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Testing the effect of descriptive dynamic social norm messages on meatless food purchases in Aotearoa New Zealand and UK university food outlets

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A reduction in meat consumption is urgently needed to address multiple harms related to the environment, animal welfare, and human health. Social norm interventions have been found to be feasible and effective at shifting consumer behaviour, however, evidence related to meat reduction behaviour is limited – especially in naturalistic settings. Two social norm interventions were conducted at university food outlets in Aotearoa New Zealand and in the UK, to assess the effect of social norm messages on meat and meatless food purchases. Both interventions consisted of a week-long intervention phase during which descriptive dynamic social norm messages referring to reduced meat intake were displayed in the food outlets (study one and two) and via social media (study two). Meat and meatless food purchases during the interventions were compared to pre- and post-intervention weeks. Surveys were also conducted with a sub-group of customers to assess demographics, dietary habits, and awareness of the social norm message. In both studies, there was no significant effect of the social norm interventions on meat or meatless food purchases, and awareness of the norms message across both studies was low. These findings indicate that social norm interventions alone may be ineffective in encouraging meat reduction. Implications for interventions to reduce meat intake to support pro-environmental food choices are discussed.

KEYWORDS

social norms, meat reduction, food choice, behavioural intervention, sustainability

1 Introduction

To improve human and environmental health, meat consumption must be reduced, especially in the Global North (Springmann et al., 2016; Willett et al., 2019). Meat eating is an entrenched social norm, and shifting meat eating behaviour at the scale required necessitates concerted and sustained behaviour change efforts (Marteau, 2017). However, dietary change is challenging due to various complex and interacting factors, such as taste preferences, habits, and the cultural and social status of meat (Stoll-Kleemann and Schmidt, 2017). These factors present significant barriers to most behaviour change efforts that rely on education or information sharing, necessitating the need for alternative strategies to overcome these barriers.

One potential strategy is the use of social norm interventions. Social norms are perceptions about peer behaviour, which may be descriptive (i.e., referring to the commonness of a behaviour) or injunctive (i.e., referring to the social acceptability or approval of a behaviour) (Cialdini et al., 1990). Multiple studies have shown that exposure to social norm messages can increase pro-environmental behaviour and change dietary behaviours (Cruwys et al., 2015; Farrow et al., 2017; Yamin et al., 2019). The use of these messages in interventions generally involves exposing participants to normative messages about a behaviour of interest. Participants' own behaviours or choices are then monitored and compared to participants who were not exposed to normative messages. Such non-deliberative approaches have been recommended to encourage environmentally sustainable behaviours, such as reduced meat intake (Marteau, 2017).

Most studies applying this approach to dietary behaviours have tested the effects of social norm messages under laboratory conditions, with moderate yet consistent effects (Robinson et al., 2014; Robinson, 2015). Extending beyond the laboratory, studies conducted in naturalistic settings have also reported favourable effects of descriptive social norm messages on dietary behaviours, though these studies are few in number. For example, Thomas et al. (2017) conducted a study in workplace cafeterias, and found that a descriptive social norm message of "Most people here choose to eat vegetables with their lunch" increased the number of vegetable side-order purchases by 4 percentage points between baseline and intervention.

These types of descriptive social norm messages may be a promising approach for reducing meat intake. In support of this hypothesis, findings from observational data show that participants' beliefs about the amount of meat other people eat (perceived descriptive norms) was associated with meat and meatless food intake (Sharps et al., 2021). To date, only a limited number of studies have investigated the effect of descriptive social norm messages on meat intake. Alblas et al. (2022) provided participants with a descriptive social norm message about the amount of meat that Dutch residents consume per day and assessed self-reported meat intake over two weeks in low and high habitual meat consumers. Findings showed that regardless of condition (e.g., descriptive social norm or control), high meat consumers reduced meat intake, while low meat consumers increased meat intake over two weeks. While this study was limited by self-report dietary measures which are prone to inaccuracies (Heitmann and Lissner, 1995), a further study in Swedish fast-food outlets which displayed a descriptive social norm message and measured the number of 'green' or vegetarian sales, also reported no effects on intake (Reinholdsson et al., 2022). However, a key limitation in both these studies was that the descriptive social norm message presented did not explicitly refer to reduced meat intake. In Alblas et al. (2022), the average amount of meat consumed was communicated (e.g., "consume meat 1.32 times per day"), and it may not have been clear to participants that these amounts reflected reductions in meat intake. Additionally, the message in Reinholdsson et al. communicated 'many here choose green', and reduction of meat was not explicitly communicated. It is possible that consumers did not link this 'green' message with reduced meat intake, especially given that many consumers are unaware of the environmental impacts of meat-rich diets (e.g., Macdiarmid et al., 2016). Further research which tests the effects of a descriptive social norm message, that explicitly communicates reduced meat intake, is needed.

Indeed, most social norm interventions aiming to reduce meat consumption have used dynamic, rather than descriptive norm

messages (Sparkman and Walton, 2017; Sparkman et al., 2020; Çoker et al., 2022). Dynamic norm messages outline how people's behaviours have changed over time, for instance, by providing the proportion of people who have reduced their meat intake in recent years. Importantly, studies testing the effects of dynamic social norm messages on meat intake have yielded inconsistent findings. In one study, researchers approached and provided customers in an on-campus café with either a control, dynamic, or static social norm message [the static message stated the proportion of people who have reduced meat intake (3 out of 10) without referring to the recency of the change] (Sparkman and Walton, 2017). Comparison of purchase data showed that customers presented with the dynamic social norm message were more likely to purchase meatless meals compared to customers in the static social norm condition (the comparison between the dynamic social norm and control conditions did not reach significance) (Sparkman and Walton, 2017). A further two studies by the same researchers, which used larger samples, delivered the dynamic social norm message using restaurant menus, and assessed the influence of messages over a longer period of time, also reported modest increases of meatless purchases (by 1–2.5 percentage points; Sparkman et al., 2020 study 1 and 2). However, another study by Sparkman et al. (2020; study 4) reported opposite effects; compared to a control message, exposure to a dynamic social norm message reduced meatless purchases and increased meat purchases. Additionally, another study conducted by a different research group in retail café settings reported no significant differences in meat or meatless purchases in response to a dynamic social norm message ("More and more [retail store name] customers are choosing our veggie options"; Çoker et al., 2022) (of note, Çoker et al., 2022 was published after this research had been planned). These studies demonstrate that findings on the effectiveness of dynamic social norm messages for reducing meat intake are mixed.

