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Can social norms promote sustainable food consumption? A systematic review

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ABSTRACT

As societies shift toward plant-based diets to address sustainability challenges, social norms have emerged as influential in promoting sustainable food choices. However, there is limited synthesis on the effectiveness of related interventions. This review evaluates existing studies aiming to reduce animal-based consumption and/or increase plant-based choices within the context of climate change. We searched five databases, gray literature, and contacted authors to collect relevant studies, identifying 23 articles (34 studies). Research interest has grown since 2017, but findings suggest that social norm-based interventions have had limited success. We highlight key opportunities for future research, including better identification of referent groups tailored to specific population segments.

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Introduction

Social norms represent one of the most interdisciplinary and broadly used approaches to influence individual and collective behavior. They regulate social life and can be particularly strong drivers of behavior in social interactions. Research interest in social norms and their role in promoting pro-environmental behaviors has increased over recent years (see Cialdini and Jacobson (2021) for a review). Nonetheless, promoting sustainable food choices has proven to be a challenging task, and the literature showing mixed effects of social norms to do so is growing (Cialdini & Jacobson, 2021). This paper systematically reviews the existing evidence on interventions based on social norms to shift consumption toward less animal-based and more plant-based diets and examines their impact.

There is growing consensus that human behavior changes, such as dietary choices, can help mitigate the effects of climate change at a global level (Poore & Nemecek, 2018; Willett et al., 2019). Where alternative sustainable eating practices have been proposed, a feature common to all is promoting a substantial reduction of meat and dairy from the diet (Jarmul et al., 2020). Some scientists have suggested that the single most effective way to regenerate planetary ecosystems is transitioning away from diets heavily centered on

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meat and dairy (Poore & Nemecek, 2018). In 2019, the EAT-Lancet Commission 'Planetary Health' dietary guidelines were explicitly designed to support human health whilst simultaneously minimizing environmental impacts. These guidelines recommend intake of predominantly plant-based foods, still allowing individual consumption of red meat, poultry, and fish not exceeding 26 kg per year overall (Willett et al., 2019). When examining projected diet patterns in 2050, a 55% per capita reduction in greenhouse gas emissions resulting from food production could be achieved if more people adopted diets excluding animal products (Tilman & Clark, 2014). Furthermore, a recent analysis showed that dietary carbon emissions for vegans accounted for just around 30.3% of those generated by people who consume over 100 grams of meat per day (Scarborough et al., 2023).

Social norms and sustainable food consumption

Changing social norms around eating practices represents a promising tool for achieving greenhouse gas (GHG) emission reductions within food systems. The influence of social norm messages has been found to both increase engagement in pro-environmental behavior (Abrahamse & Steg, 2013; Farrow et al., 2017; Yamin et al., 2019) and influence food choices (Cruwys et al., 2015; Salmivaara et al., 2021). Most studies on changing diets and food consumption manipulating social norms have been conducted as trials to improve public health by promoting healthier diets, where they have proved to be relatively cost-effective in fostering healthy food choices (Biasini et al., 2021; Higgs, 2015; Higgs et al., 2019; Robinson et al., 2014a; Thomas et al., 2017). In contrast, the present review focuses on empirical studies which have a climate framing as their motivation, i.e., objective of reducing GHG emissions from consumption of animal-proteins. This choice reflects the increasing awareness of the urgency to investigate behavioral solutions to reduce the impact food choices have on the planet.

Behaviorally informed interventions which manipulate social norms to promote a shift from animal- based to more plant-based diets have become increasingly popular (Attwood et al., 2020). Generally, we refer to social norm-based interventions as those which involve exposing participants to normative messages, i.e., messages that signal social norms about a behavior of interest. Many interventions begin with assessing and collecting data to inform the elaboration of the messages, which are then selected and tested with the target group. Messages are then presented to participants in various formats depending on the context, e.g., an online trial versus a field intervention, and their effectiveness is assessed by comparing the behavior of the participants who were exposed to them against the behavior of those who were not (Shulman et al., 2017; Rhodes et al., 2020).

Social Norms Theory argues that the perception of other people's behavior and beliefs strongly influences the behavior and beliefs of individuals (Perkins, 2003). That is especially true when behaviors are widely adopted and salient, so that focusing on their popularity provides important insight into making better decisions with little required cognitive effort (Asch, 1955; Cialdini et al., 1990). Currently, diets which excludes animal-based products are still only adopted by a minority of people (for the UK context see Stewart et al., 2021), which presents a challenge for using this behavioral approach to influence people to change. In that regard, advertising that adoption of a minority

behavior is growing might be helpful in communicating the emergence of a 'trending norm' and persuade individuals who might wish to 'join in' early (Mortensen et al., 2019; Sparkman & Walton, 2017). In the sections below we provide a theoretical framework and a description of types of social norms used in the literature.

Social norms are generally regarded as the 'rules and standards that are understood by members of a group, and that guide and/or constrain human behaviour' (Cialdini & Trost, 1998, p. 152). Norms have been classified in many ways, yet the main distinction in the literature is the one between descriptive versus injunctive norms. Descriptive norms signal the prevalence of a specific behavior (what other people do), whereas injunctive norms signal behavior that is commonly approved or disapproved of in a given situation (what other people think you should or should not do) (Cialdini et al., 1990). The psychological mechanisms behind conformity to descriptive and injunctive norms are different, working toward the fulfillment of intrapersonal and interpersonal objectives respectively. Individuals adhere to descriptive norms as heuristics to satisfy the desire to be correct making accurate decisions, whereas they conform to injunctive norms to gain social approval and affirm one's role within a group (Jacobson et al., 2011). Descriptive social norms can also be categorized into static and dynamic, where the former describe the current adoption of a particular behavior, and the latter describe how the behavior of a group is changing over time (Sparkman & Walton, 2017). Another distinction concerns the prescriptive and the proscriptive characteristics of a social norm. While prescriptive norms consist of descriptions of what others do or approve of doing, proscriptive norms consist of norms prohibitive in nature, emphasizing the inappropriateness of undesirable behavior, i.e., 'adopt a sustainable diet' vs. 'do not eat meat' (Cialdini et al., 2006). Finally, personal norms refer to the expectations a person holds about their own behavior and are subjectively perceived as a feeling of moral obligation to do the right thing (Schwartz, 1977; Thøgersen, 2006).

Contextual and demographic moderators

Some of the inconsistencies across studies regarding the effect of social norms to foster sustainable food choices may be due to the fact we have not yet identified nor fully understood the influence of moderators. With moderator we refer to a third variable that modifies a causal effect, such that the magnitude and/or direction of the relation between two variables depend on the value of this third variable (Wu & Zumbo, 2008). In the context of this review, a moderator may be a contextual factor or a demographic feature which interacts with the ways a specific social norm influences behavior in a given situation. Eating practices are characterized by a strong cultural and social connotation, which led researchers to speculate conformity to social norms around food may differ across cultures (Eom et al., 2016; Gelfand et al., 2011; Tian et al., 2016). It has been argued that social norm appeals might be more effective in collectivistic cultures (e.g., Asia and South America), rather than in individualistic ones (e.g., the United States and Northern Europe) (Chan & Lau, 2002; Kim & Sherman, 2007; Markus, 2016). However, Bergquist et al. (2019) conducted a meta-analysis of field-experiments targeting pro-environmental behaviors and found norms to be more influential in individualistic countries rather

than in collectivistic countries, although there were null effects in the study which pertained to eating meat.

