (e.g., the belief that meat is necessary to be healthy; Piazza et al., 2015).

Another limitation is the demographic skew of Reddit users, which tends to trend in the direction of young, English-speaking males. It is estimated that approximately 90% of Reddit users are under the age of 35 (Bogers & Wernsen, 2014), 63% identify as males (Pew Research Center, 2021) and just under half from the US (Statista, 2021). In this regard, our research is highly skewed toward Western Education Industrialized Rich and Democratic (WEIRD) populations. Future research ought to investigate anti-vegan sentiments with other demographic profiles, for example countries where the prevalence of vegetarian and vegan diets is much higher (e.g., India, Israel).

In our analysis, we overlooked a number of dimensions of *r/AntiVegan* communication, for example, their use of multimedia, upvotes, permalinks and hashtags. Our dataset affords the opportunity for future work to study the sharing of multi-media content. Of particular relevance would be to study the communities use of internet memes. Internet memes, humorous images, and videos, can be thought of as a fast-paced and somewhat

competitive style of humour, with memes that arouse the most attention (measured in likes, comments or in this case *upvotes*) typically out-living those that are less impactful. Aguilera-Carnerero and Carretero-González (2021) found that anti-vegan memes can range from non-offensive light humour to hate-laden attacks on vegan character and the movement as a whole. Meme-sharing thus may provide yet another window into anti-vegan thought.

We restricted our investigation to *r/AntiVegan*, yet there is reason to believe that anti-vegan attitudes bleed out from this space into other relevant subreddits: *r/VegoonCircleJerk, r/ShitVegansSay, r/CringeyVegans* and *r/DumbVeganLogic*, to name a few. Outside of Reddit, there are several English-speaking anti-vegan communities on Facebook, which has more active daily users than Reddit (Pew Research Center, 2021). Our research overlooks these spaces and in doing may present a limited view of online anti-vegan attitudes. Future research should widen its scope by analysing anti-vegan discourse across multiple platforms.

It might be a fruitful endeavour for future research to seek to understand what motivated Reddit users to join the *r/AntiVegan* community. The authors made an attempt to address this question, detailed in Supplementary Materials D. However, results from this analysis were no more revealing of the motivations for joining *r/AntiVegan,* than were those from the MEM reported in-text. We report both for the sake of completeness. Future work could investigate this by mapping an individual user's Reddit journey prior to joining *r/AntiVegan,* for example, the subreddits they frequent and any changes in their language style in the months leading up to joining the community. Previous research (Phadke et al., 2020) has outlined such an approach and has found meaningful patterns in what motivates people to join conspiracy communities. In future research, these methods could be applied to the study of the formation of anti-vegan attitudes.

Lastly, these methods could be extended to study the inter-group relations between vegans and anti-vegans. These such interactions are observable in spaces like

r/DebateAVegan, where lines of communication between vegans and those opposed to veganism is less restricted that in a space like *r/AntiVegan* where vegans are censored. Recent research by Kumar et al. (2018) has mapped out intercommunity interactions on Reddit, specifically examining cases where one community becomes mobilized by negative sentiment to comment in another community. In future research, their methods could be applied to study the intergroup processes between *r/AntiVegans* and the vegan community on Reddit.

Conclusion

In a fast-growing body of literature, academics are seeking to understand anti-vegan attitudes and what motivates them. The present study investigated anti-vegan attitudes first-hand, from the perspective of a community of individuals who publicly identify as being anti-vegan. Here, we observed that *r/AntiVegan* users are unique from the population on Reddit in the extent to which they embrace taboo topics and dark humour, they engage in critical and nuanced discussions of the moral and health claims of vegans and show signs of increased certainty and group commitment over time. The views of *r/AntiVegans* represent a stiff challenge to vegan advocacy, but also, we expect, a useful battlefield of operation for helping vegan advocates creatively refine their arguments and strategies.

Study 5: Is being anti-vegan a distinct dietarian identity? An investigation with omnivores, vegans, and “anti-vegans”

Rebecca Gregson, Dr. Jared Piazza & Dr. Heather Shaw

Abstract

Adding to research on the form and content of anti-vegan sentiment, recent scholarship has identified a group of individuals who self-subscribe as "anti-vegan". Here, we sought to determine whether anti-veganism might reflect a distinct dietarian identity with its own unique ideological profile. Two-hundred and fourteen vegans, 732 omnivores, and 222 "anti-vegans" were assessed using a survey methodology that included the Dietarian Identity Questionnaire and ideological markers related to dark humour, social dominance orientation (SDO), speciesism, male-role norms, moral relativism, and attitudes toward science. Our analysis revealed a dietarian identity unique to anti-vegans. The dietary patterns of anti-vegans were more central to their identity than for omnivores, though marginally lower than vegans. Like vegans, anti-vegans scored highly on dietarian measures of private regard and personal dietary motivations, and lower than omnivores on public regard. The diets of anti-vegans were more morally motivated than omnivores. However, anti-vegans scored higher than both omnivores and vegans on a number of ideological measures including dark humour, SDO, speciesism, male-role norms, moral relativism, and distrust of science. Somewhat surprising, anti-vegans held greater trust than omnivores in the science of plant-based nutrition. We discuss the unique dietarian identities of anti-vegans, considering both intra-group differences of omnivores and anti-vegans (e.g., in right-wing ideology), and inter-group similarities of vegans and anti-vegans (e.g., in diet centrality).

Key words: anti-vegans, veganism, group identification, dietarian identity, ideology, prejudice

Introduction

Morally dubious behaviours polarise opinion and foster the adoption of conflicting identities (Bluic et al., 2015). Consuming animal products, including meat, dairy and eggs, is an example of a highly valued but increasingly scrutinised practice (Gregson et al., 2022). Although many people value animal products for their taste (Graça et al., 2015), convenience (Lea et al., 2006) and nutritional profile (Piazza et al., 2015), their production and consumption has been linked to a range of public health, animal welfare, and ecological concerns (e.g., Poore & Nemecek, 2018). There is high consensus amongst both policy makers and academics that plant-forward diets can help address food sustainability, public health, climate change, and ecosystem degradation (Huang et al., 2020; IPCC et al., 2022; Willet et al., 2019). Consumers, likewise, are becoming aware of these issues (e.g., de Boer et al., 2013; Pohjolainen et al., 2016). As such, a commitment to not consuming animal products often relates to a person's identity and forms the basis of important social evaluations (Gregson et al., 2022; Rosenfeld, 2019).

Veganism: a dietary practice and identity

Veganism, at least in dietary terms, can be understood as the voluntary abstention from all or most animal-derived food products (The Vegan Society, 2021). There is strong evidence that over recent years vegan diets have increased in prevalence (e.g., see Asano & Biermann, 2019) and have received growing attention from both the public and academic communities (Ruby et al., 2023). Yet, despite its absolute growth in recent years, veganism remains a relatively unpopular practice. An investigation that sampled 28 countries from all six inhabited continents estimated that approximately 3% of the global population identify as vegan, though rates of veganism varied at a rate of 0-19% (IPSOS Mori, 2018). Demographically, vegans are more likely to be female (IPSOS Mori, 2018) and politically left-leaning individuals, who endorse a more liberal worldview (Asher et al., 2014). They are

thought to be well-educated, urban dwellers, who display an inclination for secular views on religious matters (Asher et al., 2014).

Though oft-considered a behavioural response to the current health and ecological crises, veganism is a lifestyle with ancient roots, diverse cultural expressions, and a deep philosophical underpinning (Zaraska, 2016). At its core, veganism is a philosophy and lifestyle which seeks to avoid all forms of animal exploitation and cruelty (The Vegan Society, 2021). Proponents of vegan diets are motivated by a multitude of personal, prosocial, and moral factors and tend to share core ideological values (Rosenfeld, 2018; Ruby, 2012). Most commonly, vegans report animal ethics as a key driver of their vegan lifestyle (Janssen et al., 2016; Rosenfeld, 2018). Hence, the adoption of a vegan lifestyle entails more than the acquisition of a new diet. It includes the formation of a social identity (de Boer et al., 2017; Tajfel & Turner, 1979).

As part of a move toward understanding meat-eating behaviour from a social identity perspective, Rosenfeld and Burrow (2018) formulated the *dietarian identity - a theoretical framework for understanding* one's thoughts, feelings, and behaviours with respect to consuming or eschewing animal products. Dietarian identity involves the centrality, motivations, group perceptions, and strictness of a person's diet-based identity (Rosenfeld & Burrow, 2018*)*. Using this framework, research has considered the unique profiles of vegans compared to vegetarians (Rosenfeld, 2019), and vegans and vegetarians compared to omnivores (Kirsten et al., 2020). Work in this area generally converges on the conclusion that, relative to vegetarians and omnivores, vegans showcase a unique dietarian identity. Specifically, vegans consider their diet to be more central to their overall sense of self and hold members of their dietary in-group in greater esteem. Compared to dietary out-groups, vegans also report stronger personal, prosocial, and moral motivations for following their diet and adhere to their diet more strictly. Furthermore, vegans judge dietary out-groups more

harshly, and feel more stigmatized by others on the basis of their vegan membership – feelings which may reinforce their strong group identification (Bagci et al., 2022; Branscombe et al., 1999).

Vegan prejudice

Vegans represent a challenge or threat to the majority view and draw attention to the potential issues with animal agriculture (Kurz et al., 2020). As such, they are often met with resentment and can elicit irritation in those who consume animal products (De Groeve et al., 2021; Dhont & Hodson, 2014; Rothgerber, 2014). Indeed, prejudicial views toward vegans have prevailed for many decades (Iacobbo & Iacobbo, 2004) and appear often in popular media (Cole & Morgan, 2011; Ragusa et al., 2014). Impressions of vegans as moralistic (e.g., self-righteous, opinionated, judgmental) and extreme (e.g., militant, overbearing) account for much of the antipathy and discrimination against them (De Groeve et al., 2021). This finding is consistent with the idea that vegans pose a symbolic or ideological threat to omnivores. Also consistent with the symbolic-threat account are studies which show that prejudice towards vegans is particularly high amongst demographics that report high meat consumption, for example: cis-gendered males (Vandermoere et al., 2019), politically right-leaning individuals (Dhont & Hodson, 2014), those endorsing traditional views of gender (Earle & Hodson, 2017), and those endorsing hierarchical views of society and dominating attitudes towards animals (e.g., speciesism; Dhont et al., 2016; Leite et al., 2018).

Self-identified anti-vegans

The research conducted to date has been invaluable in advancing our scientific understanding of vegan prejudice. However, this research has largely focused on the nature of anti-vegan sentiments expressed by members of the general public when solicited by questions or measures in surveys or experimental research. Studies of naturally-occurring

vegan antagonism, thus, can help provide a fuller picture of the prevalence, form, and content of anti-vegan sentiment. Indeed, the proliferation of the internet and other digital technologies has provided both new *opportunities* and *methods* to study anti-vegan sentiment. Over the last decade, individuals who strongly endorse anti-vegan sentiments and self-subscribe as "anti-vegan" have organised, both online and offline, around their shared views on veganism. Anti-vegan communities have emerged on popular social media platforms like Facebook and Reddit (Gregson et al., 2022). Offline, self-identified "anti-vegans" have engaged in actions such as graphic displays of animal consumption in public restaurants and at vegan food festivals (Reynolds, 2019). Research into the discourse and behaviour of self-identifying "anti-vegan" groups may provide new insights into the form and content of anti-vegan sentiment.

Recently, Gregson et al. (2022 – study 4) took a novel approach to studying anti-vegan groups. Using data derived from the popular social media platform, Reddit, the authors analysed the discourse and behavioural patterns of *r/AntiVegan* users. Their work suggests that anti-vegans' opposition to veganism extends beyond a dislike of moralistic vegans, and incorporates complex ideological perspectives on health, morality, animal death, and science. In this research, anti-vegans were observed expressing views on animal suffering and death that were both proudly speciesist and resonant with a moral relativist stance. In a similar vein, anti-vegans were highly critical of moral absolutism, of which they felt that vegan ideology was built upon. Indeed, so-called "militant" vegans were those who were seen to be endorsing a particularly strong absolutist moral position. Anti-vegans viewed vegan diets as inadequate, even damaging to human health. This critical position of the health implications of veganism was formed in relation to scientific literature and in consultation with former vegans. *r/AntiVegan* posts involved critical and nuanced discourse of scientific evidence, and espoused scepticism towards research that supported the health benefits of a vegan diet. Based

on other subreddits frequented by *r/AntiVegan* users, and compared to the wider population on Reddit, anti-vegans evidenced a particular concentration on anti-vegan content, and an affinity for dark humour. While this work was consistent with earlier learnings, it sparked a commentary around how the expression of anti-vegan *sentiment* may be psychologically distinct from the adoption of an anti-vegan *identity*. The self-identified anti-vegans in Gregson et al.'s (2022) study presented a complex critique of vegan behaviours and beliefs, as opposed to merely expressing antipathy towards vegan actors.

The current study and hypotheses

In the current study, our main aim was to determine whether anti-vegans would exhibit a unique dietarian identity and ideological profile relative to both omnivores and vegans. Accordingly, we engaged in a rich, comparative exploration of the dietarian identities and ideological correlates of individuals who identify as "anti-vegan". Though our approach was largely exploratory, we did anticipate and preregister a few predictions based on suggestive lines of evidence stemming from Gregson et al.'s (2022) analysis of *r/AntiVegan* discourse and previous studies of vegan prejudice (see pre-registration document at AsPredicted.org #92722). First, we predicted that the dietary expression of anti-vegans would be more *personally* motivated than both omnivores and vegans given their strong convictions about the health consequences of a vegan diet and the necessity of animal protein for optimal nutrition. Second, consistent with previous literature, we predicted that vegans would be more *morally* motivated and their diet central to their identity at rates higher than both omnivores and anti-vegans because of the restrictiveness of vegan diets and its ethical basis (Kirsten et al., 2020; Rosenfeld, 2019). We made no specific prediction about whether anti-vegans would view their dietary habits as more "central" to their identity than omnivores, though such a prediction might be inferred from the strong attitudes anti-vegans express regarding the moralisation of animal-product consumption (Gregson et al., 2022).