Considering this evidence, it may be that *combining* descriptive and dynamic elements could leverage the strengths and potential of both approaches to yield promising results. Specifically, descriptive dynamic messages may hold more promise for reducing meat intake for three main reasons. First, the messages explicitly specify the behaviour required (reducing meat intake), contrasting previous usage of descriptive messages to influence meat consumption (e.g., Alblas et al., 2022; Reinholdsson et al., 2022). Second, the social norm message aligns with previous studies that supported the effects of descriptive messages to increase healthy food choices (e.g., Payne et al., 2015; Thomas et al., 2017). Finally, the messages signal a durable dietary change. This contrasts to dynamic messages that indicate the recency of the dietary change, which some recipients may doubt the longevity of the change, in turn compromising the persuasiveness of the message.

Therefore, this research tested the effect of descriptive dynamic social norm messages on meat purchases in food outlets in Aotearoa New Zealand (study one, pre-registered: https://osf.io/ku35z/?view_only=bf1288ca34ce4750bccadced674421a) and in the UK (study two, pre-registered: https://osf.io/utqaj/?view_only=6604489ca34d422db1fc45f19431c6f5).

2 Study one: Aotearoa New Zealand

The aim of study one was to assess the effects of a descriptive dynamic social norm message about peer meat reduction on meat purchases in an Aotearoa New Zealand university food outlet. This

study was the first to investigate social norms messaging related to meat reduction in an Aotearoa New Zealand context. It was expected that this intervention would result in a reduction of meat items purchased.

2.1 Context

Aotearoa New Zealand is small archipelago in the south Pacific Ocean, with a population of approximately 5 million in 2020. Following colonisation, an aspiration to become a “Britain of the South” (Barker, 2012) resulted in extensive agricultural development and intensification, facilitating the growth of the meat and dairy industries. Alongside this dominant form of land use arose a national identity and pride as a rural or agricultural nation, aided by the immense economic role played by the meat and dairy industries (Ballingall and Pambudi, 2017) and reflected in high national *per capita* consumption of these products (FAOSTAT, 2020). Conversely, meat-free diets such as vegetarianism and veganism are in the minority, and have been previously perceived as “unpatriotic” or contrary to “kiwi” (New Zealander) ideals (Potts and White, 2007).

In recent years, however, low meat and meat-free lifestyles have become more common. In 2019, approximately 34% of New Zealanders had either reduced, limited, or eliminated meat from their diets (Colmar Brunton, 2019), and there has been 42% reduction in *per capita* red meat consumption from 2007–2017 (Beef and Lamb New Zealand, 2018). Due to increasing reports linking meat intake to health problems (e.g., Papier et al., 2021), New Zealand’s Ministry of Health recently revised its eating guidelines toward largely plant-based recommendations. Similarly, increasing coverage of meat’s environmental impacts may be especially poignant in a nation that places great value and pride in its natural environments, and in which pro-environmentalism is a fundamental aspect of national identity (Milfont et al., 2020). Approximately 50% of national greenhouse gas emissions come from agricultural production (Ministry for the Environment, 2023), and dairy intensification has been increasingly linked to environmental degradation, especially of freshwater habitats (e.g., Foote et al., 2015). Concerns related to ethics and animal welfare in farming practices have also become more frequent, with the recent examples of winter grazing and live export controversies (e.g., Government defers introducing tougher winter grazing rules—again, 2021; McClure, 2022). Aotearoa New Zealand’s strong historical, cultural, and economic ties to animal agriculture warrant interventions aiming to reduce meat consumption, in order to address its effects on the environment and public health.

2.2 Methods

The study was originally planned to be conducted at the University of Sheffield in the UK, however circumstances due to COVID-19 necessitated a change in location. The study procedures were initially approved by the [anonymised] Ethics Committee, and adjustments to the design and procedure for the new study setting were approved by the New Zealand university’s Human Ethics Committee. Purchase data for all customers was anonymous and recorded by outlets as standard practice. Given the anonymity, informed consent was not obtained for purchase data, however for transparency, a debrief

information notice was displayed at participating outlets at the end of the study period. Informed consent was obtained from all survey participants. Data collection for this study took place in May 2021, during the COVID-19 pandemic. However, there were no COVID-related restrictions in effect in Aotearoa New Zealand at the time of data collection.

2.2.1 Research setting

This study was conducted at a prominent New Zealand university. The research setting was a campus café, centrally located at a busy thoroughway between several lecture theatres, and which typically serves university staff, students, and workers not affiliated with the university. The café serves an array of food items including cakes, scones, plain and filled croissants, sandwiches, sushi, toasted or fresh paninis and wraps, hot pies, salads, and packaged goods (e.g., lasagne, confectionary).

For the purposes of this research, savoury items (i.e., sandwiches, wraps, paninis, calzones, sushi, pies, and packaged lasagne and noodles) were included in the analysis. On average, 73% of offerings on any given day during the research period contained meat or fish, and 27% of offerings were vegetarian; they did not contain meat or fish but may have included eggs and/or dairy. Equivalent meat and meatless foods were priced similarly. On average, approximately 53% of available items were offered every day during the research period.