Another aspect to consider is the specification of a reference group in an intervention, that is, the social group that performs the stated behavior: e.g., fellow students, citizens of the same country, athletes, or celebrities. Every social norm-based message utilized in a behavioral intervention requires the specification of a reference group. According to Social Identity Theory, increasing the social relevance of the reference group will increase norm compliance (Childers & Rao, 1992; Turner et al., 1987). Only a few studies have probed whether manipulating how closely participants identify with the reference group influences sustainable food choices (Carfora & Catellani, 2022; Sparkman et al., 2020). Results from these studies provide mixed evidence on whether observing stronger social norms around sustainable food consumption in a more socially relevant reference group will encourage individuals to make food choices that have less negative environmental impacts. Exploring the influence of moderators in social norm-based interventions might inform future research to determine the conditions under which an intervention works.

Although still a young research topic, behavioral interventions about reducing animal-protein consumption have been published and have provided useful insights (Bianchi, Dorsel, et al., 2018; Bianchi, Garnett, et al., 2018; Hartmann & Siegrist, 2017; Kwasny et al., 2022; Sánchez et al., 2021; Taufik et al., 2019; Vandenbroele et al., 2020; Wynes et al., 2018). This systematic review sets out to identify and examine the available research evidence regarding the use of social norms in behaviorally informed interventions to change food consumption habits. Specifically, we focus on the transition from animal-based (meat, fish, dairy, and eggs) to plant-based foods (fruit, vegetables, grains, legumes and meat substitutes), hence excluding studies centered around purchase and consumption of organic products, certified foods or seasonal eating. While systematic reviews and meta-analyses have investigated the effects of social influence approaches on pro-environmental behaviors in general, e.g., resource conservation, energy consumption, and sustainable transportation (Abrahamse & Steg, 2013; Bergquist et al., 2019; Farrow et al., 2017; Meier et al., 2022; Reisch et al., 2021), none has been carried out exclusively on the effect of social norms to promote more sustainable diets. Therefore, this work aims to provide an overview of social norm research in the context of sustainable food consumption. The primary questions we aimed to answer with this research are:

(1) How have social norm interventions been designed to increase sustainable food choices?
(2) What are the impacts of social norm interventions on sustainable food choices?
(3) What factors influence their social norm interventions' effectiveness?

The principal aim of this systematic review was to identify, appraise, and provide a synthesis of the data from all relevant studies which assessed the effectiveness of social-norm based interventions to promote behavior change toward reducing the intake of meat and/or increasing the consumption of plant-based foods.

Methods

The systematic review process followed the guidelines for evidence synthesis as suggested by the (Collaboration for Environmental Evidence et al., 2022) and the RepOrting Standards for Systematic Evidence Syntheses (ROSES) and the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) (Haddaway et al., 2018; Page et al., 2021). To support transparency and rigor in designing and guiding the research, it was pre-registered on the Open Science Framework (10.17605/OSF.IO/S3DXR). Minor deviations from the original pre-registered protocol are outlined in the Appendix. Following standardized procedures of methodology, stages involved specifying review objectives, defining a precise search strategy to locate relevant studies, formulating inclusion and exclusion criteria to develop a pertinent list of articles, and finally analyzing and synthesizing the data.

To determine which studies would be eligible for the purposes of our review, we applied the PICO-FS criteria (Collaboration for Environmental Evidence et al., 2022; Haddaway et al., 2017; Reisch et al., 2021). PICO-FS is an acronym which stands for Population, Intervention, Comparator, Outcome, Framing, and Study type. Each study had to fulfill each of the PICO-FS inclusion/exclusion criteria to be considered eligible). Eligible studies included randomized-controlled trials, as well as difference-in-difference designs, comparing food consumption or purchasing behavior against either a control group or in a before-after intervention comparison. Eligible studies were required to have some sort of climate framing whereby the primary focus of the research was to reduce food-related greenhouse gas emissions.

Literature search

We began by developing a full Boolean search string (in Appendix), which was finalized only after repeated testing and by examining search results in two core databases (PsycInfo and Scopus) to balance specificity and sensitivity and to see how many results the search would return. In the end, we used the following databases to perform the initial literature search: PsycInfo, Scopus, GreenFile, Medline, Embase. We decided to include gray literature to mitigate publication bias, which is the tendency from journals to publish studies with significant results, creating the potential for misguided research and distortions in the literature (Dickersin, 1990; Rosenthal, 1979). "Grey literature" includes academic theses and dissertations, committee and organization reports, conference and government papers, and ongoing research (Schöpfel, 2010). Thus, supplementary searches included ProQuest Dissertations and Theses repository, and screening bibliographies of reviews on the same topic. We also utilized the Google Scholar search engine, a particularly relevant source for the inclusion of gray literature (Haddaway et al., 2015). Finally, we contacted leading authors in the field asking for preprints and non-published manuscripts.

Literature screening

Searches were executed from August 2022 until January 2023, and no time nor language restrictions were applied during the literature screening process. We

screened the results of the searches at title, abstract, and full-text level and applied the predetermined PICO-FS inclusion criteria as previously described to finalize decision regarding eligibility (Collaboration for Environmental Evidence et al., 2022; Haddaway et al., 2017; Reisch et al., 2021). The full list of criteria can be found in Table below (Table 1).

We used the desktop version of Endnote X9 to assemble a final library of all reference files from search results downloaded. The screening and review procedure were independently carried out by two authors of the paper (DP and HZ). Any disagreements were resolved by discussion, with PF as the designated third author to settle arising conflicts in voting. Duplicate and non-duplicate records were identified during the initial stage of title-and-abstract screening and removed after first inspecting results within each database and then across them. Records were removed during the initial title-and-abstract screening if we deemed the contents not meeting our eligibility criteria. Those meeting our eligibility criteria proceeded to the final stage of full-text review, where records were evaluated in full and only included in the final pool of studies if they met all our inclusion criteria. All full text articles were independently screened by DP and HZ. If full text was not readily available, we contacted the researchers who published the studies. We conducted consistency checks with a subset of 15% of all identified articles (307/2048 articles at title, 62/416 at abstract and 13/84 at full text level) to assess inter-rater consistency in screening for eligibility. When the authors were in disagreement, we held team meetings and discussed whether the inclusion/exclusion criteria needed adjustment. Where multiple studies were included within one single article, we assessed the individual studies and retained the ones which met our inclusion/exclusion criteria.

Data extraction

One author conducted data extraction (DP) and another author cross-checked the coding (HZ). For each study included in the systematic review we coded: author, article title, source of publication, publication year, country, sample characteristics, study design, study setting, study duration approach category, theoretical framework, framing, norm type, norm representation, reference groups, comparators, measured outcome, results and direction of effects.