Regarding the ideological profile of anti-vegans, we explored some of the themes that emerged in the online discourse and subreddit behaviour of *r/AntiVegans* (Gregson et al., 2022). Our comparative hypotheses were based upon observations made by Gregson et al. (2022), but also wider findings on vegan prejudice (discussed earlier). We hypothesised that anti-vegans would perceive veganism to be a greater symbolic or ideological threat than omnivores. In line with previous perspectives (e.g., Leite et al., 2018), we hypothesised that anti-vegans would score higher on measures of social dominance orientation (SDO), speciesism, and traditional male-role endorsement than both omnivores and vegans—in other words, they would represent a more extreme subclass of omnivores in this regard. Based on *r/AntiVegans'* wider Reddit activity (Gregson et al., 2022), we anticipated that, relative to vegans and omnivores, anti-vegans would find greater entertainment in "dark" or aggressive humour—an interest that has been previously linked to right-wing ideologies (Hodson et al., 2010). Further, given *r/AntiVegans'* critique of vegans' use of moral absolutism, we anticipated that anti-vegans would adopt a more relativist approach to morality than both omnivores and vegans. Lastly, based on the critical stance of *r/AntiVegans* towards studies that support vegan diets, we hypothesised that relative to vegans and omnivores, anti-vegans would be less trusting of science, particularly research in support of plant-forward diets.

We also pre-registered a number of loose predictions about how our outcome variables might correlate with one another. This analysis was largely exploratory, though somewhat guided by previous work which has observed correlations between: vegetarian threat, SDO, speciesism, dark humour, and masculinity (Dhont & Hodson, 2014; Dhont et al., 2016; Hodson et al., 2010; Salmen & Dhont, 2022; Swami et al., 2013). As such, we anticipated that SDO would positively correlate with veganism threat, speciesism, dark humour, and male-role norm endorsement. We also expected that anti-vegan identification

(as measured by our anti-vegan identification scale) would positively correlate with veganism threat, therefore, increasing confidence in the scale's use for identifying anti-vegans.

Method

Recruitment strategy

We calculated *a priori* that a lower-bound sample of $N = 390$ (or 130 per group) would give us 0.95 power to detect a modest effect size ($f = 0.20$) with an error probability of 0.05. To account for attrition and exclusions, we aimed to over-sample using an upper-bound sample target of 480 participants (or 160 per group). Recruitment was conducted across two waves and spanned a period of eight months (April to November, 2022). Both waves of recruitment were approved by Lancaster University's Faculty of Science and Technology Ethics Committee.

Our original recruitment strategy (AsPredicted #92722) was to recruit all participants via the online crowdsourcing platform, Prolific. Prolific was desirable given that it allowed us to recruit individuals from the UK, sample "vegans" separately from non-vegans, and obtain gender-balanced samples (i.e., 50/50 representation of males and females). In the initial wave of recruitment, non-vegan participants completed a 17-minute survey and were compensated £2.41 their time. Vegan participants completed a somewhat shorter survey, excluding measures pertaining to anti-vegan identification and veganism threat and were compensated £2.00 for approximately 14 minutes of their time. A rate of £8.50/hour applied to all participants.

Our original recruitment plan (AsPredicted #92722) was to identify a subset of anti-vegan identifying individuals from the larger pool of omnivorous sample, using a 6-item anti-vegan identification measure. These items had a max score of 42; our pre-registered plan was to place participants who scored in the upper third (i.e., score of 28 or more) into the anti-

vegan group. However, only n = 3 participants satisfied this criterion. Hence, before conducting further analyses, we altered our recruitment strategy for anti-vegans. We submitted a second pre-registration document (AsPredicted #96141) outlining our new strategy, which involved identifying self-proclaimed "anti-vegans" on the popular social media platform, Twitter. We chose to use Twitter because of its wide popularity and its hashtag functionality which helps to tailor tweets to user interests. To attract people sympathetic to anti-vegan ideology, we used a number of Twitter hashtags common to anti-vegan discourse. Two members of the research team tweeted the following: "Are you opposed to veganism? Take part in this survey, for a 1 in 3 chance of winning a £50 amazon voucher. [Survey link] #antivegan #carnivore #meat #exvegan #carnivorediet #antiveganism #eatmeat #meatlover #carnivorememes #meatheals #antiveganmeme". Compensation involved the chance to win one of three £50 Amazon vouchers.

The first wave of recruitment yielded 523 survey responses. Twenty-two of these were subsequently excluded for providing incomplete data or because they indicated a dietary orientation incompatible with the pre-registered inclusion criteria for omnivores. A further 26 participants were excluded because they indicated a dietary orientation incompatible with the pre-registered inclusion criteria for vegans. The three participants that met the threshold for anti-vegan identification were retained for the anti-vegan group. Hence, after exclusions, our first wave yielded 151 vegans, 321 omnivores, and three anti-vegans.

The second wave of recruitment yielded 895 survey responses. Of these, n=94 participants were excluded for providing incomplete data and n=99 were further excluded for failing to meet the eligibility criteria for any of the three dietary groups. Wave two yielded an additional n=72 vegans, nine of whom simultaneously identified as anti-vegan and were subsequently removed. The remaining n=63 vegans were retained and combined with vegan participants from the first wave. A further n=411 participants met the pre-registered inclusion

criteria for omnivores. Our second wave of recruitment was more successful for recruiting anti-vegans and yielded a total of *n*=219 participants who qualified as anti-vegan identifiers. Hence, after two waves of recruitment the final data set included *n*=732 omnivores, *n*=222 anti-vegans, and *n*=214 vegans.

Sample demographics

Across the total sample (*N*=1,168), age ranged from 18-84 (*M*= 33.79, *SD*= 11.62). There was a fairly even distribution of genders, with 655 participants identifying as male (56.1%) and 493 female (42.2%). A further 13 participants identified as agender/non-binary (1.1%), four as "other", and three preferred not to say. The vast majority of the sample identified as British (90.8%), with the remaining indicating other nationalities. Most participants (82.8%) identified their ethnicity as white/Caucasian, 7.1% Asian, 5.8% black/African, 3% Hispanic/Latino, and 1.3% "other". See Table 5.1 for summary demographics by dietary group.

Our secondary approach to participant recruitment meant that we were unable to control for gender-balanced samples. Thus, we tested for significant gender-based differences across the three dietary groups. This analysis revealed that the three dietary groups differed significantly in their gender-identity profiles, χ^2 (8, *N*= 1168) = 21.73, $p < .005$, Cramer's V = .10. Post-hoc Chi-square tests, adjusting alpha to $p < .01$ for multiple comparisons (i.e., $p = .05/3 = .0167$), revealed a statistically significant difference in gender distribution when comparing vegans and anti-vegans, $\chi 2$ (4, *N*= 436) = 19.40, $p < .001$, Cramer's V = .21, with relatively more males to females [63:37] in the anti-vegan group than in the vegan group [46:51]. Gender distributions did not differ significantly between omnivores [57:41] and vegans, $\chi 2$ (4, *N*= 946) = 11.97, $p = .018$, Cramer's V = .11, and omnivores and anti-vegans, $\chi 2$ (4, *N*= 954) = 5.31, $p = .257$, Cramer's V = .08. Given these gender discrepancies between dietary groups, we made the decision to conduct an additional set of analyses, employing a

conservative method for controlling the effects of gender identity. The details of this analysis are outlined in the Analysis Plan.

There was a statistically significant difference in age across groups, $F(2,1164) = 27.02$, $p < .001$, $\eta_p^2 = .04$. Anti-vegans were significantly younger than both omnivores, $t(741.02) = 9.81$, $d = 0.62$, $p < .001$, 95% CI = [5.02, 7.53], and vegans, $t(353.03) = 7.33$, $p < .001$, $d = 0.71$, 95% CI = [4.45, 7.70]. There was no age difference between omnivores and vegans, $t(418.25) = -.236$, $p = .814$, $d = 0.02$, 95% CI = [-1.87, -1.47]. The three groups differed significantly in their political orientation, $F(2,1165) = 11.239$, $p < .001$, $\eta_p^2 = .02$. Vegans were significantly more liberal than omnivores, $t(315.16) = -4.31$, $p < .001$, $d = 0.34$, 95% CI = [-.74, -.28] and anti-vegans, $t(434) = -3.61$, $p < .001$, $d = 0.34$, 95% CI = [-.82, -.24]. There was no significant difference between anti-vegans and omnivores, $t(335.08) = -.22$, $p = .971$, $d = 0.02$, 95% CI = [-.25, .20].

Table 5.1. *Summary demographics by dietary group*

	Vegan (*n*=214)	**Omnivores (*n*=732)**	**Anti-vegan (*n*=222)**
Gender	109 female (50.9%), 98 male (45.8%), six agender/non-binary (2.8%) one prefer not to say (0.5%)	303 female (41.4%), 417 male (57%), seven agender/non-binary (1%), two other (0.3%), three prefer not to say (0.4%)	81 female (36.5%), 140 male (63.1%), one other (0.5%)
Age	*M*= 34.82, *SD*= 10.31, range 19-71	*M*= 35.02, *SD*= 12.74, range 18-84	*M*= 28.75, *SD*= 6.44, range 22-59
Nationality	202 British (94.4%), 12 other (5.6%)	643 British (88%), 88 other (12%)	214 British (96.8%), 7 other (3.2%)
Ethnicity	191 White (91.6%), five Asian (2.3%), four Black/African (1.9%), three Hispanic/Latino (1.4%), six other (2.8%)	619 White (84.6%), 50 Asian (6.8%), 32 Black/African (4.4%), 22 Hispanic/Latino (3%), nine other (1.2%)	152 White (84.6%), 28 Asian (12.6%), 32 Black/African (14.4%), 10 Hispanic/Latino (4.5%)
Political orientation	*M*= 2.89, *SD*= 1.55, 147 liberal (68.7%), 34 neutral (15.9%), 33 conservative (15.4%),	*M*= 3.39, *SD*= 1.36, 374 liberal (51.1%), 214 neutral (29.2%), 145 conservative (19.8%)	*M*= 3.42, *SD*= 1.52, 118 liberal (53.2%), 26 neutral (11.7%), 78 conservative (35.1%)
Diet	95 dietary vegan (44.4%), 119 lifestyle vegan (55.6%)	187 meat lover (25.5%), 394 omnivore (53.8%), 151 semi-vegetarian (20.6%)	92 meat lover (41.4%), 69 omnivore (31.1%), 32 semi-vegetarian (14.4%), 4 pescatarian (1.8%), 18 lacto- ovo-vegetarian (8.1%), 7 strict vegetarian (3.2%)

Materials

All scales and scale items can be found in Supplementary Materials A.

Dietary classification and behaviour. Participants completed a pre-existing scale of dietary classification (Piazza et al., 2018). Participants were asked to select the category that best described their dietary identity: (1) meat lover (*I prefer to have meat in all or most of my meals)*, (2) omnivore (*I eat meat and other animal products, like dairy and/or eggs)*, (3) semi-vegetarian or reducetarian (*I eat meat, but only on rare occasions or only certain types of meat*), (4) pescatarian (*I eat fish and/or seafood, as well as dairy products and eggs, but no other meat*), (5) lacto- or ovo-vegetarian (*I eat dairy products and/or eggs, but no meat or fish*), (6) strict vegetarian (*I eat no animal products, including dairy and eggs, but would not consider myself full vegan*), (7) dietary vegan (*I eat no animal products, including dairy, eggs, honey, gelatin, etc.*) and (8) lifestyle vegan (*I never consume any animal products, and avoid all non-food animal products, including leather, silk, wool, cosmetics containing animal ingredients, etc*). We included this measure to check the success of the Prolific pre-screening tools and to make any necessary exclusions based on the eligibility criteria. Participants were also asked: "In the past, have you identified with a different dietary classification?" (Yes/No). If participants selected the affirmative, they indicated from the eight dietary classifications how they had previously identified and how long ago they had stopped identifying this way, from 1 = *very recent* to 5 = *many years ago*.

Anti-vegan identification. To assess anti-vegan identification, we had non-vegan participants complete a 6-item scale, designed by the researchers for this specific purpose. Items included pertained to the specific cognitions (e.g., "I dislike vegans"; "I find it easy to get along with vegans" [reverse scored]), schemas (e.g., "I often find vegans to be annoying"), and behaviours (e.g., "I often talk with others about my dislike for vegans") and behavioural intentions (e.g., "I would be open to joining an online anti-vegan community",

aligned with the norms and values of an anti-vegan group. The scale also included a direct measure of anti-vegan identification: "I identify as 'anti-vegan' (i.e., someone who opposes veganism as a movement)". Participants indicated their agreement with each item on a 7-point Likert scale (1 = *strongly disagree;* 7 = *strongly agree*). The scale had good reliability (α= .86).

To verify the validity of our approach to anti-vegan identification we employed an adapted version of the eight-item Vegetarianism Threat Scale (Dhont & Hodson, 2014), a measure of the extent to which individuals feel threatened by the existence of veganism. The scale was adapted by replacing mention of "vegetarianism" with "veganism". Example items include: "The rise of veganism poses a threat to our country's cultural norms"; "Important culinary traditions which are typical to our country, are starting to die out because of the rise of veganism". Participants indicated their agreement with each item on a 7-point Likert scale (1 = *strongly disagree;* 7 = *strongly agree*), with higher scores indicating a stronger perception of threat (α= .93).

Dietarian identity. The Dietarian Identity Questionnaire (DIQ; Rosenfeld & Burrow, 2018) was used to measure participants' thoughts, feelings, and behaviours with respect to their eating habits or "dietary patterns". The DIQ assesses dietarian identity across eight subscales including: centrality (α=.94), private regard (α=.85), public regard (α=.93), out-group regard (α=.95), prosocial motivation (α=.97), personal motivation (α=.87), moral motivation (α=.92), and strictness (α=.88). *Centrality* relates to the importance of a person's diet for their self-concept. *Private regard* refers to a person's own feelings toward following their diet, while *public regard* involves a person's feelings about how the wider society view people who follow their diet. *Out-group regard* measures a person's evaluation of people who do not follow their dietary pattern. Three subscales measure a person's motivations behind their dietary identity: *personal* (concern with the benefit to oneself), *moral* (concern

with rightness and wrongness) *and prosocial* (concern with the benefits beyond oneself) *motivations*. Lastly, *strictness* measures how stringently a person adheres to their diet. Participants indicated their agreement with each item on a 7-point Likert scale (1 = *strongly disagree* and 7 = *strongly agree*).

Dark humour. To measure the extent to which participants found entertainment in others suffering, i.e., "dark", aggressive or disparagement humour, we employed the Humour Style Questionnaire (Martin et al., 2003), specifically, the eight-item *aggressive humour* subscale. Example items include: "When telling jokes or saying funny things, I am usually not very concerned about how other people are taking it"; "Even if something is really funny to me, I will not laugh or joke about it if someone will be offended" [reverse scored]. Participants indicated their agreement with each item on a 7-point Likert scale (1 = *strongly disagree,* 7 = *strongly agree*) with higher scores indicating greater endorsement of dark humour. The subscale had near-satisfactory reliability (α= .67)[11].

Social dominance orientation. SDO entails support for social hierarchies and the belief that certain groups are superior to other groups. We employed a shortened six-item version of the Social Dominance Orientation scale (Pratto et al., 1994). Example items include: "Some groups of people are just more worthy than others"; "Superior groups should dominate inferior groups"; "We must increase social equality" [reverse scored]. Participants indicated their agreement with each item on a 7-point Likert scale (1 = *strongly disagree,* 7 = *strongly* agree) with higher scores indicating stronger endorsement of social dominance (α= .77).