2.2.2 Design and intervention

The study period was split into three phases: pre-intervention, intervention, and post-intervention, each lasting one week. During the intervention phase, a social norms sign was displayed in the research





FIGURE 2

Study one research setting, including descriptive dynamic social norm signage atop food cabinet (left) during the intervention phase.

setting. The sign contained a descriptive dynamic norm message related to national meat reduction based on Colmar Brunton (2019) and Beef and Lamb New Zealand (2018) data. The message (see Figure 1) read “Many people in New Zealand have reduced or stopped eating meat for health, environmental, or animal welfare reasons,” and was adapted from similar messaging used by Thomas et al. (2017) and informed by McAlaney et al. (2010) and Miller and Prentice (2016). Meat reduction rationale (i.e., “...for health, environmental, or animal welfare reasons.”) was included, as norm messages may be more effective if attention is drawn to the significance of, or motivation for peer behaviour (van der Linden, 2015). The sign was designed to be read as clearly as possible, with a simple colour scheme and font choice. Like those used by Thomas et al. (2017), the sign was A4-sized and placed in a clear, plastic display atop the hot food cabinet (see Figure 2) during the intervention phase. During the pre- and post-intervention phases, this social norm signage was not displayed anywhere in the research setting, and there were no other campaigns, initiatives, or events taking place.

For one day during each of the three study phases, a paper-based survey was disseminated to customers to gain insight into their characteristics (e.g., demographics, dietary habits) and purchase experience. To assess awareness of the social norm signage, the survey included a visual multiple-choice question, which showed five images of the various signage in the café and asked which of these the customer had noticed. During the intervention week only, this question included the social norm signage as one of the selectable answer options. Surveys were conducted with a small sub-sample of customers who had made a purchase at the outlet. To account for some customers not wishing to participate in a survey, the target recruitment was approximately 50% of total customers. Participants were required to be aged 18 or over; no further eligibility criteria applied. For one day during each phase, the researcher approached these customers, inviting them to participate in the survey for the chance to win a \$50 shopping voucher via a prize draw. The researcher was not present in the café outside of these days.

2.2.3 Measures

2.2.3.1 Meat and meatless purchases

Daily purchase data was collected from the outlet for the duration of the trial. The data collected for this measure included itemised

quantities sold and corresponding financial figures from all customers who purchased an item during the trial and was recorded by outlets as standard practice. Purchase data were collected from the university operations manager at the end of the three-week period.

2.2.3.2 Customer characteristics and awareness of message

The customer characteristics survey consisted of 11 questions aiming to identify outlet customer demographics, purchase experience, and dietary habits (adapted from Papies and Hamstra, 2010 and Thomas et al., 2017). Demographic items included age, sex, ethnicity, nationality, and staff/student status. This was followed by a series of questions about participants' purchases, including what was purchased, factors that influenced the purchase, frequency of outlet visitation, and whether the social norms messaging was noticed (during the intervention week only). The survey concluded with two questions aiming to discern participants' dietary habits and whether they were reducing their meat consumption.

2.2.4 Data analysis

The data analysis was conducted using SPSS version 28 (IBM Corp, 2021). Due to the format of the data obtained from the food outlet, Pearson's chi squared tests were used to explore differences in purchases.¹ Based on their ingredients and composition, food items were coded as either *meat* (0) or *meatless* (1). The number of meat and meatless items sold were compared (a) between pre-intervention and intervention phases, (b) between intervention and post-intervention phases, and (c) between pre-intervention and post-intervention phases. For all tests to account for multiple comparisons the significance level was corrected to $p < 0.017$, and effect sizes were estimated using partial eta squared (η_p^2 , for overall sales between phases) and odds ratios (for differences in meat and meatless sales between phases). Survey data was used to characterise customer demographics across the three study phases.

¹ Deviation from pre-registration as it was realised upon handling the data that an alternative test was more appropriate.

TABLE 1 Items sold by trial phase (study one).

	Phase*			Total
	Pre-intervention	Intervention	Post-intervention	
Total items sold	1,539	1,521	1,541	4,601
Meatless items sold ()	31.1	31.1	31.9	31.3

*Each phase was one week in duration.

TABLE 2 Customer characteristics across the three trial phases (study one).

	Trial phase			Total (n = 66)
	Pre-intervention phase (n = 23)	Intervention phase (n = 23)	Post-intervention phase (n = 20)	
Age in years, mean (SD)	26.6 (12.9)	27.9 (10.8)	26.3 (7.3)	27.0 (10.6)
Sex, n (%)				
Female	18 (78.3)	12 (52.2)	13 (65.0)	43 (65.2)
Male	5 (21.7)	11 (47.8)	7 (35.0)	23 (34.9)
Other	0	0	0	0
Nationality, n (%) New Zealander	19 (82.6)	18 (78.2)	16 (80.0)	80.3
Ethnicity, n (%)				
NZ European	13 (56.5)	17 (73.9)	13 (65.0)	43 (65.2)
NZ European, Maori	4 (17.4)	2 (8.7)	2 (10.0)	8 (12.1)
Indian	1 (4.4)	0	1 (5.0)	2 (3.0)
Samoan	0	1 (4.4)	0	1 (1.5)
Chinese	0	0	1 (5.0)	1 (1.5)
Other	5 (21.7)	3 (13.0)	3 (15.0)	11 (16.7)
Diet, n (%)				
Meat consumer	21 (91.3)	17 (73.9)	17 (85.0)	55 (83.3)
Pescetarian	0	1 (4.4)	0	1 (1.5)
Vegetarian	1 (4.4)	4 (17.4)	2 (10.0)	7 (10.6)
Vegan	1 (4.4)	1 (4.4)	1 (5.0)	3 (4.6)
Reducing meat consumption (n)	1	4	3	8
Staff/student status, n (%)				
Undergraduate student	11 (47.8)	12 (52.2)	9 (45.0)	32 (48.5)
Postgraduate student	3 (13.0)	6 (26.1)	4 (20.0)	13 (19.7)
University staff	4 (17.4)	5 (21.7)	4 (20.0)	13 (19.7)
Other	5 (21.7)	0	3 (15.0)	8 (12.1)
Café visit frequency, n (%)				
Daily	2 (8.7)	3 (13.0)	3 (15.0)	8 (12.1)
Several times a week	2 (8.7)	8 (34.8)	5 (25.0)	15 (22.7)
Once a week	5 (21.7)	6 (26.1)	2 (10.0)	13 (19.7)
Several times a month	3 (13.0)	1 (4.4)	4 (20.0)	8 (12.1)
Once a month	2 (8.7)	2 (8.7)	2 (10.0)	6 (9.1)
Several times a year	2 (8.7)	1 (4.4)	1 (5.0)	4 (6.1)
Rarely	3 (13.0)	1 (4.4)	2 (10.0)	6 (9.1)
Never	2 (8.7)		1 (5.0)	3 (4.6)
Other	2 (8.7)	1 (4.4)		3 (4.6)
Sign noticed, n (%) yes	N/A	6 (26.09)	N/A	N/A