It is important to note that in assessing the impact of the interventions on sustainable food choices, we only report the main effects of the social norms' treatment against the relevant comparison groups found in each study. Thus, a 'positive significant effect' indicates that the treatment condition including normative information resulted in statistically significant, i.e., two-tailed p-value associated with its results is lower than the 0.05 threshold, behavior or intentions change compared to the control or comparison group, hence leading to a reduction of animal-based food consumption and/or increase in plant-based food consumption (see 'Criteria used to judge interventions' effectiveness' in Appendix). In contrast, a 'negative significant effect' indicates that the treatment condition including normative information resulted in a statistically significant, i.e., two-tailed p-value associated with its results is lower than the 0.05 threshold, increase in meat consumption and/or reduction in plant-based food consumption compared to the control or comparison group. We consider effects to be 'null' when the results of studies report no significant differences in behavior or intentions between the treatment and

Table 1. Eligibility (PICO-FS).

Screening Criteria	Included	Excluded	Examples of inclusion
Population	Individuals, aged over 18, and households that consume, purchase and order food. All age, gender, religion, ethnicity and social groups will be included not to strongly limit the scope of research results.	Participants receiving in- patient care, Institutionalised or pregnant are excluded.	Diners at restaurants, consumers in a Supermarket and students at canteens.
Intervention	Interventions by public or private actors testing social norms to shift consumers to eat more plant- based foods or reduce animal-based food consumption. Studies must manipulate social norms in order to test the causal relationship between social norms and outcomes and encourage behavior change over time.	Studies that measured social norms related aspects, e.g., investigating perception of norms or antecedents of behavior change. Studies that leveraged social influence approaches other than social norms, e.g., block leaders and social networks, modeling.	Messaging intervention including appeals to majority or minority norms on food consumption.
Comparator	Eligible studies must compare levels of consumer food consumption or purchasing behavior either against a control group (or a placebo control group) or in a before-after intervention comparison. Studies comparing a minimum of two groups where norm manipulation is different between the two.	Studies utilizing cross- sectional data and not reporting changes in the populations' behavior.	Control group can be a subset of participants that received no message or an irrelevant message or a message that included a normative component that varied in strength or direction.
Outcome	Included are both binary and continuous measures of choice. Both measures of self-reported or observed behavior are retained: (1) intended changes in meat and/orplant-based consumption, (2) self-reported changes in meat and/orplant-based consumption, (3) observed changes in meat and/or plant-based consumption.	Studies on cognitive measures such as values, attitudes, and also studies only measuring willingness to pay; studies centered around purchase and/or consumption of organic products, certified foods and/or seasonal eating	Selection of meat or plant-based, lunch/dinner food sales, self-reported Meat consumption through diary/journals
Framing	Included are studies which have some sort of climate framing, i.e., intent to reduce greenhouse gas emissions of the food sector, or which aim to contribute to the discussion around climate change and sustainable consumption.	Studies only focusing on health-related,or animal-welfare issues are excluded. Studies focused on marketing and commercial purposes, e.g., promoting purchasing of a climate-friendly product, are also excluded	Interventions with the objective of helping mitigate climate change, directlyor indirectly reducing greenhouse gas emissions.
Study Type	Included are empirical studies that provided primary data, randomized-controlled trials (RCTs) as well as rigorous quasi-experimental designs (pre-posttest, difference-in-difference).	Studies nor providing primarydata and/or reusing data from either a common data pool or past experiments, qualitative studies, reviews, meta-analyses, protocol or methods only papers.	Field interventions, such as university canteen studies,or experimental manipulations in an online study or lab setting.

control group ($p > .05$). Finally, 'inconclusive' describes the results of studies where findings cannot definitively be attributed to the sole effect of the normative component.

We also noted whether attention checks or other metrics for visibility or credibility were used. We extracted metadata from each study and included the information relevant for our coding categories. In cases where one article contained multiple studies, we identified each study separately and assessed it on its own. We explored supplementary files of the articles and, if necessary information was missing, we contacted the respective authors directly for clarification.

Critical appraisal

We followed the Cochrane risk-of-bias assessment tools to carry out a critical appraisal of the potential risk of bias in each study (Higgins, 2011; Sterne et al., 2019). The assessment categories used were: bias arising from the randomization process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in measurement of the outcome, bias in selection of the reported result. Each category included questions designed to evaluate studies' risk of bias and was ultimately assessed as low risk, some concerns or high risk. Finally, we evaluated each study across categories and assigned them labels as follows: low, moderate, serious, or critical risk of bias. Two members of the research Team, DP and HZ, assessed the quality of each included study independently before comparing evaluations and discussing their eligibility in case of disagreement until a common decision was taken. Because of the novelty of this field of study, we decided to maintain our assessments relatively loose, e.g., studies without a pure control/comparison group or that lacked detailed information regarding part of the methodological procedures utilized, so most studies were included in the final pool of articles included, independently of the risk-of-bias assessment. However, studies considered to have critical risk of bias were excluded.

Results

Our literature search identified 2,354 research publications potentially fitting our eligibility criteria. After review of titles and abstracts, we included 84 for full-text screening. Our final pool consisted of 23 research papers and 34 individual studies (Figure 1). A full list of articles included in the review can be found in the Appendix.

Overview

The search carried out in this systematic review identified no studies published earlier than 2017, with the number of related studies continuing to increase in ensuing years (Figure 2). Overall, we concluded the majority of the studies to be of high methodological rigor and high quality in their design. A few studies had minor limitations, as in Einhorn (2020) who does not provide detailed information regarding, e.g., an image of the stands set up in front of the dining halls or the procedure employed to convey the injunctive norm to participants. After conducting the critical appraisal, only three studies were excluded. One study deemed at critical risk of bias (Gonçalves et al., 2021) was excluded because it lacked critical information about the pool of recruited participants and the