[11] In the present study, the *aggressive humour* subscale returned lower reliability than was reported in the initial validation (i.e., *a* = .77; Martin et al., 2003). Hence, when interpreting results pertaining to dark humour, the less than satisfactory reliability of the scale should be considered a limitation.

Speciesism. Speciesism entails the degree to which someone endorses discrimination based on species membership (e.g., in favour of a person over an animal, or one species over another species), while holding all else equal (Singer, 1975). To measure this construct, we employed the six-item Speciesism scale (Caviola et al., 2019). Example items include: "Morally animals always count for less than humans"; "Humans have the right to use animals however they want to". Participants indicated their agreement with each item on a 7-point Likert scale (1 = *strongly disagree,* 7 = *strongly* agree), with higher scores indicating stronger speciesism endorsement (α = .85).

Male role norms. To measure the extent to which participants endorsed traditional gender roles, particularly those pertaining to masculinity, we employed the eight-item Male Role Norms scale (Pleck, 1994). Example items include: "A man always deserves the respect from his wife and children"; "A guy will lose respect if he talks about his problems". Participants indicated their agreement with each item on a 7-point Likert scale (1 = *strongly disagree,* 7 = *strongly* agree), with higher scores indicating stronger endorsement male role norms (α= .83).

Moral relativism. Moral relativism is the meta-ethical stance that asserts that there is no epistemological framework by which to judge between competing moral claims (e.g., that it is wrong vs. not wrong to harm cows), since all moral claims are merely expressions of opinion or cultural values and cannot be established as objectively true or untrue. To measure endorsement of moral relativism, we employed the 10-item moral relativism subscale of the Ethics Position Questionnaire (Forsyth, 1980). Example items include: "What is ethical varies from one situation and society to another"; "Moral standards should be seen as being individualistic; what one person considers to be moral may be judged to be immoral by another person". Participants indicated their agreement with each item on a 7-point Likert

scale (1 = *strongly disagree,* 7 = *strongly* agree), with higher scores indicating stronger endorsement of moral relativism (α= .87).

Trust in science. We sought to measure both generalised trust in science and trust specifically in plant-based science. To do this, we employed two scales. The first, the 21-item Trust in Science and Scientists Inventory (Nadelson et al., 2014), measured generalised trust. Example items include: "I trust scientists can find solutions to our major technological problems"; "I trust the work of scientists to make life better for people"; "We cannot trust scientists because they are biased in their perspectives" [reverse scored]. Participants indicated their agreement with each item on a 7-point Likert scale (1 = *strongly disagree;* 7 = *strongly agree*), with higher scores indicating stronger trust in science and scientists (α= .91).

To measure trust in science on plant-based nutrition specifically, the research team devised a five-item measure. Example items include: "1kg of plant protein requires 18 times less land, 10 times less water and 9 times fewer fossil fuels than that which would be needed to produce a 1kg of beef protein (Sabate et al., 2014)" and "Livestock production is responsible for 80% of agricultural greenhouse gas emissions worldwide (McMichael et al., 2007)". Participants indicated the extent to which they trusted each finding on a 7-point Likert scale (1 = *not at all trustworthy* to 7 = *highly trustworthy*) with higher scores indicating stronger trust in the science on plant-based nutrition (α= .88).

Procedure

The survey was completed online. After providing their informed consent, participants responded to items in the following order: demographic information, dietary classification, dietarian identity, dark humour, SDO, trust in science, speciesism, moral relativism, and male role norms. Omnivorous and anti-vegan participants additionally

completed, at the end of the survey, items concerning veganism threat and their anti-vegan identification.

Analysis plan

We first probed the relationship between the anti-vegan identification scale, veganism threat scale, and outcome variables, to assess the strength of our method for identifying anti-vegans. Next, as per our pre-registered analysis plan, we conducted an exploratory correlation analysis to determine the relationship between outcome variables. Given the age discrepancies between the three dietary groups, we conducted further correlational analyses to determine any meaningful relationships between age and the outcome variables – see Supplementary Materials B for these results. As preregistered, we used ANCOVA in lieu of ANOVA where age correlated with the respective outcome variable. A series of between-subjects ANOVAs (or ANCOVAs) were then conducted to determine significant mean group differences. Where a main effect of dietary group was observed, we followed up with Bonferroni-corrected pairwise t-tests for group contrasts, where alpha was adjusted to $p < .0167$ for multiple comparisons (i.e., $p = .05/3 = .0167$). Given the gender discrepancies between the three dietary groups we repeated the main analyses, with only male participants – the results of these additional analysis are viewable in Supplementary Materials C). This approach produced comparable findings for all variables, though with slight deviations for dietarian centrality and motivations. Given that our final sample exceeded that outlined in our pre-registration, we conducted a post-hoc power analysis to determine the risk of Type I errors for effect sizes $d > .20$ (effect sizes below .20 were not significant even with the increase in power). Effects sizes within the range of $d = 0.20$ to 0.28 were at risk of Type 1 error and were not significant under conditions of lower power (see Supplementary Materials D). Thus, effect sizes within this range should be interpreted with some level of caution.

Results

Anti-vegan identification

Assessment of the anti-vegan identification and veganism threat scales provides assurances of our method. The two scales were strongly correlated, $r(952) = .75$, $p < .001$. Furthermore, anti-vegan participants exhibited significantly higher veganism threat scores (M=5.22, SD=0.44) compared to omnivores (M = 2.75, SD = 1.16), $t(952) = -31.15$, $p < .001$, d = 2.82. Additionally, the two scales had comparable relationships with key individual difference variables – see Table 5.2. For example, both scales evidenced a strong positive correlation with dark humour, SDO, speciesism, moral relativism and male-role norms and a strong negative correlation with trust in science. Based on this initial investigation, we were assured of our approach for ascertaining anti-vegan identification.

Table 5.2. *Correlational relationship between anti-vegan identification, veganism threat and key markers of individual difference.*

	Dark humour	SDO	Science trust	Plant nutrition	Speciesism	Relativism	Male role norms
Anti-vegan identification	.463**	.660**	-.636**	-.023	.675**	.389**	.736**
Veganism threat	.396**	.591**	-.646**	-.065*	.695**	.497**	.698**

Notes. **correlation is significant at the 0.01 level, *correlation is significant at the 0.05 level

Correlations: Dietarian identity and ideological variables

In our investigation of the relationship between the DIQ subscales and the ideological variables, across the entire sample, a number of key relationships emerged – see Table 5.3.

We observed significant associations between the eight subscales of the DIQ which were consistent with the strength and direction of intercorrelations previously reported, both during scale development (Rosenfeld & Burrow, 2018), and later works (e.g., see Kristen et al., 2020); diet centrality, private regard, prosocial, personal, and moral motivations, as well as strictness, were positively related to one another and negatively related to public and outgroup regard. As expected, we observed positive correlations between scores of SDO, dark humour, speciesism, moral relativism endorsement and male role norms. By contrast, SDO was negatively related to trust in science and trust in science on plant-based nutrition, variables which were positively related to each other. Further to our expectations, we found a positive relationship between dark humour and male-role norm endorsement.

Table 5.3. *Correlational relationship between dietarian identity and ideological variables with the entire sample*

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. DI-Centrality	-	**.54****	**-.29****	**-.45****	**.61****	**.39****	**.61****	**.19****	-.05	**.16****	**-.15****	**.30****	.02	**.19****	**.25****
2. DI-Private		-	**-.41****	**-.38****	**.55****	**.35****	**.52****	**.12****	.01	.05	-.03	**.33****	.03	**.23****	**.12****
3. DI-Public			-	**.45****	**-.38****	**-.11****	**-.35****	**-.06***	**-.11****	-.03	**.18****	**-.21****	**-.10****	**-.13****	-.02
4. DI-OGR				-	**-.63****	**-.13****	**-.66****	**-.19****	**-.32****	**-.50****	**.51****	**-.14****	**-.44****	**-.23****	**-.49****
5. DI-Prosocial					-	**.40****	**.80****	**.29****	.04	**.19****	**-.18****	**.35****	**.10****	**.18****	**.29****
6. DI-Personal						-	**.33****	.24	**-.11****	-.04	.07*	**.32****	.008	**.22****	**.12****
7. DI-Moral							-	**.38****	.05	**.22****	**-.24****	**.30****	**.10****	**.15****	**.34****
8. DI-Strictness								-	**-.15****	**-.06***	.05	**.08****	**-.33****	**-.36****	**-.17****
9. Dark Humour									-	**.44****	**-.40****	**-.22****	**.47****	**.20****	**.32****
10. SDO										-	**-.63****	**-.29****	**.59****	**.27****	**.67****
11. Science Trust											-	**.32****	**-.55****	**-.28****	**-.58****
12. Plant Nutrition												-	**-.21****	.04	**-.10****
13. Speciesism													-	**.40****	**.67****
14. Relativism														-	**.51****
15. Male Role Norms															-

Notes. **significant at the 0.01 level, *significant at the 0.05 level. *N* = 1,168. DI = Dietarian Identity. OGR = Out-group regard; SDO = Social Dominance Orientation.

Dietarian identity

For the DIQ dimensions, all analyses of variance revealed a main effect of dietary group. Follow up Bonferroni-corrected pairwise t-tests revealed several differences between vegans, omnivores, and anti-vegans. Table 5.4 presents a summary of the Dietarian Identity group differences.

Table 5.4. *A summary of the Dietarian Identity group differences results*

	Mean (SD)				
	Vegans (*n*=214)	Omnivores (*n*=732)	Anti-vegans (*n*=222)	F-value	ηp^2
DI-Centrality^{adj}	5.29 (1.25)$_a$	3.89 (1.43)$_c$	4.95 (1.23)$_b$	109.34	0.16
DI-Private Regard	5.36 (1.10)$_a$	4.21 (1.11)$_b$	5.21 (0.99)$_a$	136.70	0.19
DI-Public Regard^{adj}	3.15 (1.58)$_b$	4.41 (1.43)$_a$	2.99 (1.20)$_b$	119.63	0.17
DI-Out-Group Regard^{adj}	4.25 (1.61)$_b$	5.45 (1.46)$_a$	3.08 (1.40)$_c$	213.25	0.27
DI-Prosocial^{adj}	5.39 (1.24)$_a$	3.51 (1.43)$_c$	5.08 (1.03)$_b$	222.28	0.28
DI-Personal	5.17 (1.24)$_a$	4.66 (1.43)$_b$	5.36 (1.03)$_a$	30.20	0.05
DI-Moral^{adj}	5.56 (1.47)$_a$	3.33 (1.55)$_c$	5.22 (1.06)$_b$	265.34	0.31
DI-Strictness	5.70 (1.54)$_a$	3.09 (1.44)$_b$	2.77 (1.05)$_c$	331.07	0.36

Note. ^{adj} = F-values adjusted for ANCOVA. Main effects are significantly different at $p < .01$. Subscripts ($_a$ indicating the largest mean value, $_b$ indicating the middle value and $_c$ indicating the smallest value) differ significantly at $p < .01$.

Controlling for age, we found a significant effect of dietary group on centrality, $F(2,1163) = 109.34$, $p < .001$, $\eta_p^2 = .16$. Post-hoc tests revealed that, consistent with the hypotheses, vegans reported significantly higher centrality than both omnivores, $t(392.20) = 13.89$, $p < .001$, $d = 1.04$, 95% CI = [1.20, 1.59] and anti-vegans, $t(434) = 2.80$, $p = .005$, $d = 0.27$, 95% CI = [.10, .57]. Anti-vegans reported significantly higher centrality compared to omnivores, $t(417.83) = 10.80$, $p < .001$, $d = 0.79$, 95% CI = [.87, 1.26]. Thus, vegans view

their diets as highly central to their identity, more so than anti-vegans, though anti-vegans view their eating patterns as more identity-defining than do omnivores.

There was a significant effect of dietary group on private regard, F (2,1165) = 136.70, $p < .001$, $\eta_p^2 = .19$. Post-hoc tests revealed that vegans reported significantly higher private regard than omnivores, $t(944) = 13.46$, $p < .001$, $d = 1.04$, 95% CI = [.99, 1.32]. Anti-vegans reported significantly higher private regard compared to omnivores, $t(952) = 12.15$, $p < .001$, $d = 0.95$, 95% CI = [.84, 1.17]. There was no significant difference between vegans and anti-vegans, $t(434) = 1.50$, $p = .134$, $d = 0.14$, 95% CI = [-.05, .35]. Hence, we find that vegans and anti-vegans hold members of their own dietary identity in higher regard than do omnivores.

There was a significant effect of dietary group on public regard, after controlling for age, F (2,1163) = 119.63, $p < .001$, $\eta_p^2 = .17$. Post-hoc tests revealed that the vegans reported significantly lower public regard than omnivores, $t(944) = -11.10$, $p < .001$, $d = 0.84$, 95% CI = [-1.49, -1.04]. Anti-vegans also reported significantly lower public regard compared to omnivores, $t(428.33) = -14.91$, $p < .001$, $d = 1.08$, 95% CI = [-1.63, -1.22]. There was no significant difference between vegans and anti-vegans, $t(397.09) = 1.20$, $p = .231$, $d = 0.11$, 95% CI = [-.10, .43]. Hence, vegans and anti-vegans see members of their dietary identity as experiencing low levels of public regard, lower than omnivores perceive of their group.

There was a significant effect of dietary group on out-group regard, after controlling for age, F (2,1163) = 213.25, $p < .001$, $\eta_p^2 = .27$. Post-hoc tests revealed that omnivores reported significantly higher out-group regard than both vegans, $t(944) = 10.51$, $p < .001$, $d = 0.78$, 95% CI = [.99, 1.45] and anti-vegans, $t(377.81) = 22.00$, $p < .001$, $d = 1.66$, 95% CI = [2.17, 2.60]. Vegans reported significantly higher out-group regard compared to anti-vegans, $t(421.61) = 8.07$, $p < .001$, $d = 0.78$, 95% CI = [.88, 1.45]. Overall, we find that omnivores

hold dietarian out-groups in higher regard, than do vegans and anti-vegans, though vegans hold dietarian out-groups in higher regard than anti-vegans.

There was a significant effect of dietary group on prosocial motivations, after controlling for age, F (2,1163) = 222.28, $p < .001$, $\eta_p^2 = .28$. Post-hoc tests revealed that vegans reported significantly higher prosocial motivations than both omnivores, $t(394.05) = 18.84$, $p < .001$, $d = 1.41$, 95% CI = [1.68, 2.07] and anti-vegans, $t(414.82) = 2.77$, $p = .006$, $d = 0.27$, 95% CI = [.09, .52]. Anti-vegans reported significantly higher prosocial motivation than omnivores, $t(501.13) = 18.09$, $p < .001$, $d = 1.26$, 95% CI = [1.40, 1.75]. Overall, we find that vegans reported higher prosocial motivations than both anti-vegans and omnivores, though anti-vegans reported higher prosocial motivations than omnivores.