2.3 Results

On average, 1,534 items were sold per trial phase, and the average sales per phase were similar, $p=0.961$, $\eta p^2=0.007$ (see Table 1 for a breakdown of sales per trial phase). Pearson's chi squared tests revealed that phase was not associated with a significant difference in items purchased (meat versus meatless); intervention compared to pre-intervention phase; $\chi^2(1)=0.002$, $p=0.960$, OR=1, 95% CI [0.86, 1.17], and to post-intervention phase; $\chi^2(1)=0.207$, $p=0.649$, OR=1.04, 95% CI [0.89, 1.21]. There was also no significant association in items purchased between pre-intervention and post-intervention phases; $\chi^2(1)=0.257$, $p=0.612$, OR=1.04, 95% CI [0.89, 1.21].

In total, 66 customers completed the customer characteristics survey, and distribution of participants across the three trial phases was similar (see Table 2). Notably, only 6 participants (approximately 26% of all participants) noticed the social norms signage during the intervention phase. Additionally, the majority of customers (approximately 83% in total) were meat consumers, and only a small number of these were currently reducing their meat consumption.

3 Study two: the UK

The aim of study two was to test the effect of descriptive dynamic social norm messages about meat reduction on meat purchases, at three food outlets in a UK university. Building upon study one, study two incorporated several research sites and message delivery modes. As the message referred to a referent group that has been previously found to be favourably perceived, and referred to data on rates of meat reduction specific to this context (Patel and Buckland, 2021), it was expected that the social norm intervention would reduce purchases of meat items and increase meatless purchases.

3.1 Context

Per capita meat consumption in the UK is higher than the global average (OECD, 2022), with consumption levels exceeding recommendations for optimal human (e.g., National Health Service, 2021) and planetary health (Willett et al., 2019). However there is evidence to suggest that alternative low and no meat diets are growing in prevalence (e.g., YouGov, 2019), with a decline in meat consumption (Stewart et al., 2021). Whilst this is promising, meat reduction rates must be accelerated to address the issues caused by high *per capita* meat consumption.

UK university food environments appear to be less meat-centric, especially compared to those in Aotearoa New Zealand at time of writing. This is evident in the number and range of meatless food items available, and the primary researcher's lived experience in both contexts. Having an adequate variety of available meatless items is important to support any intervention aiming to change food behaviours, including reducing meat consumption (e.g., Stoll-Kleemann and Schmidt, 2017), and it is thus likely that the increased range of meatless items available in UK university food outlets increases the potential effectiveness of the intervention.

3.2 Methods

The study procedures were approved by [anonymised] Ethics Committee. Purchase data was anonymous and recorded by outlets as standard practice, so was acquired for all customers making purchases. Given the anonymity, informed consent was not obtained for purchase data, however a debrief information notice was displayed at participating outlets at the end of the study period for transparency. Informed consent was obtained from all survey participants. Data collection took place in February 2022. There were no COVID-19 restrictions in place at the time of data collection; some measures (e.g., mask wearing) were encouraged but not mandatory.

3.2.1 Research setting

This study was conducted at The University of Sheffield, a prominent UK university with an ambitious sustainability strategy (The University of Sheffield, 2020). The study arose through a Living Labs initiative,² aiming to utilise and build upon previous research exploring sustainable diets at the University of Sheffield's Student Union (SSU), a focal point of the university featuring multiple food outlets. This study was conducted at three food outlets at the SSU, chosen based on three criteria. First, outlets had to be operated by the SSU. Second, outlets were required to offer an adequate range of meatless items; at least one quarter of all savoury offerings available were required to be meatless. Third, the purchase data needed to include clear differentiation between meat and meatless purchases. Finally, eligible outlets were discussed and determined following feasibility conversations with university operations and outlet management. As such, the final decision of three study sites was pragmatically determined, based on what the SSU agreed to make available for participation.

The three sites used in this study were, *Site A*: A café, serving hot and cold drinks and an array of sweets, snacks, and sandwiches; *Site B*: A burger bar, serving burgers, fries, and drinks; and *Site C*: An express food shop, serving fast hot foods such as toasted sandwiches, noodle pots, nuggets, baked potatoes, and soup with a self-service ordering system. All sites had a consistent menu that did not differ between days or trial phases. For the purpose of this research, only savoury items were included in the analyses; drinks, packaged snacks, sides, and sweets were excluded. The relative proportion of available meat and meatless offerings differed between sites. At site A, 40% of offerings were meat and 60% were meatless, at Site B, 60% of offerings were meat and 40% were meatless, and at site C, 47% of offerings were meat and 53% were meatless. Equivalent meat and meatless foods were mostly priced identically, with the exception of beef items at sites B and C, which were priced £1 and 50p extra, respectively, as part of an ongoing sustainability initiative.