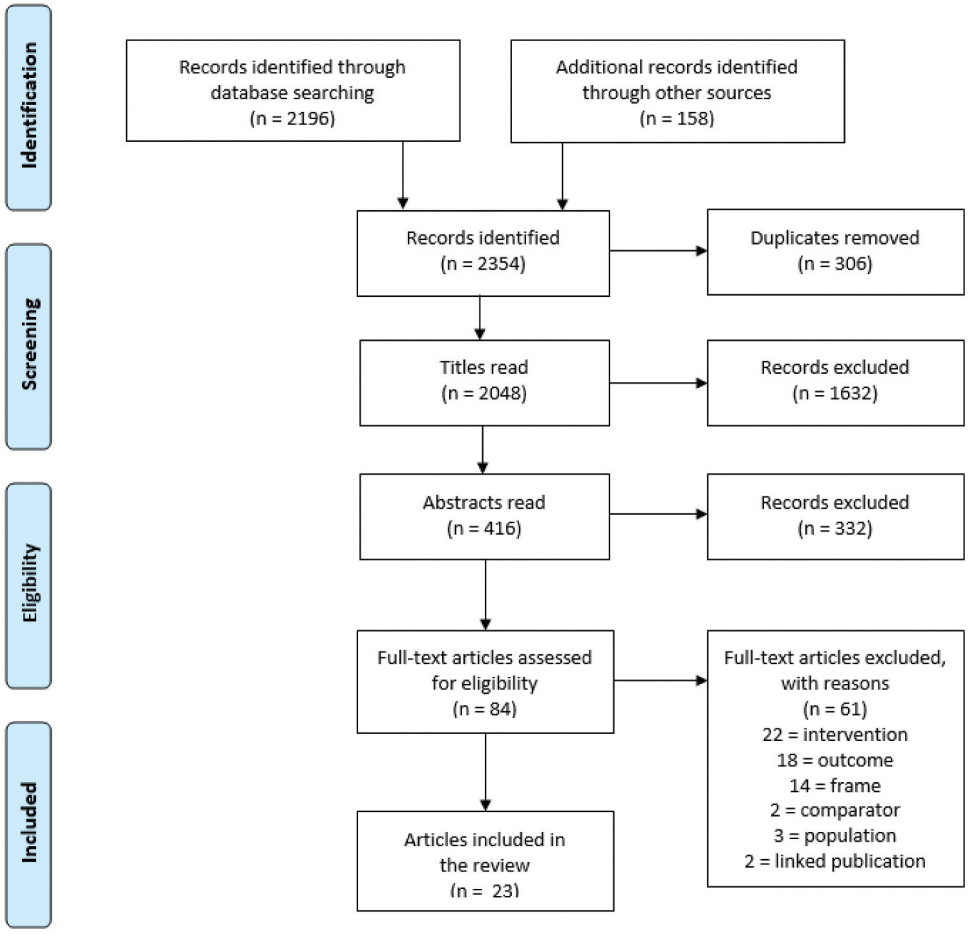

Figure 1. Flow diagram for systematic reviews.

dubious temporal validity of its intervention design. Despite two studies being rated at moderate and serious risk of bias, we excluded them (Berger & Burkhalter, 2022; Vogelaar & Priante, 2021) because one reported an outcome measure related to ratings of environmental friendliness of purchased items without specification of being meat or plant-based, whereas the other exposed participants to treatment conditions which only vaguely refer to social norms information as outlined in this review, i.e., 'please eat meat alternatives' and 'don't eat meat'.

In the end, 23 eligible publications were identified in this review, of which 13 (57%) came from peer- reviewed journals, while the remaining 10 (43%) came from gray literature, including five working papers, two unpublished manuscripts and three student dissertations. The largest proportion (around 60%) of these peer-reviewed journals specialized in environmental sciences, which might be expected given our search criteria. Most of the papers had only one study which met our criteria, though six (26%) had more than one, and one paper (Sparkman et al., 2020) had as many as six studies which were included in our review. Notably, nine (26%) of the studies we included are from the same lead

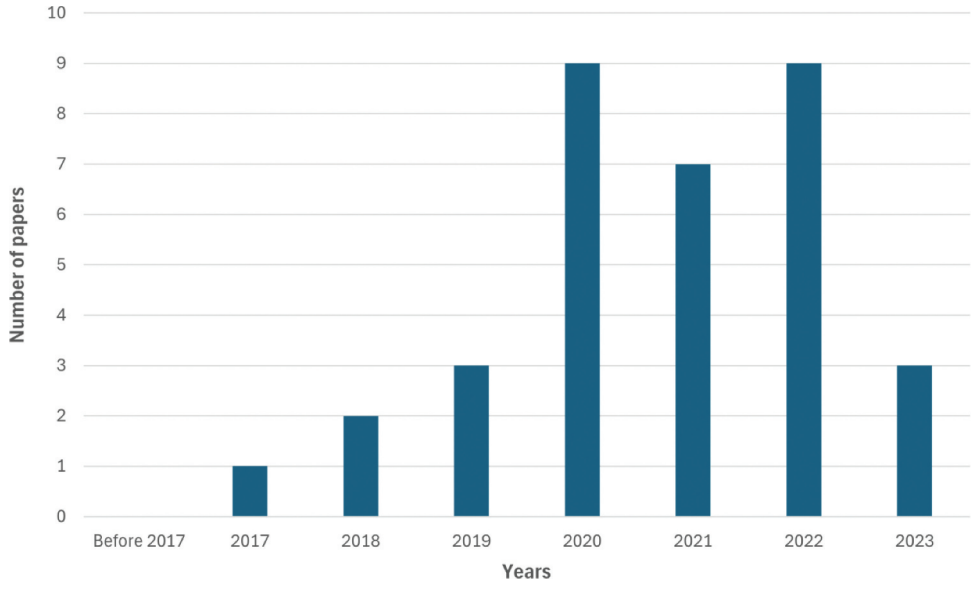

Figure 2. Number of research papers published per year.

author, or group of authors (Sparkman & Walton, 2017; Sparkman et al., 2020, 2021). Further details on publication sources, along with the criteria we used to assess the effectiveness of interventions and overview of study characteristics, can be found in the Appendix.

Results indicate that 22 (65%) of the studies found no effect of the experimental manipulation on food choice, four (12%) reported a significant positive effect (Banerjee & Picard, 2022; Blondin et al., 2022; Sparkman et al., 2020, Study 3), two (6%) found a significant negative effect (Biggs, 2022; Sparkman et al., 2020, Study 4), and six (17%) yielded inconclusive findings (Amiot et al., 2018; Carfora & Catellani, 2022; Lim et al., 2021; Sparkman et al., 2020, Study 1; Sparkman et al., 2021, Studies 1 and 2) (Figure 3). In five of the inconclusive cases, it was not possible to isolate the effect of the norm component, whereas another one used four models to analyze the dataset, only half of which were statistically significant (Sparkman et al. (2020) paper, Study 1). Another field study found marginally significant effects when comparing results from participants in a dynamic-norm condition to those in the control group ($p = .053$) (Sparkman & Walton, 2017, Study 4). We considered the results of this study be statistically non-significant and included it in the 'null' category. However, it should be noted that the direction of the effects was positive and the percentage of diners who ordered a meatless was higher in the dynamic norm group (34%).