There was a significant effect of dietary group on personal motivations, F (2,1165) = 30.20, $p < .001$, $\eta_p^2 = .05$. Post-hoc tests revealed that vegans reported significantly higher personal motivation than omnivores, $t(306.40) = 4.32$, $p < .001$, $d = 0.38$, 95% CI = [.28, .75]. In keeping with our hypothesis, anti-vegans also reported significantly higher personal motivation than omnivores, $t(507.55) = 8.70$, $p < .001$, $d = 0.56$, 95% CI = [.54, .86]. However, contrary to our hypothesis, there was no difference between vegans and anti-vegans, $t(346.59) = 1.50$, $p = .135$, $d = 0.17$, 95% CI = [-.44, .06]. Hence, vegans and anti-vegans held high personal motivations for their diet, higher than omnivores.

There was a significant effect of dietary group on moral motivations, after controlling for age, F (2,1163) = 263.34, $p < .001$, $\eta_p^2 = .31$. Post-hoc tests revealed that vegans reported significantly higher moral motivations than both omnivores, $t(944) = 18.68$, $p < .001$, $d = 1.48$, 95% CI = [1.99, 2.46] and anti-vegans, $t(385.87) = 2.74$, $p = .006$, $d = 0.27$, 95% CI = [.10, .58], as hypothesised. Anti-vegans reported significantly higher moral motivations compared to omnivores, $t(535.33) = 20.71$, $p < .001$, $d = 1.42$, 95% CI = [1.71, 2.07].

Overall, we find that vegans reported higher moral motivations than both omnivores and anti-vegans; however, anti-vegans reported higher moral motivations than omnivores.

Finally, there was a significant effect of dietary group on strictness, F (2,1165) = 331.07, $p < .001$, $\eta_p^2 = .36$. Post-hoc tests revealed that vegans reported significantly higher dietary strictness than both omnivores, $t(329.03) = 22.20$, $p < .001$, $d = 1.75$, 95% CI = [2.39, 2.85] and anti-vegans, $t(324.13) = 23.18$, $p < .001$, $d = 2.22$, 95% CI = [2.69, 3.19]. Omnivores reported higher strictness than anti-vegans, $t(495.36) = 3.61$, $p < .001$, $d = 0.25$, 95% CI = [.14, .49]. Hence, vegans reported adhering to their diet more strictly than both omnivores and anti-vegans, and omnivores adhered to their diet more strictly than anti-vegans.

Ideological variables

For the ideological variables, all analyses of variance revealed a main effect of dietary group. Follow up Bonferroni-corrected pairwise t-tests revealed several differences between vegans, omnivores, and anti-vegans. Table 5.5 presents the means and standard deviations for the ideological variables, by group.

Table 5.5. *Means and Standard Deviations for each Individual Difference Markers by Dietary Group*

	Mean (SD)				
	Vegans (*n*=214)	Omnivores (*n*=732)	Anti-vegans (*n*=222)	F-value	ηp^2
Dark humour [adj]	3.15 (0.95)$_c$	3.39 (0.89)$_b$	4.01 (0.69)$_a$	49.04	0.08
SDO [adj]	2.38 (1.14)$_c$	2.84 (1.17)$_b$	3.77 (0.58)$_a$	80.61	0.12
Speciesism [adj]	2.11 (1.12)$_c$	3.29 (1.11)$_b$	4.82 (0.93)$_a$	323.24	0.36
Male-role norms [adj]	2.86 (1.17)$_c$	3.89 (1.09)$_b$	5.09 (0.69)$_a$	265.41	0.31

Moral relativism ^{adj}	3.86 (1.07)$_c$	4.30 (0.87)$_b$	5.38 (0.76)$_a$	167.55	0.22
Trust in science ^{adj}	4.99 (0.91)$_a$	4.74 (0.90)$_b$	3.92 (0.46)$_c$	90.83	0.14
Trust in science on plant-based nutrition ^{adj}	5.72 (1.12)$_a$	4.62 (1.12)$_c$	5.23 (1.00)$_b$	97.19	0.14

Note. ^{adj} = F-values adjusted for ANCOVA. Main effects are significantly different at $p < .01$. Subscripts ($_a$ indicating the largest mean value, $_b$ indicating the middle value and $_c$ indicating the smallest value) differ significantly at $p < .0167$.

There was a significant effect of dietary group on dark humour, controlling for age, $F(2,1163) = 49.04$, $p < .001$, $\eta_p^2 = .08$. Post-hoc tests revealed that anti-vegans reported significantly higher dark humour than both vegans, $t(388.53) = 10.75$, $p < .001$, $d = 1.03$, 95% CI = [.70, 1.02] and omnivores, $t(464.66) = 10.83$, $p < .001$, $d = 0.78$, 95% CI = [.50, .73]. Omnivores reported significantly higher dark humour compared to vegans, $t(944) = 3.44$, $p < .001$, $d = 0.26$, 95% CI = [.10, .28]. Thus, as predicted, anti-vegans reported the highest levels of dark humour, higher than both vegans and omnivores.

There was a significant effect of dietary group on SDO, controlling for age, $F(2,1163) = 80.61$, $p < .001$, $\eta_p^2 = .12$. Post-hoc tests revealed that anti-vegans exhibited significantly higher SDO than both vegans, $t(312.50) = 15.79$, $p < .001$, $d = 1.54$, 95% CI = [1.21, 1.55] and omnivores, $t(760.01) = 15.94$, $p < .001$, $d = 1.01$, 95% CI = [.81, 1.04. Omnivores exhibited higher SDO compared to vegans, $t(944) = 4.97$, $p < .001$, $d = 0.40$, 95% CI = [.27, .63]. Thus, as expected, anti-vegans exhibited levels of SDO higher than both omnivores and vegans, and vegans had the lowest SDO scores.

There was a significant effect of dietary group on speciesism, controlling for age, $F(2,1163) = 323.24$, $p < .001$, $\eta_p^2 = .36$. Post-hoc tests revealed that anti-vegans reported significantly higher speciesism than both vegans, $t(411.11) = 27.16$, $p < .001$, $d = 2.63$, 95% CI = [2.51, 2.90] and omnivores, $t(431.43) = 20.52$, $p < .001$, $d = 1.49$, 95% CI = [1.38, 1.68]. Omnivores reported significantly higher speciesism compared to vegans, $t(944) = 13.48$, $p <$

.001, d = 1.06, 95% CI = [1.00, 1.34]. Thus, like SDO, anti-vegans endorsed speciesism at levels higher than both omnivores and vegans, and vegans endorsed speciesism the least.

There was a significant effect of dietary group on male-role norms, controlling for age, F (2,1163) = 265.41, p < .001, η_p^2 = .31. Post-hoc tests revealed that anti-vegans endorsed male-role norms higher than both vegans, t(343.17) = 23.89, p < .001, d = 2.32, 95% CI = [2.04, 2.40] and omnivores, t(574.08) = 27.69, p < .001, d = 1.32, 95% CI = [.1.58, 1.82]. Omnivores endorsed them more than vegans, t(944) = 6.00, p < .001, d = 0.91, 95% CI = [.35, .69]. Thus, like with SDO and speciesism, anti-vegans endorsed male-role norms more than both omnivores and vegans, and vegans endorsed male-role norms less than omnivores.

There was a significant effect of dietary group on relativism, controlling for age, F (2,1163) = 167.55, p < .001, η_p^2 = .22. Post-hoc tests revealed that anti-vegans endorsed moral relativism at significantly higher rates than both vegans, t(381.84) = 17.03, p < .001, d = 1.64, 95% CI = [1.35, 1.70] and omnivores, t(952) = 16.55, p < .001, d = 1.32, 95% CI = [.95, 1.20]. Omnivores had significantly higher relativism scores compared to vegans, t(300.16) = 5.55, p < .001, d = 0.45, 95% CI = [.28, .60]. Thus, as expected, anti-vegans endorsed moral relativism at rates higher than both omnivores and vegans; vegans endorsed it the least.

There was a significant effect of dietary group on trust in science, controlling for age, F (2,1163) = 90.83, p < .001, η_p^2 = .14. Post-hoc tests revealed that vegans reported significantly higher trust in science than omnivores, t(944) = 3.61, p < .001, d = 0.28, 95% CI = [.12, .39] and anti-vegans, t(310.71) = 15.38, p < .001, d = 1.48, 95% CI = [.93, 1.20]. Omnivores reported significantly higher trust in science than anti-vegans, t(737.16) = 18.03, p < .001, d = 1.15, 95% CI = [.72, .90]. Hence, as predicted, anti-vegans trusted science the least. Vegans had the highest trust in science.

There was a significant effect of dietary group on trust in science on plant-based nutrition, controlling for age, F (2,1163) = 97.19, $p < .001$, $\eta_p^2 = .14$. Post-hoc tests revealed that vegans trusted the science on plant-based nutrition at rates higher than both omnivores, $t(944) = 12.65$, $p < .001$, $d = 0.98$, 95% CI = [.93, 1.27] and anti-vegans, $t(424.91) = 4.73$, $p < .001$, $d = 0.46$, 95% CI = [.28, .68]. Yet, unexpectedly, anti-vegans reported higher trust in science on plant-based nutrition than omnivores, $t(952) = 7.36$, $p < .001$, $d = 0.57$, 95% CI = [.45, .78]. Overall, as expected, vegans held the greatest trust in science on plant-based nutrition. However, anti-vegans were more trusting in science on plant-based nutrition than omnivores were—an unexpected finding.

Discussion

A wealth of past research has explored the ideological underpinnings of prejudice towards vegans (e.g., Dhont & Hodson, 2014; Dhont et al., 2016). More recently, research suggests that there exists a group of individuals who hold strong "anti-vegan" views (Aguilera-Carnerero & Carretero-González, 2021; Gregson et al., 2022). Accordingly, new research has begun to unpack the social psychological profiles of individuals who self-identify as "anti-vegan" via the discourse they share in organised online groups (Gregson et al., 2022). In the current study, we sought to advance on these perspectives by more directly probing the dietarian identities of individuals who we identified as "anti-vegan", and by contrasting their profile with omnivores who lack a strong anti-vegan identity and the targets of their antagonism, vegans. In doing so, we sought to build a richer portrait of the dietarian and ideological identities of anti-vegans, taking clues from past research, as a way to better understand the strength and source of their dietary convictions.

Broadly, our investigation returned two key sets of findings. First, we found evidence that anti-vegans possess a unique dietarian identity that differs in many ways from omnivores, but that also shares some similarities with vegans. Second, we found that anti-

vegans have a unique ideological profile that differs in many ways from both omnivores and vegans. This profile helps clarify their heightened antagonism towards vegan practices. We discuss these findings, and related research in turn, below.

Dietarian identities of anti-vegans

Past theorising has suggested that more restrictive dietary patterns lend themselves to stronger dietarian identities, for example, higher centrality and stronger personal motivations (Kirsten et al., 2020). We certainly found this to be true for vegans. Consistent with previous research on vegans' dietarian identities (e.g., Rosenfeld, 2019), vegans had the most pronounced dietarian identity profiles, scoring highest of the three groups on diet centrality, prosocial motivations, and moral motivations. These results are easily explained by considering the degree of food restrictiveness that vegans exercise (Kirsten et al., 2020) and the core ethical values that they widely endorse (e.g., Janssen et al., 2016; Rosenfeld, 2019).

Nonetheless, we observed a great deal of overlap between vegans and anti-vegans that cannot be explained simply by contrasting the restrictiveness of vegans and anti-vegans or by considering how strict or flexible anti-vegans are in their eating patterns. Despite anti-vegans' relaxed approach to eating, they scored higher than omnivores on diet centrality, and their dietary practices were just as personally motivated as vegans' dietary practices. Compared to omnivores, their eating habits were also more morally and prosocially motivated, albeit less so than vegans. That the diets of anti-vegans are more morally motivated than omnivores, and more central to their identity, likely reflects their higher level of interest in the topics of meat, dietary nutrition, and morality (Gregson et al., 2022). Gregson et al. (2022) found that "anti-vegans" communicating on Reddit engaged in rich discourse on the topics of vegan diets (e.g., their nutritional inadequacy), the inevitability of animal suffering to feed people, and opposition to moral absolutism and what they perceived as misanthropy from vegans. Furthermore, many members of the subreddit group were ex-vegans who had become

disaffected with their former diet. Thus, anti-vegans appear to be individuals who take a strong ideological and moral stance towards food, however, one that is more pragmatic and relativistic rather than idealistic and objectivistic.

Anti-vegans also set themselves apart from omnivores by exhibiting the least regard for other dietary groups. Previous studies have shown that vegans tend to show low-levels of regard for other dietary groups, probably due to their core ethical principles which are not adopted by other dietary groups (Rosenfeld, 2019). By contrast, our findings isolate a group of individuals that score even lower than vegans on out-group regard. These findings might be best interpreted in light of anti-vegans' resistance to the moralisation of eating (Gregson et al., 2022), an interpretation that finds convergent support in the results regarding moral-relativism endorsement (discussed below). Additionally, anti-vegans may be particularly reactive to other dietary groups on account of feeling that their relativistic perspective on food is becoming increasingly threatened by the societal embrace of plant-forward diets (Bagci et al., 2022).

That vegans and anti-vegans did not differ on personal motivations for eating, both significantly higher than omnivores on this dimension, speaks to the distinctiveness of "anti-veganism" as a dietarian identity. Previous research has shown that personal health is a key motivator for both vegans (Rosenfeld, 2019) and anti-vegans (Gregson et al., 2022). However, it is also a clear point of inter-group contention, with anti-vegans strongly refuting the argument that an all-plant-based diet is nutritionally adequate or optimal for human health (Gregson et al., 2022). Thus, personal health may be a dimension on which the *values* of anti-vegans and vegans are compatible, but their *views* highly diverge. This divergence of views speaks to the polarisation between vegans and anti-vegans and likely contributes to their lower levels of out-group regard – though future research should test this inference more directly.