3.2.2 Design and intervention

Much of the design of this study was similar to study one. However, to address issues around awareness and acceptance of the social norm message reported in study one, several changes were made in study two, including the use of a more credible (based on collected data) and relevant norm message, increased modes of

² <https://www.sheffield.ac.uk/sustainability/living-labs>

delivery, and using more sites. These changes align with Yamin et al. (2019)'s recommendations for situated social norm interventions, which highlight the importance of (1) credibility, with the social norm message ideally developed using data from the same target referent group, and (2) the design and strategic placement of messages to optimise visibility and accessibility (e.g., via the use of different message formats). Not only were these changes made to increase the effectiveness of the intervention, but they also allowed for a more complex intervention approach. Complex interventions are those that emphasise real world transferability and feasibility over absolute scientific fidelity (Craig et al., 2008; Skivington et al., 2021). In doing so, they often incorporate several components or settings.

As in study one, this study used a three-phase pre-post design (i.e., pre-intervention, intervention, and post-intervention), each with a duration of one week. During the intervention phase, a descriptive dynamic social norm message was displayed in the three research settings. All signage contained the same message; "Most staff and students here have reduced or stopped consuming meat for health, environmental, or animal welfare reasons." Extending study one's message and to increase credibility, the signage referred to two data sources to support the social norm message (Larner et al., 2021; Patel and Buckland, 2021). These sources included data on the number of people reducing meat intake at the university. All signage used a consistent colour scheme and font and were designed in collaboration with the Student Union's marketing team. This ensured that norm messages were stylistically consistent and congruent with the usual marketing materials displayed around the building. Student Union and Living Labs branding were included at the bottom of the poster at the request of the marketing team.

The size and placement of the signage differed according to each specific research site and was informed by the feasibility conversations with stakeholders. In site A (café), a large A3-sized poster was placed in a prominent display typically used for marketing (Figure 3, Panel 1). In site B (burger bar), 16:9 landscape posters were displayed on digital screens within the bar for a

duration of ten seconds within a circulation of other marketing materials (Figure 3, Panel 2), and A4-sized posters were placed on individual clipboards holding the menu (Figure 3, Panel 3). In site C (express shop), small laminated business-card sized signs were attached to the self-serve screens, which served as the menu and point of decision and purchase. All signage was displayed from the first day until close-of-business on the final day of the intervention phase. The social norm message was also posted on the Student Union's social media accounts (see Figure 4 for an example) in an attempt to increase the potential reach and visibility of the norm message and add to the authenticity of the intervention by utilising communications channels that would be typically used by the outlets. At the request of the marketing team, the social media posts were accompanied by contextual text (see Figure 4). The social media posts were posted on the second day of the intervention phase. During the pre- and post-intervention phases, no social norms signage was displayed anywhere in the sites or posted on social media.

As in study one, a short survey was conducted to gain insight into demographics, dietary habits, experience at the research site(s), and whether customers had noticed the social norms poster. During the final two days of the post-intervention phase, posters containing QR codes were displayed in each of the research sites. When scanned, these QR codes directed customers to an online survey (Qualtrics, Provo, UT). After obtaining consent, eligibility was checked (aged 18 and over) and participants proceeded to answer questions on demographics, dietary habits, experience at the research site(s), and awareness of the social norm message. Upon completion, participants had the opportunity to enter a prize draw for a £50 shopping voucher.

Related to survey recruitment, it is important to highlight two changes that were made to the design of study one. First, due to COVID-19 and safety concerns, in-person survey participant recruitment was avoided, and adverts containing QR codes were used. Second, in an attempt to keep surveys temporally close to the intervention whilst minimising effects on purchasing behaviour, the QR adverts and survey were live for only the final two days of the post-intervention phase.



FIGURE 3 Examples of the descriptive dynamic social norm message in different research sites of study two; Panel 1. Poster at site A; Panel 2. Digital signage at site B; Panel 3. Menu clipboard at site B.

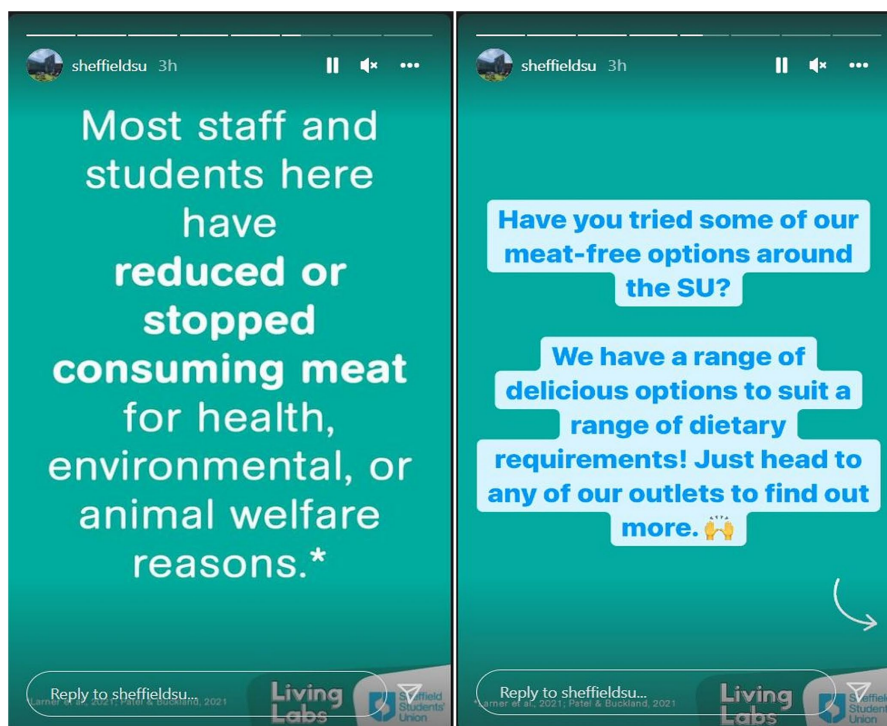


FIGURE 4

An example of the descriptive dynamic social norm messages posted on social media channels (Instagram; study two).