Region

Consistent with similar reviews (Reisch et al., 2021), the vast majority of studies took place in Europe (50%) and North America (44%) (See Figure 4). The United States was most represented with 13 studies, followed by the United Kingdom ($n = 8$) and Germany ($n = 4$). Only two studies took place outside these areas: one from New Zealand and one

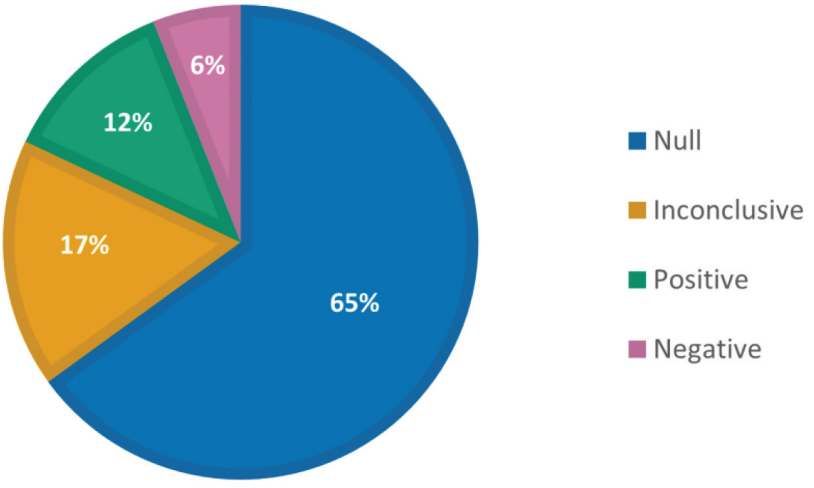

Figure 3. The impact of social norm-based interventions on sustainable food choices. NB: We report only the main effects of the social norms' treatment against the relevant comparison groups found in each study.

Figure 4. Map of the research locations. NB: Red dots identify the respective country, e.g., United States of America, United Kingdom.

from China. No studies were conducted in Latin America, South Asia, Indonesia, or in countries of the African continent.

Sample characteristics

Of the studies reporting data from individuals, sample sizes ranged from 32 to 6,374 participants. In most studies, the sample size was below 4,000, with the majority falling between 100 and 500. Only one study used a sample size of less than 100; this was a four-

week, multimodal intervention which specifically targeted young male university students (Amiot et al., 2018). Data from field studies were generally more complex and heterogeneous, given the diversity of designs and measures (e.g., individual items sold, number of dinner party orders, proportion of meatless entrees served). Broadly speaking, observations used as the unit for analyses ranged from approximately 2,500 dining parties in an upscale restaurant over a 38-day trial (Sparkman et al., 2020, Study 4) to almost 350,000 items purchased at 136 burger chain outlets over a seven- week experiment (Reinholdsson et al., 2022).

Data on participant gender were available for two-thirds of the studies. Of these, 74% of the samples consisted of more females than males, sometimes in ratios as high as 3:1. Where reported, participants' age ranged from 18 to 80, with an average between 25 and 40. About one-quarter of the studies in our review used student samples. Most of these studies specifically targeted students in the normative intervention, i.e., by including some sort of university reference in the norm statement. However, since a number of studies recruited from sources associated with a particular academic institution (e.g., university social media sites or participant pools for online studies, nearby food outlets or restaurants for field studies), it is likely that a high percentage of participants were students in these cases, even though they were not necessarily the target population.

Of the online studies, most recruited from large crowdsourcing platforms and, in some cases, market research panels such as Ipsos, Kantar, and YouGov. Convenience sampling was less prevalent, with five studies relying on snowballing through the authors' social media sites and personal contacts. Not surprisingly, this method of recruitment was most associated with student samples in studies which used lotteries or raffles to incentivize participation rather than cash payment. Only two studies reported using volunteers in their interventions (Carfora & Catellani, 2022; Carfora et al., 2022).

Theoretical motivation

Eleven publications (48%) reported applying some sort of formalized theory in the experimental design. The theories most frequently used were the Focus Theory of Normative Conduct ($n = 6$) followed by the Theory of Planned Behaviour ($n = 4$). Other frameworks used included Social Identity Theory (Childers & Rao, 1992; Turner et al., 1987), the Health Belief Model (Hochbaum, 1958; Rosenstock, 1974), Social Judgement Theory (Sherif & Hovland, 1961), the Stage Model of Self-regulated Behaviour Change (Bamberg, 2013), and framing theory more generally. The remaining 52% of papers in our review either referenced 'nudging' – broadly or specifically, e.g., as part of the title – or did not take a theoretical approach.

Comparator

An important distinction to make in the context of the studies included in this review is the presence of different types of comparators. In this review, we differentiate between 'pure' control groups and placebo control groups, also called 'active controls'. A 'pure' control group is an experimental condition that does not receive any treatment at all and serves as a baseline. A placebo group is an experimental condition that appears to mimic the active treatment, e.g., social norm manipulation, but which in reality is neutral and

does not contain any active treatment. Placebo groups are expected to control for anything but the active ingredient present in the experimental treatment manipulation. Twelve studies (35%) utilized placebo control groups, the majority of which presented textual or graphical messages providing information to participants (e.g., about the negative impacts of meat consumption), yet lacking the normative component (Bruynzeel, 2019; Fesenfeld et al., 2021; Mansell, 2020; Stea & Pickering, 2018). In contrast, other studies (Sparkman et al., 2020, 2021) embedded a social norm in their control condition but applied it in a different behavioral context, such as trends in social media use, exercise habits, or leisure activities. The most common control group design in the rest of the studies (52%) was a pure control group in which participants saw no message and directly performed the experimental task. Three studies (Lim et al., 2021; Patel et al., 2023) used a pre-post design with no separate control group. Finally, two studies only compared results between two experimental conditions, limiting the interpretation of the findings (Carfora et al., 2022; Lim et al., 2021).

Outcome

The majority (62%) of the studies in our review reported behavioral outcomes. Twelve of these were based on observational data, reported as the percentage of vegetarian items or meals purchased and/or the likelihood (odds ratio) of choosing a meatless meal. Nine studies relied on self-reported meat consumption using food diaries or survey questionnaires. The remaining 38% of studies measured behavioral intentions only, either through surveys ($n = 5$) (e.g., self-reported likelihood of choosing meatless meals in the coming week) or hypothetical choice experiments ($n = 8$). For example, Blondin et al. (2022) conducted two online experiments: In Study 1, they presented participants with a sequence of eight different meal pairs and asked them to choose one from each pair of plant- versus animal-based items, and in Study 2 they asked participants to select one meal from a menu including an assortment of both vegetarian and meat entrees. One paper conducted an online experiment with the objective of promoting more 'climate-friendly' diets (e.g., fish or poultry versus beef or lamb), rather than the reduction of meat per se (Banerjee & Picard, 2022). As such, even though the norm statement explicitly referred to people 'who stopped eating meat' and 'are choosing plant-based dishes', the authors reported outcomes in terms of overall carbon emissions from participants' (hypothetical) meal selections, many of which contained meat.

Framing

About half of the studies in our review were motivated by climate framing alone, whereas the other half were evenly split between either environment and health framing or a combination of environment, health, and animal welfare. Only one study (Bruynzeel, 2019) was motivated by an environment plus animal welfare frame.

Study design

Setting

Twenty-one of the studies reviewed (62%) took place online, with three of these using SMS or chatbot messages in the intervention (Carfora & Catellani, 2022; Carfora et al.,

2022; Lim et al., 2021). One of the studies used a mixed setting, including both laboratory sessions and SMS messaging (Amiot et al., 2018). The remaining 12 studies (35%) were field experiments. As previously discussed, the majority of these were conducted on or near university premises, with six studies taking place in student canteens or similar food outlets (Biggs, 2022; Einhorn, 2020; Griesoph et al., 2021; Patel, 2023; Sparkman & Walton, 2017). Additionally, two studies were run with popular restaurant chains: one situated inside a major UK retail store (Çoker, Jebb, et al., 2022) and the other at a well-known Swedish fast-food establishment (Reinholdsson et al., 2022).