Two final points of similarity between vegans and anti-vegans have to do with their regard for their own dietarian group, and how they think other groups perceive them. Vegans and anti-vegans in our study held their own group in *high* esteem. They also thought that other groups held their group in *low* esteem. A key source of vegan prejudice is that of "anticipated moral reproach" (Minson & Monin, 2012), the prediction that vegans will judge non-vegans harshly for not following their dietary pattern. Indeed, previous studies have found that much of the prejudice towards vegans derives from the perception of vegans as self-righteous and overly critical of others (De Groeve et al., 2021). Vegans in our sample anticipated that other groups held them in low esteem, perhaps partly for this reason (see also Rosenfeld, 2019). Nonetheless, anti-vegans also believed that other groups held them in low esteem. This cannot be for the same reasons as vegans, since anti-vegans' approach to eating is entirely non-moralistic (Gregson et al., 2022). Their understanding of their group's low public regard likely comes from a different source—for example, the awareness that their antagonism towards vegans may not be endorsed with the same fervour outside of their own community.

On the other hand, both vegans and anti-vegans had a strong sense of private regard, meaning that they took pride in the views and practices of their own group. This sense of private regard did not differ between the two groups, however, it again likely derives from different sources. For vegans, a sense of in-group pride likely derives from their shared, core ethical values related to non-violence, the promotion of animal welfare, and the rejection of speciesism (Rosenfeld, 2019; Ruby, 2012). For anti-vegans, a sense of in-group pride may derive from a sense of camaraderie in the opposition to veganism and what they perceive as a moralistic or absolutist approach to eating (Gregson et al., 2022).

Our analysis of the dietarian identities of anti-vegans suggests that they share much in common with the profile of conscientious omnivores (Rothgerber, 2015). Anti-vegans were

found to be more concerned with personal, prosocial, and moral aspects of food consumption, compared to omnivores. Furthermore, Gregson et al.'s (2022) analysis of anti-vegan discourse found, that similar to vegans, anti-vegans believe that humans should limit the suffering of animals in the production of food. Nonetheless, anti-vegans criticise vegans within this discourse for placing too much value on animal life (e.g., being "misanthropic") and for their absolute rejection of animal products. Hence, it would appear that both vegans and anti-vegans (at least relative to omnivores) are concerned with a conscientious approach to eating, however, the two groups differ in their beliefs about *how* conscientious diets are achieved – possibly explained by their differing moral philosophies and stance towards speciesism.

Ideological profile of anti-vegans

The ideological profile of anti-vegans that emerges from this study reaffirms and advances what we know about antipathy towards meat avoiders. Previous work on vegan prejudice suggests that antipathy towards meat avoiders stems from the perceived symbolic threat that they pose to traditional, socio-cultural values (Dhont & Hodson, 2014; Dhont et al., 2016). As such, individuals who express negative attitudes towards meat avoiders are those who endorse traditional views on social hierarchy (Dhont et al., 2016) and human supremacy over animals (Leite et al., 2018). In the present research we found that anti-vegan identity was highly related to the perceived threat posed by veganism, and the endorsement of both social dominance and speciesism. Furthermore, part of the symbolic threat of meat avoiders is the way in which they challenge traditional gender norms—for example, the symbolic link between meat and masculinity (MacInnis & Hodson, 2017; Salmen & Dhont, 2022). Indeed, anti-vegans scored highest on male-role norm endorsement, which further supports the symbolic-threat account of vegan prejudice.

Our findings also provided confirmation of several inferences drawn from Gregson et al.'s (2022) study of online anti-vegan groups. Gregson et al. observed that anti-vegans frequented subreddits dedicated to dark humour, a predominantly male interest (Hofmann et al., 2020) underpinned by right-wing, conservative ideology (Hodson et al., 2010). We directly tested whether anti-vegans endorsed dark humour, and confirmed this to be the case, at rates above both omnivores and vegans. We also replicated the relationship between dark humour and SDO previously reported by Hodson et al. (2010). Consistent with theorising regarding dark humour as an expression of hegemonic masculinity (Plester, 2015), we observed links between dark humour and the endorsement of traditional male-gender roles.

Gregson et al. (2022) observed discussion of several themes among anti-vegan redditors. One common theme involved morality, particularly the rejection of vegan arguments about the wrongness of killing animals for food and statements which appeared to endorse moral relativism (e.g., "*everyone has different moral values there aren't a set of defined rules we must ad-hear to*"). In the present study, we directly tested whether anti-vegans have a more relativistic view of morality and confirmed this to be the case. This relativistic stance likely contributes to anti-vegans' (a) relaxed, non-prescriptive approach to eating, and (b) critical stance towards dietary out-groups (e.g., vegans) that moralise eating.

Gregson et al. (2022) also observed themes related to scientific inquiry, whereby anti-vegans scrutinised and evidenced a distrust in the science on plant-based nutrition, which blended into discourse on adjacent topics (e.g., vaccination research). We found that anti-vegans were the least trusting of science, relative to both omnivores and vegans, and vegans had the highest levels of trust in science. We suspect that this distrust may be a by-product of their more "right-wing" profile. Indeed, some previous work (e.g., Kerr & Wilson, 2021) has shown that a SDO-conservative-values nexus correlates with distrust in science.

Looking at trust in the science on plant-based nutrition, we found that vegans held the greatest levels of trust. However, contrary to our original theorising, we found that anti-vegans trusted the science on plant-based nutrition more so than omnivores. This seemingly counterintuitive finding might be explained by several factors. A potential *familiarity* effect could be at play: previous literature suggests that anti-vegans are well versed in the scientific discourse around plant-forward diets, given the time they spend critiquing and discussing this literature (Aguilera-Carnerero & Carretero-González, 2021; Gregson et al., 2022). For each statement of the science on plant-based nutrition scale we referred to research papers in the scientific literature (e.g., "The World Health Organisation, 2014"). It is possible that anti-vegans, on the whole, are more familiar with the conventions of scientific literature than omnivores, having interrogated the science around plant-based eating more rigorously. As a result, they may be more likely to interpret the presence of citations as some indication of positive evidence for scientific claims. The items used to test trust in plant-based science were also fairly non-controversial and presented by the research team; a neutral source with no obvious "vegan agenda". Future research should consider whether this heightened trust in plant-based science, relative to omnivores, would replicate for more controversial claims or when presented by sources with an obvious pro-vegan stance.

Implications

The present research combines with earlier work on group-based anti-vegan discourse (e.g., Gregson et al., 2022) to highlight the importance of identity processes in the wider societal debate about sustainable diets. It also enriches the study of dietary change by providing an in-depth examination of a sub-population of omnivores who display a unique dietarian and ideological profile. Current models of plant-forward eating transitions (e.g., Bryant et al., 2022) tend to emphasise three segments of the population, each requiring unique intervention strategies: pre-intenders (i.e., individuals lacking knowledge on the issue

of plant-based eating and therefore have no intention to change), intenders (i.e., those informed on the issue, but who are not yet acting) and actors (i.e., those currently acting on their knowledge). The present line of investigation offers evidence of a fourth group: *informed rejectors* – i.e., individuals who are well informed about plant-forward diets yet reject the notion that behaviour change is necessary. Anti-vegans appear to be members of this fourth group, with whom the status of "informed rejector" (i.e., rejector of vegan ideology) plays a central role in their dietarian identity.

The dietarian and ideological profile of anti-vegans emerging in the current research offers novel insights to researchers and advocates concerned with plant-based eating. Advocacy, if directed at anti-vegans, should be tailored to their unique concerns and values, which differ in many ways from other omnivores. For example, given their relativistic meta-ethical stance and "flexible" (non-strict) approach to eating, strategies promoting absolutism or total abstention of animal products, as opposed to measured reduction, are likely to be met with strong criticism from this group. Furthermore, anti-vegans' greater distrust of science means that advocates should take care when drawing broad conclusions from nutrition science that could be read as "vegan bias". By contrast, anti-vegans' critical stance towards industrial agricultural systems (see Gregson et al., 2022) might be a useful starting point for building mutual understanding and initiatives. Finally, given the strong link between anti-vegan sentiment and dominance-related beliefs, general efforts to address hierarchical group-oriented attitudes are likely to have downstream implications for the adoption of plant-based diets, beyond the wider societal benefits of reducing intergroup conflict and prejudice (Dhont et al., 2016).

Limitations

We acknowledge that there are limitations on the generalisability of our samples. Our methods of recruitment differed for the anti-vegan sample, who were recruited through the

means of social media, whereas vegan and omnivorous samples were recruited predominantly through the crowdsourcing platform, Prolific. It is possible that individuals recruited through social media systematically differ from crowdsourcing participants in significant ways, limiting the comparative conclusions we can draw regarding these populations. However, it should be pointed out that all participants received similar information about the study (that it was about "personality" and "eating habits") prior to giving their consent. Thus, selective participation, as a potential limitation, would apply equally to all three dietary groups.

Further, we acknowledge that there may be limitations to our approach of identifying anti-vegan participants, which combined both bottom-up and top-down processes. That is, participants who were placed into the anti-vegan group were those who had 1) opted in to complete a survey which was advertised as seeking to recruit a group of "individuals who oppose veganism" and 2) who scored highly on measures that pertained to specific cognitions ("I dislike vegans"), schemas ("I find vegans to be annoying"), behavioural intentions (e.g., "I would be open to joining an online anti-vegan community") and behaviours (e.g., "I often talk with others about my dislike for vegans") aligned with the norms and values of an anti-vegan group. Irrespective of the bottom-up processes at play, it might be argued that identity cannot be enforced top-down which we recognise as a limitation of our method. Moreover, the measure of anti-vegan identification and veganism threat were highly correlated with one another and related to key markers of individual difference in much the same ways. This may speak against the discriminant validity of our anti-vegan identification measure. Future work ought to consider the role that veganism threat plays in anti-vegan identification, relative to other cognitions and attitudes and develop more refined methods to measure anti-vegan identification.

We also recognise that there was a slight difference in gender distributions across our three dietary groups, with vegans having a larger proportion of female-identified and

agender/non-binary participants, relative to the omnivore samples. Though gender-identity is undeniably a relevant factor in research of this kind, we reiterate that the results reported here hold when comparing male-only participants (with slight divergences concerning diet centrality and prosocial motivations; see Supplements C).

Last, we acknowledge the limits on establishing causal directions from our research: we cannot firmly establish whether the dietarian and ideological characteristics of anti-vegans are reasons for their antipathy towards vegans or whether their antipathy towards vegans is the reason for these characteristics.

Conclusion

Our investigation of the dietarian and ideological identities of "anti-vegan" individuals revealed numerous intra-group differences between anti-vegans and omnivores, as well as several inter-group similarities between anti-vegans and vegans. As a dietarian identity, being anti-vegan, like being vegan, is highly central to a person's sense of self. Like vegans, anti-vegans are also highly personally motivated, have low regard for other dietarian identities, and believe other groups perceive them quite negatively. These were all traits that anti-vegans and vegans exhibited to a greater extent than omnivores. Yet, in many ways, the profiles of vegans and anti-vegans differed. For instance, vegans were somewhat more morally motivated and had stricter eating habits. Analysis of the ideological underpinnings of anti-vegans helped account for these differences, as well as their strong opposition towards vegans. Anti-vegans endorsed a suite of values related to social aggression and dominance, traditional gender norms, and relativism as a moral philosophy. These characteristics stood in stark contrast to the more egalitarian, non-traditional, and non-relativistic stance of vegans, as well as the more moderate profile of non-antagonistic omnivores. Anti-vegans appear to be a subgroup of the population with a strong anti-moralistic stance towards food, fuelled by a complex nexus of right-wing ideology, science scepticism, moral relativism, and a pragmatic

view of animal suffering. Future work should explore the pathways by which individuals come to identify as anti-vegan and how their ideological and intragroup commitments modulate their opposition towards veganism.

General discussion

Humanity's window for climate action is closing rapidly (Tollefson, 2022). Given the ecological footprint of our current food system, scholars and non-governmental organisations have urged that a transition to a safe and sustainable food system is of pressing importance (Clark et al., 2022). To achieve sustainability in our food system, the EAT-Lancet commission has prescribed a 50% decrease in the production and consumption of animal-derived foods, and an increased uptake of plant-based proteins (Willett et al., 2019). Given the prevailing socio-cultural value of animal-derived foods, a large-scale transformation of the global food system is likely to be one of society's greatest challenges in the 21st century. Such a transformation will require the collaboration of many actors both in- and outside of academia (e.g., social scientists, food technologists, businesspeople, and advocates). The field of Psychology has a unique role to play in studying human behaviours and cognition pertaining to societal eating norms and the acceptance of plant-forward diets. Psychologists are tasked with understanding how the relative acceptance, or reluctance to engage in plant-forward diets at the individual level may predict societal-level shifts in eating norms.

Accordingly, this body of work presents a rich exploration into the influence that the social-cultural milieu has on food-related cognitions and decision making – specifically, one's thoughts, feelings, *and* behaviours as they pertain to plant-forward diets. Food-related decision-making occurs at various levels of society and food systems – including at the micro- (e.g., an individual's attitudes, motivations, and capabilities), meso- (e.g., family roles and relational dynamics) and distal-level (e.g., societal, and cultural food norms; Boulet et al., 2021). In our investigations, we considered the social influences on food-related decision-making at each of these three levels. In study 1, we were engaged in a micro-level analysis, investigating the facilitative effects of social support for influencing individuals' commitment to reducing their meat consumption. In studies 2 and 3, our analytic focus progressed to the

meso-level (i.e., the household), where we considered the influence of one's primary social units (i.e., family members and romantic partners) on decisions pertaining to plant-forward diets. Last, in studies 4 and 5 we considered the intergroup and social-cultural context of plant-forward diets at the distal-level. Specifically, our investigation concerned the collective identity and ideological motivations of those individuals actively engaged in overt antagonism or opposition towards vegan ideology. The aim of the current chapter is to provide a summary of the key findings across this body of work. Moreover, I consider how the research presented in this thesis might inform policy makers and actors in the field who wish to promote plant-forward diets, as well as a number of key limitations that may inform future research in this area.

Study 1: A micro-level analysis of plant-forward diets

A vast and comprehensive body of research has considered the barriers that may impede an individual from engaging with a plant-forward diet (for reviews, see e.g., Bryant et al., 2022; Graça et al., 2019). Of particular relevance here, a wealth of previous research has found that social aspects of one's environment – including stigmatisation (e.g., see Markowski & Roxburgh, 2019) and a lack of social support (e.g., Hoek et al., 2017; Lacroix & Gifford, 2019) - may have particularly deleterious effects on the pursuit and maintenance of plant-forward diets. Social barriers are reported at almost every stage of behaviour change (Lacroix & Gifford, 2019) - non-actors anticipate that were they to engage in the focal behaviour they would experience a lack of social support and face potential exclusion and stigmatisation (Markowski & Roxburgh, 2019). Research with practicing vegetarians and vegans appears to corroborate the *projected* concerns of omnivores (e.g., Markowski & Roxburgh, 2019). Moreover, individuals who go on to abandon their plant-forward diet, often retrospectively identify social consequences as one of the principal causes of their abandonment (Anderson & Milyavskaya, 2022). In the present body of research, we sought to

address these deficits by investigating the potential facilitative effects of social support on plant-forward dietary transitions. Across two studies (study 1 & 3), we considered whether the provision of social support, either experimentally manipulated or naturally occurring, would lead to the actualisation of behaviour change (e.g., sustained meat-reduction).