3.2.3 Measures

3.2.3.1 Meat and meatless purchases

Daily purchase data was collected from the three outlets for the duration of the trial. The data was recorded by outlets as standard practice, and included itemised quantities sold from all customers who purchased any item during the specified period. Purchase data were collected from the university operations managers at the end of the three-week period.

3.2.3.2 Customer characteristics and awareness of social norm message

The customer survey assessed demographics, purchase experience, and dietary habits. Demographic items included age, gender, ethnicity, nationality, and staff/student status. This was followed by a question that queried which of the three participating outlets the participant had visited over the past two weeks. Participants were then presented with questions specific to the outlets specified. These questions assessed how often the outlet(s) were visited, and what was purchased at outlet(s) over the previous two weeks. Participants were then asked about their dietary habits, including whether they were reducing their meat consumption. Finally, all participants were asked whether they recalled seeing the social norms signage over the past two weeks. Those that did recall were asked in what location and format (i.e., in which of the outlets or social media platforms was the sign viewed). Participants were then debriefed.

3.2.4 Data analysis

All data analyses were conducted using SPSS version 28 (IBM Corp, 2021). The data was first cleaned by removing items not

intended for analysis. These items included drinks, packaged snacks (e.g., crisps, chocolate), sides (e.g., fries, sauces), and sweet treats (e.g., cakes, cookies). As such, the food items for analysis were savoury items. Based on their ingredients and composition, food items at each outlet were coded as either *meat* (0) or *meatless* (1).

A binary logistic regression³ was used to assess the effect of trial phase, site, and the interaction between the two on sales across all three sites combined. The dependent variable was binary (0 = meat, 1 = meatless), and the experimental variables were entered as categorical variables (phase 1 = preintervention, 2 = intervention, 3 = post-intervention; site = A, B, C). Due to differences in baseline sales, each site was also assessed separately using Pearson's chi-squared tests to explore differences in purchases. For each food outlet, the number of meat and meatless items sold were compared (a) between pre-intervention and intervention phases, (b) between intervention and post-intervention phases, and (c) between pre-intervention and post-intervention phases. For all tests the significance level was corrected to $p < 0.017$ to correct for multiple comparisons, and measures of effect were estimated using odds ratios. Survey data was used to assess customer demographics across the three study phases.

3.3 Results

In total across the three phases 1,121 sales were recorded in site A, 1,909 sales were recorded in site B, and 950 sales were recorded in

³ Deviation from pre-registration as it was realised upon handling the data that an alternative test was more appropriate.

site C. Total sales varied between the three time phases and across sites (see Table 3).

Overall, the binary logistic regression revealed that the overall model correctly predicted 63.3% of sales and was statistically significant when compared to the null model: $\chi^2(8) = 153.63, p < 0.001$. Site had a significant effect on sales ($p < 0.001$), but phase did not ($p = 0.144$), and there were no significant interaction effects identified between phase and site ($p = 0.350$). For site, the odds of a meat item being purchased was highest in site C (compared to site A: $\beta = -0.826, p < 0.001$, odds ratio = 0.438; and site B: $\beta = -0.98, p < 0.001$, odds ratio = 0.375).

The proportion of meatless items sold for each of the food outlets across the three time phases are shown in Figure 5. Per site, Pearson's chi squared tests revealed no significant association in the number of items purchased between the intervention and pre-intervention phase; site A: $\chi^2(1) = 2.93, p = 0.092, OR = 1.29, 95\% CI [0.96, 1.72]$; site B: $\chi^2(1) = 0.02, p = 0.904, OR = 1.02, 95\% CI [0.76, 1.36]$; site C:

$\chi^2(1) = 1.56, p = 0.212, OR = 1.25, 95\% CI [0.88, 1.77]$. There were also no significant associations in sales between intervention and post-intervention phases in any of the three outlets; site A: $\chi^2(1) = 3.26, p = 0.071, OR = 0.75, 95\% CI [0.55, 1.03]$; site B: $\chi^2(1) = 0.13, p = 0.720, OR = 1.05, 95\% CI [0.82, 1.34]$; site C: $\chi^2(1) = 0.22, p = 0.641, OR = 1.09, 95\% CI [0.77, 1.54]$. Finally, no significant associations were identified between sales in pre-intervention and post-intervention phases; site A: $\chi^2(1) = 0.01, p = 0.936, OR = 0.99, 95\% CI [0.75, 1.31]$; site B: $\chi^2(1) = 0.28, p = 0.596, OR = 1.07, 95\% CI [0.84, 1.34]$; site C: $\chi^2(1) = 3.58, p = 0.059, OR = 1.36, 95\% CI [0.98, 1.86]$.

Completion rates for the customer survey were low ($n = 13$), however the descriptive data is included in the Supplementary material for transparency. Given the low completion rates, responses need to be interpreted with caution. Notably, 6 out of 13 participants reported that they had noticed the social norms signage during the intervention phase.

TABLE 3 Items sold by site and trial phase (study two).

		Phase*			Total
		Pre-intervention	Intervention	Post-intervention	
Site A	Total items sold	478	311	332	1,121
	Meatless items sold (%)	52.1	58.5	51.8	53.8
Site B	Total items sold	465	389	1,055	1909
	Meatless items sold (%)	32.3	32.6	33.6	33.1
Site C	Total items sold	376	240	334	950
	Meatless items sold (%)	29	33.8	35.6	32.5

*Each phase was one week in duration.