Duration

Studies were fairly evenly split between short-term, primarily cross-sectional designs versus long-term studies which ran as long as 125 days (Sparkman et al., 2020, Study 3). Half of the studies included in this review tested the effects of a one-shot norm messaging intervention, specifically investigating the impact of a single, short-term, non-repeated intervention. For online interventions, about half of the long- term studies were *repeated exposure* experiments, where the intention was to reinforce the effects of the normative information present in the treatment condition. An example of this design is one study which ran a text-based intervention for 8 weeks during which participants received 2–3 text messages per week, with measurements taken three times: prior to the intervention, immediately post-intervention, and 1 month after the intervention (Carfora et al., 2022). In contrast, the other long-term online studies were *repeated measurement* designs which aimed to assess persistence of effects or allow them to develop over time (Alblas et al., 2022; Sparkman et al., 2021). In these cases, participants in the treatment condition were exposed to the normative information only at the beginning, with measurements taken immediately after exposure and then again in subsequent waves weeks or months later.

Norm manipulation

A full list of social norm statements used by papers in this review can be found in the Appendix.

Norm type

Most (69%) studies only used one norm condition in the intervention, although several did test more than one, or combinations of different types of norms. A few studies looked at the influence of injunctive norms on their own, but the majority which used injunctive norms did so in combination with a descriptive component. Some studies included a direct appeal as part of the norm manipulation. For instance, a number of statements used 'joining' messaging, such as 'let's join in' or 'join this growing movement' (Blondin et al., 2022; Lim et al., 2021). Of the studies incorporating a descriptive norm, 52% used a dynamic norm framing which emphasized a recent increase or growing trend in particular food choices. In a conceptual replication of a well-known U.S. study on energy consumption (Schultz et al., 2007), one intervention in the Netherlands (Alblas et al., 2022) provided weekly feedback to participants on their meat consumption relative to other participants. Many manipulations were ambiguous with respect to prescriptive ('do this') versus proscriptive ('don't do this') framing, but in general studies tended to be evenly split between these two types or chose neutral terms such as 'replace'.

Norm representation

Virtually all studies used written text to communicate the norm statement. For online studies, this was most commonly done through vignettes, text snippets, or campaign. Field studies used text on posters or in notes attached to menus, for instance on menu boards or digital ordering kiosks. Although a few studies used visuals which may have augmented the norm, e.g., colorful photos of vegetables or disturbing photos of animals in food production, only one study (Aldoh et al., 2023) explicitly tested the effect of adding graphical representation of the norm to the written description. A few studies used animation or illustrations to help draw attention to the norm statement. Notably, about a third of the interventions included additional information – beyond what people do or approve of, usually regarding impacts on the planet or environmental motivations for others' changing their diets. One study which tested a 'reduce' versus an 'eliminate' message in an op-ed format used multiple strategies, including images, direct appeals, and factual as well as social information (Sparkman et al., 2021, Studies 1 and 2). The aforementioned multicomponent intervention on young men in Canada (Amiot et al., 2018) used a slide presentation to convey the normative information.

The majority of studies did not use specific statistical information in their norm statement, instead relying on vague terminology such as 'most', 'many', or 'more'. A typical message might state 'More and more of [norm referent] are choosing veggie options' (or 'eating less meat'). Of the studies that did use statistics, many tried to base their figures on evidence, e.g., through focus groups, pilot surveys, or data from sales or publications. However, one author used deceptive information (Mansell, 2020), only informing participants about the deception in the debrief, and another group used an intervention testing the message '90% of Americans are making the change to eat less meat' without referencing any source for this statistic (Blondin et al., 2022). About half the studies did reference a source for the normative information, either directly (e.g., an article in *The Lancet Planetary Health*) or implicitly (e.g., a food venue referring to the choices of its own customers

Norm referent

We considered norm referents who might constitute a peer group or other close social network to be proximal, e.g., friends, family, coworkers, or fellow students. In contrast, referents at a regional or national level, e.g., 'Americans' or 'British', would be considered distal. We found it useful to further distinguish between generic and specific referents, e.g., 'people' versus 'our customers' because the latter, whilst localized, might be more or less relevant (proximal) depending on factors such as participants' brand identity or how often they patronized the food venue. Over half of the studies in our review used norm referents that were both generic and distal, e.g., 'people in the UK' or even just 'people' (see the Appendix for a full list of reference groups used). The most specific and proximal referents were found in canteen studies which used fellow students in their norm statements. Two field studies (Çoker, Pechey, et al., 2022; Reinholdsson et al., 2022) used fellow restaurant patrons as the norm referent which, whilst specific, is indeterminate as far as proximal relevance. Of note, one paper tested a range of different norm referents, e.g., 'our community', 'people like us', 'non-vegetarians', with mixed results (Sparkman et al., 2020). Interestingly, we only identified two studies which made an attempt to assess participants' identification with the norm referent, either directly as

a survey question or in focus groups when crafting the norm statements (Biggs, 2022; Patel et al., 2023).

Discussion

Prior research investigating the effects of social influence approaches on pro-environmental behaviors has shown that social norms can be effective drivers of behavior and intentions change. Since 2017, we have witnessed a rapid increase in literature produced on the use of social norms interventions to encourage sustainable food consumption. However, in this systematic review we find that studies implementing this behavioral approach have had little success. Overall, this paper provides a systematic assessment of the evidence on intervention effectiveness and illustrates that only 12% of studies included reported a significant and positive effect of the social norm-based intervention on sustainable food choices. Most studies (65%) found no statistically significant differences between the treatment and the control groups. For some it was difficult to attribute effects to the norm component on its own, as the social norm messages included other information (e.g., set of motivational appeals in an op-ed format in Sparkman et al., 2021, recipe suggestions in; Lim et al., 2021), or were delivered as part of a larger multi-modal intervention (Amiot et al., 2018).

The results of two field studies showed that exposing customers to norm messages lowered the odds of them selecting a vegetarian meal (Sparkman et al., 2020, Study 4; Biggs, 2022). One of the two studies took place in a fine-dining restaurant at dinner time and researchers speculated psychological reactance to the intervention might have caused the reduced number of vegetarian choices (Sparkman et al., 2020, Study 4). Boomerang effects are not rare in the social norms' literature (Richter et al., 2018; Schultz et al., 2007), and such undesirable effects can emerge for a number of reasons. Individuals can perceive norm messages as direct attempts to manipulate them, which in turn triggers reactance, a motivational state occurring when an individual perceives that their freedom is being threatened (Brehm & Brehm, 1981). For instance, it is possible that after reading a dynamic descriptive norm message about the increasing number of people choosing more plant-based meals, individuals wished to restore their freedom of choice and selected the animal-based option instead. Although Sparkman et al. (2020) coupled the presentation of the norm messages with a second line to mitigate the negative effects of psychological reactance, their studies provided mixed evidence on the effectiveness of the interventions implemented. Although most social norm- based trials reviewed here lacked direct psychological evidence to examine the presence of psychological reactance, Biggs (2022) explored perceived salience and appropriateness of the messages in a post-trial survey. Despite interpretations being limited by a low response rate, they found messages were not viewed negatively, with no evidence of message-induced psychological reactance to explain the negative effects of their intervention.