Social support

Study 1 investigated the potential benefits of adhering to a meat-reduction pledge with and without the provision of social support. Participants made a commitment to reduce their consumption of meat under one of three conditions of the experimental manipulation of social support: either alone (solitary condition), as a member of an online support group (nominal-group condition), or with members of their household (known-group condition). During the intervention, intentions to pledge, daily meat consumption, and pledge adherence rates were tracked using smartphone-based experience-sampling. Baseline, post-intervention, and two-week follow-up surveys were administered to investigate longer-term changes in meat-eating behaviours, as well as explicit- and implicit-attitudes. The results of the manipulation check revealed a failure to induce feelings of social support in participants of the nominal-group condition. By comparison, participants who completed their pledge with members of their household reported significantly higher feelings of social support. However, irrespective of the manipulation check results, we did not demonstrate a significant effect of condition. That is, condition assignment (or the degree to which participants received social support) was not predictive of pledge-adherence rates, nor sustained behaviour change[12]. Hence, at least in the way in which it was studied in Study 1, we were unable to demonstrate the facilitative effects of social support.

[12] It is worth noting here that pledge adherence rates were high across all three conditions, making it difficult to detect meaningful differences.

Upon reflection of these findings, we recognised the need to differentiate between different conceptualisations of social support and physical or tangible support specifically. Broadly, the wider psychological literature conceptualizes social support in three ways: *structural, functional,* and *enacted* support (Hogan et al., 2002). Structural support refers to the *availability* of potential support givers, functional support the emotional experience of *feeling* supported, and *enacted* support the provision of supportive behaviours (e.g., tangible assistance, advice). While participants in both the nominal and known-group conditions were provided with a structure of support, those in the nominal-group failed to report the experience of feeling supported (or *functional* support). Further, despite evidence to suggest that participants in the known-group condition experienced elevated *feelings* of support relative to those in the nominal-group condition, we noted that engagement with one another was relatively low, possibly suggesting an absence of *enacted* support (i.e., tangible assistance).

This lack of tangible assistance between participants in the known-group condition may be explained by the cohabitation style of students who lack the familiarity and hierarchical systems typical of family households, and who likely pursue independent rather than interdependent eating habits. Hence, it may be too simplistic to assume that access to a structure of support (e.g., an online support group) will satisfy a need for social support within this context. This may be particularly the case here, given that participants were not previously engaged in meat reduction efforts and as a result reported facing a high degree of practical barriers. Typically, these practical challenges pertained to the poor accessibility, increased time demands and perceived cost of meat-free alternatives. Hence, for individuals at an early stage of transition, social support may not be of much value unless it helps to assist the individual as they navigate the more pressing practical challenges associated with the behaviour change.

Meat-reduction interventions

Although we were unable to demonstrate the facilitative effects of social support, study 1 was further informative of food decision making at the micro-level. We found that meat-reduction interventions which provide recipients with the *opportunity*, *motivation*, and *capacity* to engage in the focal behaviour (e.g., meat-reduction) are relatively accessible and predictive of short-term behaviour change, elevated motivations, and sustained increases in perceived self-efficacy. Though, these conclusions came with a number of caveats. We demonstrate that the downstream successes of a meat-reduction intervention may be dependent upon the extent to which participants *adhere* to their commitment, which in turn, may depend upon their prior capacities for enacting the focal behaviour (e.g., perceptions of one's ability to cook plant-based foods). In the present study, greater adherence to a meat-reduction pledge led to increased motivations for reducing meat in the days immediately following the intervention as well as enhanced perceptions of capacity for plant-forward eating two-weeks later.

Although participants elevated capacities for engaging with plant-forward diets were sustained in the longer-term, the same patterns were not found for motivations to reduce meat consumption and actual meat consumption – rates which returned back to baseline two-weeks later. This waning of motivations may be explained by particular features of our study design, for example, the provision of an extrinsic reward which may have a *"crowding out"* effect on intrinsic motivation for task-related behaviour outside of the testing phase (Wiersma, 1992). In earlier work by Piazza et al. (2021) participants who completed a meat-free pledge reported greater meat cravings across the 28-day study, when compared to no-pledge control group. Hence, an increased craving for meat may help to further explain why motivations to continue reducing meat consumption are hampered once the pledge is complete. Reductions in motivation, even in the face of enhanced capabilities, may help to explain why meat-

reduction pledge campaigns fail to foster sustained behaviour change beyond the boundaries of the intervention (Dakin et al., 2021; Piazza et al., 2021). Indeed, behaviour change theory posits that intention to change is a prerequisite for action and intentions are comprised of one's motivation, capability, and opportunity (Mitchie et al., 2012). Hence, it is possible that behavioural changes were not sustained because, despite the increases in capacity, motivation was diminished and the opportunity to practice meat reduction had been removed. Moreover, while intention is hailed as an import prerequisite for behaviour change, the intention-behaviour gap (Webb & Sheeran, 2006) suggests that intentions alone may be insufficient for prompting change and highlights the need for researchers to observe processes other than behavioural intentions (e.g., attitudes and emotions).

Interim conclusion

In summary, we were unable to demonstrate the facilitative effects of social support in study 1. The failure to detect an effect of social support at this stage in the research programme encouraged a progression in the way that we thought about support. Specifically, it highlighted the need to differentiate between *types* of social support (incl. *structural*, *functional,* and *enacted* means of support) with an increased focus on *who* makes up our structure of support, and the value of *enacted* support in particular. As such, the results of study 1 prompted a progression in the current body of research: a move from studying food decision-making at the micro- to the meso-level. Specifically, we progressed to study the facilitative effects of social support, including tangible assistance and advice, afforded by pre-existing relationships (e.g., family members, partners).

At the micro-level, study 1 highlighted the importance of perceived self-efficacy for engaging in plant-forward diets and the intervention potential of meat-reduction pledges for boosting a person's capacity to eat meat-free. Qualitative reporting of the practical barriers that inhibit engagement with plant-forward diets were further revealing of the interaction

between distal-level provision of plant-based alternatives, and micro-level ascriptions of capacity. The relative inconvenience and poor provision of plant-based foods, impeding one's ability to engage with the intervention. Hence, we anticipate that the increasing availability of plant-based alternatives to animal products (incl. plant-milks and faux or cell-cultured meats) will have a cascading impact on the uptake of plant-forward diets (Piazza & Gregson, in press). So long as animal-product alternatives are appetising, affordable, and accessible, the increased availability of plant-forward options will help to erode perceptions of plant-based eating as inconvenient. We predict that elevating perceptions of self-efficacy for eating plant-based will encourage individuals to try plant-forward diets, further boosting their motivations to reduce and their sense of capacity for eating plant-based.

Study 2 & 3: A meso-level analysis of plant-forward diets

Informed by the findings of study 1, we progressed to investigating how the transition toward plant-forward diets unfolds at the *meso*-level – specifically, amongst cohabiting romantic partners (study 2) and families (study 3). Given the co-ordinated nature in which cohabiting units consume food, an individual's family members or partner represents a key influence on a person's eating patterns, if not, for couples, the *strongest* influence (e.g., see Øygard & Klepp, 1996). Thus, when an individual considers a change in their eating behaviour, this decision inextricably impacts on close others and can lead to complications, if met with resistance (Eriksen, 1994). As a result, dietary *transitions*, in particular, can be a significant source of disruption within the household. Previous research has shown that members of the household often perceive the adoption of a plant-forward diet as a threat to the relational harmony, traditions, and group identity (Roth, 2005). It can be common therefore for close others to respond negatively to a member's decision to reduce or abstain from animal products (e.g., dismissing the individual, or engaging them in active conflict; Roth, 2005).

Given that relational systems have a natural tendency to want to achieve harmony, such confrontations are unlikely to continue indefinitely (Seshadri, 2019). Though, research looking at how the established leadership style and emotional connection of the relationship govern how families and partners navigate and resolve the disruption brought about by plant-forward diets is notably lacking. During the conceptualisation of the present research, notably absent from the literature was a "family systems" perspective, which considers families and romantic partnerships as complex systems in which members interact to influence each other's behaviour including food-related decision-making. In the present thesis, we recognised that micro-level food decision-making takes place within the broader context of intra-family food negotiations, which may be subject to the leadership style and emotional connection of the relationship. Accordingly, we sought to provide a rich investigation into how the relational climate of cohabiting families and romantic partnerships, would modulate their anticipated and materialised openness to plant-forward dietary transitions.

Across this body of work, we employed the *relational climate* framework (Olson, 2000, 2011). Relational climate is a measure of the degree to which a family system is *balanced* in their cohesion and flexibility. Central or balanced levels of cohesion and flexibility are typically considered optimal for family functioning, whereas the extremes, or "unbalanced" levels are typically seen as problematic (Olson, 2000). *Cohesion* is defined as the emotional bonding that members have towards one another. When cohesion levels are too high (i.e., enmeshed) family members are thought to be too dependent on one another, and when too low (i.e., disengaged), attachment or commitment to the relationship is absent (Olson, 2000). *Flexibility* is the amount of change in its leadership, roles, and rules. Flexible relational styles are thus characterized by egalitarian leadership, and a democratic approach to decision-making. When flexibility levels are too high (i.e., chaotic) there may be an

absence of leadership and when too low (i.e., rigid) strict rules may be imposed by a leader (Olson, 2000).

In study 2 we conducted a foundational investigation to determine the relevance of *relational climate* in this context – specifically, how it relates to pre-established food practices in couples, and how it governs their willingness to adopt a plant-forward diet. This preliminary work provided scope for further inquiry into the role of relational climate for the pursuit and maintenance of plant-forward diets. As such, study 3 carried forward the concept and theoretical framework of relational climate to consider how it determines a family-systems response to a member's decision to reduce or abstain from animal products. Taken together, study 2 and 3 were revealing of the prevalence and nature of *anticipated* and *materialised* tensions, the tendency of relational systems to seek ways to mitigate disruption and maintain harmony, the facilitative effects of social support and the modulating effects of family systems and their relational climate on plant-forward dietary transitions. I discuss these insights, in turn, below.

Mitigating disruption and maintaining harmony within the household

It was clear across both study 2 and 3 that plant-forward diets are often considered a disruption to established eating norms of a household since they require members to reconfigure how they relate to the eating patterns of another. However, contrary to the dominant literature which suggests that social consequences relate to a fear of exclusion and stigmatisation (Markowski & Roxburgh, 2019), our work revealed a desire to mitigate disruption and maintain harmony within the household. In study 2, couples expressed concern that plant-forward diets, especially if pursued by just one member of the relationship, would induce unwanted strain due to the additional practical and financial pressures that come with needing to source and prepare separate meals. We demonstrate that while the experience of being aligned with one's romantic partner in dietary terms, fosters greater levels of dietary

coordination and harmony, it simultaneously presents a barrier to the adoption of plant-forward diets. Couples who are aligned in their eating habits anticipate greater tension were they, or their partner to transition to a plant-forward diet, and, as such, are less open to such change. One potential interpretation of this finding relates to an unwillingness of aligned couples to disrupt the dietary harmony within their household. By contrast, unaligned couples may be less resistant because they are already well-practiced in managing differences in their eating habits and have a pre-established culture of independence when it comes to food and possibly other behaviours.

In study 3, we found that individuals who were pursuing a plant-forward diet report few instances of tension, in part, because they were actively engaged in managing the *potential* disruption that their dietary transition could have on the family foodways. Individuals who pursue a plant-forward diet feel beholden to two conflicting duties: 1) upholding their vow to reduce their consumption of animal products, and 2) maintaining dietary harmony within the household. From the perspective of Moral Foundations Theory (Graham et al., 2009), this conflict may be between two competing moral values: (a) concern for the wellbeing of others (e.g., animals, the planet), and (b) loyalty to one's family.

When faced with such a moral dilemma, individuals may feel compelled to comply with the wider eating norms of the family system – perhaps to be expected, given the pervasive influence of the social context on eating (Higgs & Ruddock, 2020). Hence, in some contexts, pressures to mitigate potential conflicts and maintain harmony may take precedence over one's personal dietary goals. In cases where participants were reluctant to comply with the eating norms of the family system (e.g., when eating norms are backed by firm moral values), they may become strategic in navigating joint mealtimes – for example, in the use of time and space to ensure the separation of food consumption within the household. Though the strategies may have mitigated the materialisation of disruption, many participants

expressed their dissatisfaction and a reluctance to continue such habits for their deleterious effects – both in relation to their stunted efforts to achieve a plant-forward diet and the resultant division within the household. As such, many participants reported trying to avoid withdrawal and disengagement, and wished to adopt a more integrative strategy that would allow for the whole family to eat together in harmony.

Beyond the scope of qualitative insights, our research was limited in its ability to speak to the particular strategies that may aid families in navigating transition to plant-forward diets. In study 3, we found *some* evidence of positive-problem solving (e.g., advanced meal-time planning and compromise), more commonly reported amongst cohesive families. However, given that our sample were predominantly students in parent-child households, they were often passive in family food work, and as such were reliant upon other family members (i.e., parents) to accommodate them during mealtime preparations. Hence, our insights into positive-problem solving were limited to instances whereby a family member had made the necessary concessions for the participant. Future research should further probe the positive problem-solving strategies employed by families and individuals who are successful in their dietary transition to help inform intervention designs. This work might consider how the family unit *collectively* negotiate food-related decision making. At the wider distal-level, efforts to alter perceptions around plant-forward diets as disruptive (either perceptually, or physically by increasing the provision of accessible plant-alternatives) would also be beneficial to appease both anticipated and materialised conflicts within the household.

Functional and enacted familial support

In study 3, we further probed the facilitative effects of social support within the context of the family environment. Here, we found that the majority of social interactions between the participant and their family were positive. Respondents reported experiencing

support in many forms, including *functional* support (i.e., social validation and acknowledgement), and *enacted* support (i.e., tangible assistance and food provision). The experience of social support had clear implications for *behavioural outcomes* during plant-forward dietary transitions. Specifically, respondents who reported greater social support within their daily experiential reports tended to report more positive outcomes during the testing phase, including enhanced coordination of their diet within their family unit, and reduced dietary tension. Moreover, support was facilitative of dietary success. Specifically, respondents who reported higher levels of support reported more positive outcomes *over time*: greater "stage of change" progression, dietary goal achievement and commitment, and lower animal-product consumption, two weeks beyond the initial testing phase. Based on these results, we concluded that the provision of functional and enacted support by the family members of one's household was facilitative of plant-forward dietary transitions.