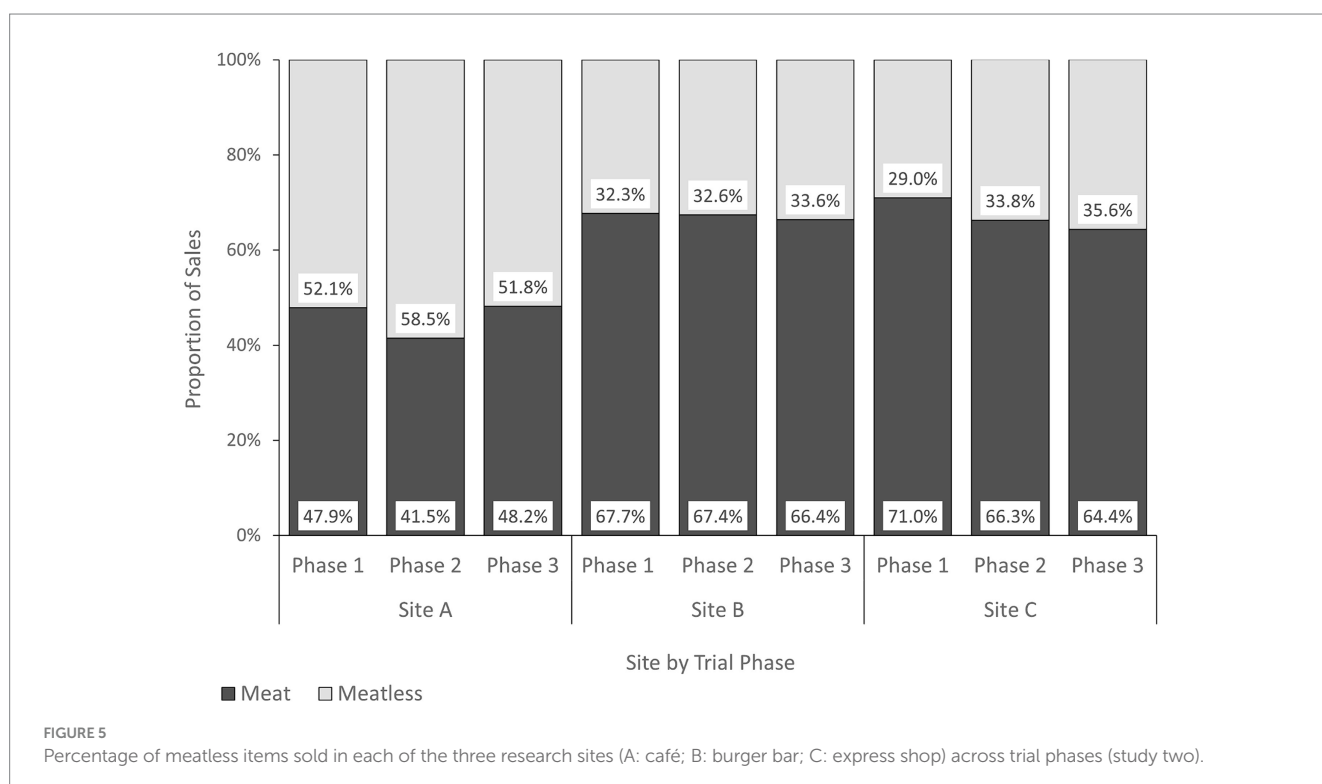


FIGURE 5 Percentage of meatless items sold in each of the three research sites (A: café; B: burger bar; C: express shop) across trial phases (study two).

4 General discussion

Across two studies, sales of meat and meatless items did not significantly change in response to a descriptive dynamic social norm intervention that encouraged reduced meat intake. Study one, conducted in a university food outlet in Aotearoa New Zealand, displayed a social norm message for one week which referred to ‘people in New Zealand’ as the referent group. No significant associations were found between purchases (meat or meatless) and trial phases. Study two extended study one by increasing the visibility of the social norm message (location, delivery methods of messages), referring to a more relevant referent group, basing the social norms message on previously collected dietary data (credible message) and being based in three University food outlets at a UK University which provided a range of meat-free options. However, similar to study one, there were no significant changes in the amount of meat and meatless purchases in response to the social norm message. These studies add to increasing evidence that social norm messages delivered via signs in food outlets and corresponding social media posts are ineffective at reducing meat consumption.

Indeed, several studies have also reported no effects of a social norm message to reduce meat intake (Sparkman et al., 2020, study 4; Çoker et al., 2022; Reinholdsson et al., 2022). However, several other studies reported that exposure to a dynamic social norm message reduced meat purchases (Sparkman and Walton, 2017; Sparkman et al., 2020, studies 1 and 2). The reasons for the mixed findings are currently unclear, however there are a few potential explanations. One of these concerns engagement with the social norm message. When researchers hand-delivered the social norm messages to customers waiting in line to order food, the intervention was effective at reducing meat intake (Sparkman and Walton, 2017), likely because exposure to the norm message was ensured. However more naturalistic interventions that did not directly involve the researcher in message delivery (e.g., Sparkman et al., 2020; Çoker et al., 2022; the present research) were ineffective. Additionally, most previous food-related norm interventions used a prescriptive norm – they *encouraged* rather than *discouraged* choice (Mollen et al., 2013; Payne et al., 2015; Thomas et al., 2017; Çoker et al., 2022). The message used in the current studies specified meat *reduction*. It is possible that social norm interventions may be less effective when being used to *reduce* food intake or *discourage* choice. Further research directly comparing the effects of social norm messages that encourage (e.g., encourage alternatives to meat such as plant-based foods and pulses) versus discourage food choices (e.g., reduce meat intake) will be beneficial to confirm if any and which types of message framing used in social norm interventions can be effective to encourage reduced meat in favour of environmentally sustainable alternatives.