Although early research evidence showed promising signs (Sparkman & Walton, 2017), the overall findings of this review indicate that attempts to motivate a shift from animal-based to plant-based meals via descriptive dynamic social norm messaging were often found not to be effective in both field and online trials (Aldoh et al., 2021, 2023; Çoker, Jebb, et al., 2022). Carfora et al. (2022) provided evidence showing that adding a dynamic norm component to messages presenting environmental information to

participants did not improve the effectiveness of their intervention compared to presenting environmental information on its own. Nonetheless, all the four studies found to produce significant positive effects employed descriptive dynamic social norms in their interventions. A field experiment compared meal orders made in a fine dining Italian restaurant after randomly assigning certain days to a menu-based dynamic norm intervention and others to a control menu condition and found that the intervention increased the odds of choosing a vegetarian meal over a non-vegetarian one (Sparkman et al., 2020, Study 3). In an online experiment recruiting participants from the UK, Banerjee and Picard (2022) tested messages including a descriptive dynamic social norm component before participants placed their intended orders for the online meal delivery. Their study is the only one identified by this systematic review to provide calculations regarding the emissions of participants' food choices, and they found their social norm treatment condition lowered intended orders of carbon-intensive meals (from 19.4 kilos of carbon-equivalent CO2e in the control condition to 16.6 kilos of carbon-equivalent CO2e in the social norms one). Blondin et al. (2022) trialed a selection of environmental messages to promote plant-based choices in an online restaurant setting and showed that a descriptive social norm message motivating people to 'join a movement' resulted in a large increase of vegetarian dishes selected. However, the authors used fabricated statistics in their messages, a practice which might raise some concerns from an ethical perspective when applied to a real-world scenario rather than an online setting.

One explanation for the limited effectiveness of these norm-based interventions may be that most studies have used generic, non-socially relevant referent groups, i.e., 'people', 'people in the UK' and 'other customers' (Aldoh et al., 2021; Çoker, Pechey, et al., 2022; Patel et al., 2023). Prior research suggests that norms about eating practices might be more salient when the social reference group used in the message is 'close' to the individual (Robinson et al., 2014a; Stok et al., 2014; Liu et al., 2019). Nonetheless, one of the studies identified by this review specifically explored the impact of using a close referent group, i.e., students from the same university college, within the social norm message (Biggs, 2022). The authors also carried out focus groups before the field intervention to examine students' perceptions of their social networks and understand what groups were relevant in influencing food choices to decide the exact wording of the norm messages. They did not find a positive effect in using a close referent condition compared to using a distant referent one, i.e., people in the UK. A number of studies included in this review focused on providing information regarding certain population groups' attempt to 'try to eat less meat' or 'make an effort to reduce meat consumption'. However, an unexplored research avenue which could prove useful would be to suggest that the reference groups included in the social norm messaging have successfully changed their dietary habits to improve their health or protect the environment.

Similarly, another interesting aspect examined was the inclusion of a measure of in-group identification to understand how strongly the study sample identified with the reference group. Among the studies included in this review, only two have employed a similar measure (Albas et al., 2022; Carfora & Catellani, 2022). Although Albas and colleagues found that people in their study identified strongly with the reference group, their social norm intervention did not effectively influence a reduction in meat consumption. Carfora and Catellani tested whether participants' food choices were

moderated by different levels of identification with flexitarians. They observed that identification did not influence short-term effects yet played a significant role over a long-term period, so that higher identification with flexitarians increased consumption of legumes across all conditions. To further understand where and with whom norm effects promote sustainable eating practices, future research trials should continue investigating whether social norm-based messaging can be strengthened by including reference groups perceived to be socially relevant by the targeted population. We recommend conducting preliminary research to tailor the intervention on the target population, taking into account its potential heterogeneity, and facilitating enough of a social connection. Ideally, the norm statements elaborated by the researchers should be developed either by pretesting the messages via pilot studies and focus groups or by using data from the same target reference group in order to enhance their credibility and salience.

While online studies represent the majority of trials reviewed, field experiments provide the opportunity to evaluate observed changes in behavior across various decision-making contexts, e.g., university canteen versus restaurant, and with a high degree of ecological validity compared to online settings. However, the interpretation of results from field interventions must take into account a number of general limitations as these trials are more often associated with lack of control over unpredictable circumstances, such as changes in price, availability of different meal options, or even weather events. The studies included in this review show that correct designing and implementation of a field intervention requires meticulous communication with the different stakeholders involved. In field experiments, there is no way to ensure exposure to the norms message, and careful positioning of the messages might be crucial to ensure visibility of the message. In two studies reviewed here, fidelity check visits were carried out to guarantee that norm messages displayed would remain visible and in place throughout the intervention period (Biggs, 2022; Çoker, Jebb, et al., 2022). In a natural setting, customers and diners often make their food choices with friends and family. Social norms arising from these close referents may limit awareness or processing of the social norm and overpower the messages displayed by the researchers, making conflicting social and proximal cues at the point of purchase an area worth further examination in the future. Finally, in the case of field interventions running across different days and/or locations, it is important to minimize the risk of treatment contamination, e.g., when participants in the control condition are inadvertently exposed to the intervention.

One common limitation of the studies included in this review is not including measures or analyses on the visibility and credibility of the norm messages utilized. Most reviewed studies lacked any form of 'metric of visibility', with only a few carrying out post-trial surveys or attention checks asking questions within the online survey design to evaluate whether diners noticed the norm message and could recall its content, e.g., 'what has happened to meat consumption in the last 5 years?', 'what was the message about?', 'did you notice the note, at the top right of the menu?' (Banerjee & Picard, 2022; Biggs, 2022; Brachem et al., 2019; Carfora & Catellani, 2022; Fesenfeld et al., 2021; Sparkman et al., 2020, 2021). In some cases, participants not correctly answering questions regarding information contained in the messages were removed from subsequent analyses (Alblas et al., 2022). This systematic review finds that message content recall was especially low in field settings, where messages may not have been visible enough to

produce the intended effects. Two field trials reported that only about a quarter of all participants noticed the social norms signage and remembered the exact message (Einhorn, 2020; Patel et al., 2023). In turn, this makes it difficult to assess whether the failure of some of the norm interventions included in this review can be attributed to the lack of effects of the norm information provided or to the lack of visibility of the messages displayed. Moreover, we recommend that future studies continue to carefully examine trust, perceived credibility, and coercion of the messages employed to ensure they are not perceived as patronizing and simply false by participants, who might experience a large discrepancy between their personal experience and communicated social norm.