The provision of support may be suggestive of a general openness or receptivity to plant-forward diets at the meso-level. Indeed, it was more common in supportive environments for the divergent member to have an influential impact on the eating patterns of their family members, causing them to consider a reduction of their own consumption of animal foods. Previous research has also reported on the potential influence that vegetarian individuals may have on changing norm perceptions and subsequently the eating habits of their family members (Menzies & Sheeska, 2012). Together, these findings challenge the current dominant and rather pessimistic view that micro-level change is unlikely to spark large-scale change (for commentary see Bolderdijk & Cornelissen, 2021). Instead, the current findings present a more optimistic view that individuals who assert their dietary preference not to consume animal products may catalyse change at the meso-level, by signalling to their immediate social networks that an alternative foodway is possible. If harnessed by policy makers and advocates, micro-level change may have the potential to cascade throughout

individuals' social networks and beyond, fostering widespread social change at the distal-level and leading to tipping points in global food consumption norms (e.g., see Nardini et al., 2020).

Relational climate: a moderator of the response to plant-forward diets

In the present thesis, we recognised that micro-level food decision-making takes place within the broader context of intra-family food negotiations, which is subject to the leadership style and emotional boding of the relationship. Accordingly, we sought to understand how the *relational climate* (Olson, 2000, 2011) of a family unit in particular may have modulated this response. Across this body of work, there was clear variation in the way that relational units approached food-related decision-making and plant-forward diets. Concerns over the potential disruption of plant-forward diets on shared foodways were evident. But how families or couples responded to these concerns differed both between and within relationships. In study 2, we found that balanced cohesion and flexibility was predictive of positive outcomes within the food decision-making arena. For example, couples with balanced cohesion and flexibility were more aligned in their dietary goals, reporting greater food coordination and dietary harmony and subsequently less tension around food choices. These findings are consistent with theoretical perspectives in this space, which predict that balanced relational styles are optimal for family functioning and individual psychological well-being. Hence, we were able to demonstrate the relevance of relational climate in the context of research on food related family negotiations.

Concerning how relational climate governs a couple's willingness to adopt a plant-forward diet – we found that relational flexibility was negatively related to tensions anticipated by a member reducing their consumption of animal products. Given that flexible relational styles are characterized by egalitarian leadership, and a democratic approach to decision-making this finding was suggestive that couples with more balanced or egalitarian

leadership styles may be better able to handle the inevitable disruption caused by a member transitioning to a plant-forward diet. Further exploratory correlation analysis was suggestive that couples who reported greater chaotic flexibility may be more open to adopting plant-forward diets. Within chaotically flexible systems, couples may make impulsive decisions and roles are unclear or may shift between individuals (Olson, 2000). Though unbalanced relational systems are typically thought to be problematic for relationships to develop and for couples to balance change, it is also recognised that high levels of flexibility might be potentially useful and even necessary in certain cases - for example during family illness (Olson, 2000; Olson & Gorall, 2003). Here, we demonstrated that for the specific case of plant-forward dietary transitions, flexibility may be beneficial. That is, a "rogue partner" and flexible roles and rules in a relationship, could be a facilitator of plant-forward diets.

Study 3 carried forward the relational climate framework to develop further understanding as to how the broader context of intra-family food negotiations govern micro-level food decision-making. We found that actors pursuing plant-forward diets who report a more balanced, cohesive relational system, receive more support and as a result, are better able to achieve their dietary goals of reducing their animal-product consumption over time. On the contrary, *unbalanced* cohesions, for example, highly enmeshed relational systems, were characterised by lower support, which was associated with negative outcomes - greater tension and increased animal-product consumption. Tension was more commonly reported by plant-forward dieters from *unbalanced* family systems, specifically those which reported extremely high cohesion (i.e., enmeshed systems) or extremely low levels of cohesion (i.e., disengaged systems) and flexibility (i.e., rigid systems).

In enmeshed family systems, characterised by an extreme level of interpersonal closeness and an absence of personal boundaries, attempts to achieve autonomy over one's eating habits could be taken as a sign of relational disloyalty. Within such systems, there may

be increased pressure to comply with the status quo. In disengaged systems, on the other hand, individuals who seek to pursue a plant-forward diet may find that the emotional separateness of their family system means that they are unable to turn to others at home for support. Given the interdependent nature of shared eating habits, this is likely to arouse feelings of exclusion and spark potential tensions at mealtimes. Rigid relationships often involve one individual who is in charge and highly controlling (Olson, 2000). In the context of shared eating behaviours, this may be the household's key decision maker (e.g., a parent) when it comes to meal-time preparations and provisions (Brannen & O'Connell, 2016). Hence, the need to accommodate a divergent member during shared eating practices may arouse tension as it undermines the idea that the balance of food provision responsibilities and power reside with a single authority.

Interim conclusion

In summary, study 2 and 3 demonstrated that individual level decisions around food consumption are subject to the established leadership style and emotional connection of the relationship. As such, the strive for sustainable diets ought to be studied and understood with within the broader context of intra-family negotiations.. Family systems, including romantic partners, demonstrate a clear desire to mitigate disruption and maintain harmony within their households. Because of the perceived practical barriers that come with them, plant-forward diets are considered a disruption to established eating norms between couples and families. Hence, even in the absence of materialised conflicts, divergent members are often engaged in mitigating *potential* disruptions which can result in their compliance with or withdrawal from the wider family system. Both strategies are recognised as problematic – not conducive either to one's personal dietary goals or relational cohesion – and there was a clear desire to adopt more positive problem solving.

Functional and enacted support from one's primary social units is integral for the long-term maintenance of plant-forward diets and potentially influential of behaviour change at the meso-level. However, the provision of support may depend upon the family's relational climate. That is, families that are more balanced in their emotional bonding, and couples with more flexible leadership styles, may offer up an environment that is more conducive to plant-forward dietary transitions. Advocates and stakeholders ought to harness the insights of family food decision-making as a lever for facilitating a "greener" transformation of the global food system.

Study 4 & 5: A distal-level analysis of opposition towards vegan ideology

At the distal-level, the consumption of animal-derived foods remains a cherished and prevailing eating norm. As such, individuals who abstain from the consumption of animal products push the boundaries of our eating norms and are perceived to pose both *symbolic* and *realistic* threats to shared cultural values, tradition the social status quo (Dhont & Hodson, 2014; Judge & Wilson, 2015; Stanley, 2022). Given that out-group threat is a fundamental antecedent to prejudice (Stephan & Stephan, 2000), those who abstain from the consumption of animal-derived foods, and particularly vegans, are often met with resentment (de Groeve et al., 2021; Dhont & Hodson, 2014; Rothgerber, 2014). Prejudice toward those who abstain from animal-derived foods has prevailed for many centuries (Iacobbo & Iacobbo, 2004). Today, prejudice toward meat-abstainers, and particularly vegans, is a feature of western culture, where such sentiments are expressed without reservation in popular media (Cole & Morgan, 2011; Ragusa et al., 2014).

The research conducted to date has been invaluable in advancing our scientific understanding of anti-vegan sentiment. However, during the conceptualisation of the present research, notably absent from this field of work was the study of *naturally* occurring antagonism toward meat-abstainers. That is, previous research has largely focused on the

nature of anti-vegan sentiments expressed by members of the general public when solicited by questions or measures within a study or experiment. Thus, much of what we know about anti-veganism has come from those who express anti-vegan sentiment, *reactively*, when solicited under experimental conditions.

Over the last decade, prejudice against vegans has become increasingly apparent (Dhont & Stober, 2020). Individuals who strongly endorse anti-vegan sentiments and self-subscribe as "anti-vegan" have become organised, particularly online, around their shared views on veganism (Aguilera-Carnerero & Carretero-González, 2021; Gambert & Linné, 2018; Reynolds, 2019). Some evidence, reported by *The Times*, even suggests that vegan-related hate crimes may be on the rise in the UK (Nachiappan, 2020). According to the article, one-third of all 172 vegan hate crimes occurring between the years 2015-2020 took place in 2020 alone. Accordingly, we thought it necessary to provide a fuller picture of the prevalence, form, and content of anti-veganism, as an ideology and group identity. Advancing upon earlier insights, we investigated anti-veganism through the lens of group processes to understand the social psychological effects of belonging to an anti-vegan community.

Across two studies we considered the social-cultural context of plant-forward diets at the distal-level, specifically, a group-identity investigation into individuals engaged in stigmatising animal-product abstainers. In study 4, we adopted a novel approach to understanding those who oppose veganism, using computerised text analysis and behaviour analytics. In study 5, we engaged in a rich, comparative exploration of the dietarian identities of individuals who we identified as "anti-vegan" relative to both omnivores and vegans. This social psychological approach to understanding anti-vegans revealed a number of findings that were consistent with previous literature and added a newfound level of nuance. While this work aligned with earlier learnings on the form and content of anti-vegan prejudice, it

sparked a commentary around the need to study anti-vegan *identity* as psychologically distinct from the expression of anti-vegan *sentiment*. We found evidence that speaks to the distinctiveness of "anti-veganism" as a dietarian identity; intra-group *differences* between omnivores and anti-vegans (e.g., in right-wing ideology) and inter-group *similarities* between vegans and anti-vegans (e.g., in diet centrality).

Anti-veganism: a group-identity perspective

Our research speaks to the development of a group identity borne out of opposition to veganism. Across two studies, we show that anti-veganism is highly central to the identity of self-identified anti-vegans who belong to a growing[13] and increasingly sophisticated group. In our linguistic analysis of the *r/AntiVegan* discourse, several longitudinal changes in language use were observed within the community, reflecting something of a group acculturation process: increased group-identification signatures and the professionalization of group-like qualities (e.g., hierarchical structures and leadership-follower distinctions). Specifically, as an individual user becomes integrated with the group they rely less on the first-person *'I'* and increasingly the collective *'we'.* Not only do these users reference themselves less, but over time the authenticity in their speech is reduced suggesting a move away from valuing what is individual and original and a move towards group conformity. Users' persistent activity on *r/AntiVegan* increases their confidence and certainty, possibly suggesting that, as time goes on, a hierarchy of group leadership emerges amongst a subset of highly committed *r/AntiVegan* users. We also noted a decrease in cognitive processing, suggesting that persistent activity on *r/AntiVegan* resulted in a reduction of logic-driven, critical thinking around the topic of veganism. Importantly, we do not argue that anti-vegan argumentation

[13] Over the course of study 4, the userbase of the subreddit *r/AntiVegan* grew exponentially - at the point of publication, membership stood at 18.7k (a figure which excludes passive "lurkers" who may be active though not posting). Since publication of this work, the subreddit has experienced further growth, and now stands at 23.5k users.

becomes increasingly illogical. Instead, talk moves away from defending one's anti-vegan position as users become increasingly comfortable with the community and more epistemically certain of their anti-vegan position.

In study 5, we engaged in a rich, comparative exploration of the dietarian identities of individuals who we identified as "anti-vegan" and vegans. The results of this study were suggestive that the way in which anti-vegans and vegans relate to their dietarian identity, shares many similarities. For example, both vegans and anti-vegans feel that their thoughts, feelings, and behaviours with respect to consuming or eschewing animal products are highly central to their self-concept. Equally, both vegans and anti-vegans hold their own group in high esteem and take pride in the views and practices of their own group. Furthermore, vegans and anti-vegans did not differ on personal motivations for eating, both of whom scored significantly higher than omnivores on this dimension – a finding which speaks further to the distinctiveness of "anti-veganism" as a dietarian identity and the shared values between vegans and anti-vegans. Previous research has shown that personal health is a key motivator for both vegans (Rosenfeld, 2019) and here we demonstrate the same for anti-vegans. However, personal health is also a clear point of inter-group contention, with anti-vegans strongly refuting the argument that an all-plant-based diet is nutritionally adequate or optimal for human health. Hence, personal health may be a dimension on which the *values* of anti-vegans and vegans are compatible, but their *views* highly diverge – revealing of the ensuing polarisation.

While both vegans and anti-vegans hold their in-groups in high esteem, they believe that members of wider society hold their groups in low esteem: critical of their behaviour and subjecting them to stigmatization. For vegans, anticipating that other groups hold them in low esteem, may be explained by the prevalence and relative acceptance of prejudice toward vegans in western culture (Cole & Morgan, 2011; Ragusa et al., 2014) and their direct

experience with stigma (MacInnis & Hodson, 2017). It is not clear that the same can be said for anti-vegans. To the authors knowledge, anti-veganism is yet to be receive the degree of negative attention that veganism has received. This is likely because anti-vegans' approach to eating is entirely non-moralistic and compatible with prevailing eating norms. Their understanding of their group's low public regard likely comes from a different source—for example, the awareness that their antagonism towards vegans may not be endorsed with the same fervor outside of their own community or by vegans themselves.

An alternative explanation is that anti-vegans low public regard may reflect a defensive form of in-group commitment and an exaggerated perception of in-group threat – otherwise known as collective narcissism (Cichocka & Cislak, 2020; de Zavala et al., 2009; de Zavala et al., 2013). Collective narcissists tend to be convinced that others undervalue and purposefully seek to undermine their group, making them especially sensitive to criticism (de Zavala et al., 2016). That anti-vegans score high on social dominance orientation is further reason to understand their group processes against the backdrop of collective narcissism, given the overlap between these two ideologies (de Zavala et al., 2009). Research on collective narcissism has identified several related social consequences, including sensitivity to threat, retaliatory aggression and an unwillingness to forgive outgroups. Future work should follow up on this line of inquiry and determine the extent to which anti-vegans are defensively attached to their anti-vegan identity. Such an inquiry would have further implications for vegan-anti-vegan relations, for example, for measuring and potentially mitigating the risk of vegan hate crimes.

"Informed rejectors"

Studies 4 and 5 also enrich the study of dietary change by providing an in-depth examination of a sub-population of omnivores who display a unique dietarian and ideological profile. Current models of plant-forward eating transitions (e.g., Bryant et al., 2022) tend to

emphasize three segments of the population, each requiring unique intervention strategies: pre-intenders (i.e., individuals lacking knowledge on the issue of plant-based eating and therefore have no intention to change), intenders (i.e., those informed on the issue, but who are not yet acting) and actors (i.e., those currently acting on their knowledge). The present line of investigation offers evidence of a fourth group: *informed rejectors* – i.e., individuals who are informed about plant-forward diets and reject the notion that behaviour change is necessary. Anti-vegans appear to be members of this fourth group, with whom the status of "informed rejector" (i.e., a rejector of vegan ideology) plays a central role in their dietarian identity. In study 4, we also found that ex-vegans, individuals who attempt and eventually abandon veganism, align their struggles with anti-vegans suggesting that termination of a behaviour may lead to an individual adopting a position of informed rejection. Formerly adopted models of behaviour change do not equip advocates of promote plant-forward diets with strategies for avoiding rejection and re-engaging rejectors with sustainable diets. Advocacy, if directed at anti-vegans, should be tailored to their unique concerns and values, which differ in many ways from other omnivores. Below, we summarise some of these considerations.

Morality. The findings of study 4 and 5 finding coincide with previous literature which highlights the moral underpinning of plant-forward diets as a fundamental antecedent to prejudicial attitudes (de Groeve & Rosenfeld, 2021). In our work, while we do not claim that this is a point of contention that accounts for the *majority* of antipathy and discrimination toward meat-abstainers, we recognise that it certainly plays a part. We advance the understandings further and demonstrate that those opposed to veganism, possess a moral orientation that differentiates them from regular omnivores and meat-abstainers. So, while anti-vegans endorse many of the moral concerns that underpin veganism (e.g., minimisation of harm to animals), their approach to these issues differ. Anti-vegans adopt a flexible

approach to eating and a relativist approach to moral issues. They specifically reject vegans' *absolutist* stance on morality. Indeed, others have recognised that absolutist approaches to the promotion of plant-forward diets (i.e., calls for immediate, and total abstention) may contribute to the mobilisation of oppositional forces and thus be counterproductive (Leenaert, 2017). We recommend that actors in the field who seek to promote plant-forward diets ought to harness points of agreement between actors and informed rejectors (e.g., a shared distrust of industrial agricultural systems) even if that requires being sympathetic to pragmatic approaches to the promotion of plant-forward diets (i.e., encouraging reduction, as opposed to abstention).

Science scepticism. Advocates seeking to promote plant-forward diets ought to be aware of the wider psychological barriers that may inhibit informed-rejectors from engaging with plant-forward diets. Across study 4 and 5, we found evidence to suggest that a distrust of science and scientists, clearly differentiates anti-vegans from both vegans and regular omnivores. It is important to note that this distrust in science was not specific to plant-based nutritional science, but more generalised to science as a discipline. We suspect that this distrust may be a by-product of their more "right-wing" profile, given anti-vegans social dominance orientation (SDO) and the positive relationship between SDO and science distrust (e.g., Kerr & Wilson, 2021). General efforts to address distrust of science and scientists are likely to have downstream implications for the adoption of plant-based diets, beyond the wider societal benefits of reducing the science scepticism and the spread of misinformation. Effective strategies for rebutting science scepticism include providing the facts about a topic from reputable sources and uncovering the rhetorical technique typical for denialism (e.g., see Schmid & Betsch, 2019).

Social dominance. In study 4, we noted a particular affinity for dark humour (i.e., that which finds comedic value human suffering and topics which are typically considered

taboo) amongst *r/AntiVegan* users. Specifically, we found that relative to a sample of *r/askreddit* users, *r/AntiVegan* users were more likely to frequent subreddits that engage in dark humour (e.g., *r/darkjokes, r/AccidentalRacism*). In study 5, we later confirmed that anti-vegans score higher on measures of aggressive humour, relative to vegans and omnivores, using self-report methodology. Given that dark humour often includes the expression of prejudicial attitudes towards marginalised or minority groups (e.g., women and people of colour) study 5 included further probing of related measures, namely social dominance orientation (Hodson et al., 2010). Recent theorising has shown that human-human bias (i.e., generalized ethnic prejudice) and human-animal bias (i.e., speciesism) share common ideological roots, namely, social dominance orientation (i.e., a desire for group-based dominance; Dhont et al., 2016). We concluded that anti-veganism is underpinned by a complex nexus of right-wing ideology, including social dominance orientation, traditional gender roles, and speciesism. Thus, general efforts to address hierarchical group-oriented attitudes are likely to have downstream implications for the adoption of plant-based diets, beyond the wider societal benefits of reducing intergroup conflict and prejudice (Dhont et al., 2016).

Interim conclusion

Individuals who deviate from the wider societal eating norm, which is to consume animal-derived foods, may find themselves the target of stigmatisation - a feature of western culture, where popular media outlets express negative views toward vegetarian and vegans without reservation (Cole & Morgan, 2011; Ragusa et al., 2014). The perpetuation of stigma toward those who abstain from animal-derived foods reinforces social barriers to plant-forward diets and helps to reaffirm the distal-level social eating norms around animal-derived food products. Given compelling evidence of a recent escalation of prejudice toward vegans,

both in on- and offline settings (Aguilera-Carnerero & Carretero-González, 2021; Nachiappan, 2020) we sought to advance current perspectives of anti-vegan behaviour.

Utilising novel methods, we investigated anti-veganism through the lens of group processes (i.e., as an ideology and group identity). Taken together, studies 4 and 5 speak to the development of a group identity borne out of opposition to veganism, which is highly central to the individual's sense of self and becomes increasingly sophisticated over time. Anti-vegans demonstrate a defensive attachment to their group identity; holding their in-group in high esteem and anticipating efforts to undermine them from non-members. Underpinned by a complex nexus of right-wing ideology, science scepticism and moral relativism, anti-veganism represents a stiff challenge in the strive for sustainable diets. Our findings have direct implications for advocates and policy makers seeking to refine their arguments and strategies to avoid rejection and engage informed rejectors. Specifically, harnessing of pragmatic approaches to plant-forward diets, as well as engaging in efforts to rebut science denialism, and address hierarchical group-oriented attitudes. To conclude, this work highlights the importance of identity processes in the wider societal debate about sustainable diet and enriches the study of dietary change by identifying a sub-population of omnivores who display a unique dietarian and ideological profile - *informed rejectors.*

Limitations and future directions

While every effort was made to mitigate limitations during the conceptualisation and implementation of each study, there are a number of outstanding limitations that pertain to this body of work as a whole. First, concerning the methodological limitations that relate to the *generalisability* of these research findings. The present research was conducted with predominantly "WEIRD" samples which places clear limits on the wider generalisability of our findings (Henrich et al., 2010). Indeed, there is reason to believe that the learnings here may not be readily applied to other societies outside of western culture – given cultural

differences in eating norms and close relationships. What constitutes appropriate food consumption, both in terms of content and volume, differs culture-to-culture (Higgs, 2015). Hence, perceptions around the consumption of plant-forward diets are also likely to differ. Animal-derived foods have been a feature of western eating norms for many centuries, where these products have a long history of ascribed status and power (Leroy & Praet, 2015). The consumption of meat and by-products from cows, pigs, sheep, and chickens specifically, constitute key staples in the western diet. The same eating norms do not apply elsewhere. For example, in India where the dominant religion is Hinduism, there is a long-standing emphasis on non-violence toward other life forms, and animals that are readily consumed in the western world (i.e., cows) are endowed with sacred status (Hamilton, 2000; Khara et al., 2020). However, India's developing economy and increasingly secular views have seen an increase in meat consumption – a shift in eating norms, *from* plant-based eating *to* diets more heavily reliant on animal-derived foods. Hence, in this part of the world, it is omnivorous diets that are the target of negative social judgment, and this has forced the consumption of some animal products (e.g., beef in particular) "backstage" (Khara et al., 2020). These distinctions between western and eastern culture evidence the influential power that distal-level eating norms have for the treatment of those who deviate from established food practices – though via inverse patterns. Hence, our work on anti-veganism would likely not apply in non-western cultures like India, and future work might seek to understand the potential parallels between the stigmatisation of meat *consumers* in the east and meat *avoiders* in the west.

Furthermore, traditional gender roles in romantic partners, as well as the structure and relational bonding of families differ between cultures (Argyle et al., 1986; Georgas, 2003). Family systems theory, the relational climate framework employed in the present body of work, reflects the assumptions (i.e., the lens through which behaviour is investigated) and

functions (i.e., attitudes and behaviour) of western culture, where greater emphasis is placed on the individual self (Carteret, 2010). There is reason to believe that family systems theory may not apply in equal measure to non-western families, for example in collectivist cultures (e.g., Middle East or Asia) where greater emphasis is placed on the collective self, social cohesion, and co-operation (Carteret, 2010). For example, research has shown that differences exist between individualist and collectivist families both in terms of configuration (Carteret, 2010; Georgas et al., 2001) and interdependence (Mayer et al., 2012). Hence, what is considered relationally maladaptive in individualist culture (e.g., high levels of cohesion or *enmeshment*) may not be considered so in collectivist cultures (Rothbaum et al., 2004). Future work should investigate if the learnings presented in the current thesis apply to groups with different cultural backgrounds - for example, whether and how individuals in collectivist societies grapple with the moral dilemma that participants in the present research report between maintaining harmony in the family and adhering to their personal convictions to reduce their animal product consumption.

Moreover, this research was limited to mostly cis-gendered individuals, and heterosexual relationships, further constraining the generalisability of our conclusions. LGBTQA+ individuals represented a small proportion of our samples, meaning that we were unable to explore more diverse sexual orientations or gender identities as they relate to relational climate, food work within households and the associated processes that govern transition toward more sustainable eating. Moreover, our inferences about openness to plant-forward diets and resultant tensions are based in relational dynamics that may not extend to LGBTQA+ relationships. The underrepresentation of LGBTQA+ perspective is a wider issue in the literature on family systems (e.g., see Hartwell et al., 2017) and shared eating practices (e.g., see August et al., 2022) and deserves greater attention. We see future research with LGBTQA+ individuals as a fruitful space for new explorations into the interplay between

relational climate and meat consumption. Given the emerging work which suggests unique discrepancies in the food dynamics of same-sex couples versus heterosexual couples (e.g., food work is more likely to be shared in same-sex couples; August et al., 2022) we believe that research would benefit from extending the examination to more diverse relationships and illustrating how sexual orientation might be relevant in the context of sustainable eating.

Second, concerning the *theoretical* limitations of the present research. In the present body of work, we looked at food-related attitudes and behaviours from people at various stages of change. Our samples included those considered "pre-intenders" (i.e., individuals lacking knowledge on the issue of plant-based eating and therefore have no intention to change), those who are "intenders" (i.e., those informed on the issue, but who are not yet acting) and actors (i.e., those currently acting on their knowledge). We also propose a new group of individuals who we call informed rejectors (i.e., individuals who are well informed about plant-forward diets yet reject the notion that behaviour change is necessary). Throughout we gained insight about the particular relevance of social barriers at each stage of change. For example, for those yet to act, we recognise that practical barriers may supersede the value of social support. In contrast, those already engaged in action were more susceptible to social barriers and embroiled in marrying their personal dietary goals with the wider food decision-making of their relational systems. Yet, we did not engage in a systematic approach that assessed barriers based on stage of change. Wider theoretical accounts that have emerged during the course of this research suggest that this may be a fruitful endeavour for directing advocacy efforts (e.g., Bryant et al., 2022). In their review paper, Bryant et al. highlight that social barriers may be particularly deleterious at later stages of behaviour change. This claim converges with our findings and provides a potential explanation for the failings of our social support manipulation in study 1. That is, that our sample were not already engaged in self-driven efforts to reduce their meat consumption, may explain why they were unmotivated to

make use of the support provided. Future work considering the barriers to plant-forward diets thus ought to assimilate learnings from Bryant et al. (2022) and adopt a more tailored perspective.

Also absent from the current body of research is perspective from *"former actors"* – individuals who have tried and failed to maintain a plant-forward diet. The relative absence of former actors from our investigation limits our ability to speak to the impeding nature of social stigmatisation and exclusion. Study 4, indirectly, unearthed some insights from former actors and suggests that individuals who try and fail to pursue a plant-forward diet may face health and social obstacles and lean into communities of *informed rejectors* for support and advice. This suggests that individuals who exit veganism may grow resistant towards, and reluctant to reengage in, plant-forward diets. Given the high rate of vegetarians and vegans who abandon their diet (~ 84% - Asher et al., 2014), research with former vegetarians and vegans offers unique perspective on the barriers to plant-forward diet and potentially fruitful opportunity to develop knowledge around how individuals can be encouraged to re-engage with sustainable eating practices. Future research might employ advanced methods to understand the likelihood of former actors resuming a plant-forward diet as well as the variables that predict abandonment and reuptake.

Finally, the present research generated a number of actionable insights that, due to time limitations, we were unable to investigate within an experimental design. Throughout, we made a number of recommendations about how individuals who are pursuing sustainable diets, may be strategic in their communication with non-compliant, or resistant others. In our work, actors pursuing plant-forward diets expressed concern that their strategies for managing their commitment to their family and their plant-forward diet were either 1) not relationally adaptive or 2) not conducive to their own personal goals. Our samples expressed a clear desire for positive problem-solving strategies to help navigate shared eating habits.

While we allude to the overall beneficial effects of social support for achieving goals, we would have liked to conduct a more thorough investigation into the particular positive problem-solving strategies employed by relation units (e.g., intra-family food-related compromise and negotiations), including experimental assessments of their efficacy. Given that micro-level changes may be catalysts for inspiring wider change at the meso-level, we see this as fruitful endeavour informing advocates and policy makers in this space. Furthermore, in the present work, a number of recommendations were made about the ways in which individuals who advocate for plant-forward diet might be strategic to avoid reactance and the engage informed rejectors. However, no experimental research was conducted to manipulate and test the long-term efficacy of these strategies. Hence, future work might consider an inter-group investigation into pre-existing communication patterns between advocates and informed rejectors, followed up by a more targeted intervention design to test the efficacy of a particular strategy (e.g., rebuttal of science denial).

Conclusion

This research utilised advanced methods to paint a rich picture of food-related decision-making as it occurs at the micro-, meso- and distal-level. At the micro-level, perceived self-efficacy and capability was a key moderator of engagement with plant-forward diets. For individuals who are newly engaged in efforts to reduce their consumption of animal products, *practical* barriers may take precedence over *social* barriers. Thus, the beneficial aspects of social support at this stage of change are forms of support that aid actors in managing these practical concerns (e.g., assistance with identifying desirable alternatives). At the meso-level, individuals actively engaged in pursuing a plant-forward diet face a moral dilemma between maintaining the well-established harmony within their relational system and upholding their commitment to reducing animal-derived foods – two *seemingly* incompatible goals. Efforts to alter perceptions around plant-forward diets as disruptive and

increase the provision of accessible plant-alternatives would be beneficial to manage both anticipated and materialised conflicts within the household. However, as plant-forward diets increase in prevalence, there may be a burgeoning resistance at the distal-level, which has gained traction and demonstrated increasing sophistication over the past decade. In the present thesis, we identified a group of informed rejectors, for whom resistance toward plant-forward diets is of deep psychological interest, and we outlined a number of ways in which future advocacy efforts might avoid sparking resistance or re-engage informed rejectors in sustainable diets. To conclude, modern day society faces increasing pressure to achieve a sustainable food system. Progress toward widespread plant-based eating is likely to pose many challenges given the immense social-cultural significance of animal-derived foods in the western diet. Mapping out the means by which individuals may effectively navigate their social-cultural milieus will be important for fostering society-wide shifts in how we eat.

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