Many studies included in this review relied on self-report dietary measures, which are easy to deploy and widely used in nutrition studies but are also prone to measurement error (Alblas et al., 2022; Amiot et al., 2018; Carfora & Catellani, 2022; Carfora et al., 2022). The Food Frequency Questionnaire (FFQ) and daily food diaries were used as structured recall tasks to assess food consumption, by asking participants to think about past food intake and report eating frequency of different categories of foods. Although these are both considered valid measures of food habits, they might be subject to researcher demand or social desirability biases leading to erroneous estimation of caloric intake (Subar et al., 2015). Prior research has suggested that there could be advantages in repeated exposure to norm messages over participants reading the messages only once, i.e., long-term exposure versus one-shot interventions, in terms of behavior change (Carfora et al., 2022). However, we do not find evidence of that in the results gathered from the studies included.

Compared to more automatic and fast choice architecture approaches, social norm messages require perhaps a higher level of engagement, and we suggest future research should design manipulations which sufficiently engage participants with the text. One promising method might be that of communicating normative information via visual cues. Although the most common mode to deliver the normative information to participants was through written text, using visual cues to show an increasing norm proved beneficial in one study (Aldoh et al., 2023). Aldoh and colleagues found that dynamic norms accompanied by a visual graph representing the percentage of British people who try to limit the consumption of meat resulted in more positive intentions to reduce meat intake compared to the condition without a visual cue. Their results align with the tenets of Dual Processing Theory, where visual images stimulate rapid information processing by engaging the experiential processing system (Epstein, 1994). In the case of social norms messaging, imagery might increase engagement with the information provided by clearly signaling the change in prevalence over time and, in turn, increase the effectiveness of the manipulation. Future studies should continue to examine what the exact mechanism explaining the effects of visual cues accompanying normative information might be. Further, changing the format and delivery mode of the normative information may involve different communication channels, such as social media accounts (Patel et al., 2023), or using number of people engaged rather than percentages, as some people struggle to interpret relative changes in percentages (Parker & Leinhardt, 1995).

While our review focused on social norms communicated through messages, research increasingly suggests that other forms of social influence may implicitly shape behavior change (Abrahamse & Steg, 2013; Raghoebar et al., 2019). Cues in the food environment can signal social norms, such as product placement suggesting a food's popularity due to

high demand. For example, emptier trays or shelves may trigger a scarcity mind-set, enhancing the perceived popularity of plant-rich dishes (Pollicino et al., 2024). Garnett and colleagues demonstrated that increasing the availability of vegetarian meal options can boost their sales (Garnett et al., 2019). One interpretation of their findings is that greater availability not only enhanced the visibility of these meals but also conveyed a descriptive social norm about typical food choices. Future research should explore how embedding social norms in food environments could be more effective in reducing animal-based food consumption than overt messaging, as it may bypass psychological reactance. An interesting research avenue is to examine whether greater availability of plant-based meat substitutes in dining settings enhances their perceived normalcy and social acceptability, particularly among individuals with strong meat attachment (Graça et al., 2015).

As for the characteristics of sample groups recruited in the studies reviewed, one study in this review focused exclusively on a male sample population (Amiot et al., 2018). This is noteworthy since research trials encouraging various pro-environmental behaviors have often been found to be most effective when targeting a sample of the population comprising young, female, liberal and student participants (Dietz et al., 2002; Trelohan, 2022). When investigating potential shifts toward more sustainable food consumption, targeting the male population promises some challenges as eating meat has often been associated with perceptions of masculinity and strength (Rothgerber, 2013; Ruby & Heine, 2011). However, targeting this segment of the population might also generate the most beneficial effects, especially when recruiting the young adults (18–25 years-old) as they are still establishing their social identity and may be more sensitive to norms about their peers and friends (Sharps et al., 2024).

Limitations

One limitation of this review is that we are not able to attribute the effects of a number of social norm-based interventions purely to their normative component. Interventions often target several different factors to promote a reduction in meat consumption, hence relying on a more holistic approach to behavior change. For example, Amiot et al. (2018) carried out a 4-week trial consisting of a social norm component, an educational one, an emotional appeal, a mind attribution and goal setting/self-monitoring component. The intervention significantly lowered total red meat intake after 4 weeks, however, the combination of components does not allow us to attribute the success of the intervention solely to the social norms messaging. Similarly, Banerjee and Picard (2022) showed that when people are encouraged to reflect upon their will to conform to social norms and pledge their commitment to conform, choice intentions for sustainable food items almost doubles relative to the social norm condition alone.

In the case of encouraging more plant-based food consumption and reducing animal-based consumption, interventions targeting multiple factors would likely more successful than those harnessing social norms only. As we outlined above, we decided not to include trials that explored the topic of sustainable food consumption exclusively from a health-based or animal-welfare perspective. We are aware this decision might have increased the chances of excluding studies providing insightful data and findings on both the intervention and outcomes of interest. We suggest future systematic reviews and meta-analyses on

this topic to also look into the health and animal welfare literature. Another common limitation in systematic reviews concerns the presence of publication bias which can inflate the results reported. We decided to include gray literature, e.g., reports, conference papers and unpublished manuscripts, and we carefully developed the search strings and search criteria in the attempt to minimize this bias. Nonetheless, it is possible that we failed to identify and include relevant articles in the final pool of articles selected for this systematic review. Finally, all but one of the studies identified in this review were conducted in 'WEIRD' countries (Henrich et al., 2010), and none in what is generally considered as the 'Global South'. Thus, we cannot generalize the findings of the present work across cultural contexts.

Conclusions

To the best of our knowledge, this work presents the first ever systematic literature review in the domain of social norms and sustainable food consumption. The scientific community understands the vital importance of reducing meat consumption worldwide and mitigate the negative effects of unsustainable diets on the on the environment, human health, and the welfare of animals. In this review, we have provided evidence that social norm-based interventions have not yet been effective in fostering sustainable food choices. Although we have only reported the presence and direction of main effects, this work provides a first systematic assessment of the overall effectiveness of social norm-based interventions and offers some guidance to future research efforts to understand under which conditions social norms may or may not work. Researchers need to address critical knowledge gaps regarding how to design and implement these interventions to successfully encourage a shift toward more plant-based food choices. Social norm messaging represents a scalable and easy to implement approach for food service retailers, yet messages need to be carefully tailored to various segments of the population and should include defined reference groups with whom individuals strongly identify. In conclusion, we consider this review an essential first step to outline the principal characteristics of the studies included, and a necessary advancement toward conducting a more informative meta-analysis which incorporates the impact of moderating variables to provide further insight on the results.

Pre-registration & data availability

The study was pre-registered at: https://doi.org/10.17605/OSF.IO/S3DXR

Deviations from the initial protocol are declared with transparency in the Appendix.

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DP, GS, and MMG conceptualized the study. DP and HN designed the study. DP, HZ and PF carried out the review, and formally analyzed and curated the data extraction. DP, GS and HZ wrote the first draft. DP, GS, MMG and HZ revised the subsequent versions. GS, MMG and HN supervised the study.

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