Notably, there were several changes from study one to study two to maximise the delivery of the social norm intervention in line with key recommendations for social norm intervention designs (Yamin et al., 2019). First, to be effective, it is important to use a credible social norm message (Burchell et al., 2012; Yamin et al., 2019). Study one’s social norm message was not informed by dietary data and referred to “people in New Zealand” as the referent group. Whilst Aotearoa New Zealand prides itself on its pro-environmentalism, there is also a concurrent perception that meatless options and lifestyles are an “un-Kiwi” threat to the national identity (Potts and White, 2008). Furthermore, whilst national identity is a fundamental aspect of social

identity (Milfont et al., 2020), it is possible that this referent group (“people in New Zealand”) was too general and did not facilitate enough of a social connection or identification with customers at the food outlet. Therefore, to increase the credibility of the social norm message and increase identification with the referent group in study two, the social norm message was informed by dietary data collected from the specific context and referent group (Patel and Buckland, 2021). Another change was the availability of the meatless options. In study one’s food outlet there was a limited range of meatless options (only 27% of total savoury offerings being meatless) and this may have limited the opportunity to observe changes in meat and meatless purchases. Stoll-Kleemann and Schmidt’s (2017) model of influences on meat eating behaviour includes appropriate “plant-based diet friendly” infrastructure as a key external incentive to reduced meat consumption. Therefore, in study two food outlets that offered a range of appealing meatless alternatives were used to evaluate the effects of the social norm message. However, despite these changes, the social norm messages used in study two did not significantly shift food purchasing behaviour in any of the three food outlets.

Of note, in both studies, the awareness of the social norm message was low. In study one, only one norm message was displayed during the intervention phase. Anecdotal observations of customer behaviour by the researcher and café staff independently suggested that many customers seemed to know what they had planned to purchase and did not tend to browse the cabinet or examine surrounding signage. This may be indicative of regular or returning customers who are less inclined to browse for new options (Sparkman et al., 2020), and is likely to have resulted in the relatively small percentage of individuals who reported noticing the norm message during the intervention phase. Low sign awareness also occurred in study two (note that this was based on a low sample size of thirteen survey participants), despite efforts to increase the visibility of the social norm message by increasing the size of posters, placing them in more visible locations, and posting the message on social media channels. Importantly, Mollen et al. (2013) reported that their social norm message was only effective at influencing food choice among participants who had reported seeing it. Sparkman et al. (2020) noted that people are generally not obliged to look at norm messages given that they act as a distraction from their primary goal, at that time, to view and select food options. The potentially limited exposure to norm messages highlights a trade-off inherent in naturalistic field studies. Whilst ecological validity is maximised, it is difficult to ensure exposure to the norm message which can be achieved in controlled laboratory-based studies (Robinson et al., 2014).

There are strengths of the current studies. First, these studies are among the very few that have naturalistically tested the effect of social norm messages on meat and meatless purchases, as well as eating behaviours more generally. While there is a wealth of research assessing the role of social norms on eating behaviours conducted in the laboratory (Robinson et al., 2014), there are very few that have been applied in real world eating contexts, leading to calls for more naturalistic designs (e.g., Robinson, 2015). These studies contribute to evidence that applied social norm interventions may not be as consistently effective at changing food behaviours as they are in the laboratory, even when following design recommendations to optimise their behaviour change potential (e.g., those concerning the credibility,

design, and placement of norm messages). Furthermore, these studies were conducted in two different countries with different meat-eating contexts, with Aotearoa New Zealand having a more meat-centric culture when compared to the UK. That both studies resulted in similar findings adds strength to the conclusions drawn.

These studies also evidence the possibility of fruitful, collaborative relationships with stakeholders in promoting healthy and sustainable diets. Relative to other types of interventions, social norm interventions are feasible to implement and present low financial risk, and these types of interventions have been found to be more acceptable than others (e.g., menu reformulations, disincentives) to both customers and retail stakeholders (Graham et al., 2020). Additionally, these studies were designed and conducted in close consultation with stakeholders at all stages of the process. Stakeholder engagement has been identified as a key consideration in the success of applied interventions (Skivington et al., 2021), not only to increase the potential effectiveness of the intervention, but to also bring context-specific insights and expertise, boosting real world transferability and ensuring smooth implementation. Prior to any intervention, it is important to first lay the groundwork so that stakeholders understand the importance of the issue and why it requires their investment and involvement (Graham et al., 2020). Only when interventions are acceptable and feasible for stakeholders will they be sustainable for long term implementation.

There were also several limitations that are worth noting. First, COVID-19 and time constraints prevented the collection of dietary data to refer to in the social norm message, and there were also several unplanned events during study two's intervention week (e.g., severe thunderstorms and staff strikes) which decreased the number of customers in the university's Student Union during the intervention week, as reflected by fewer overall sales observed across all research sites. These events were impossible to predict and plan for and reflect the challenges of conducting research in naturalistic settings. The intervention duration was also relatively short (1 week), however another UK study with a two-week intervention also reported the same non-significant results (Çoker et al., 2022). Finally, limited information was obtained about the customers in both studies, due to low numbers of customers completing the customer characteristics surveys. As such, the information drawn from the survey results (i.e., percentage of customers that noticed the norms messages) cannot be considered representative and should be cautiously interpreted.

There is no doubt that social norms around meat intake are important for changing meat-centric cultures. However, as our findings and others indicate, naturalistic social norm interventions without researcher involvement in message delivery are relatively ineffective at reducing meat intake. Future research may benefit by testing different wording of the social norms message, modes of message delivery, or exploring alternative behaviour change interventions. Interventions which have shown more promise for reducing meat intake include information provision and labelling (e.g., Brunner et al., 2018; Larner et al., 2021), reformatting menus so that desirable options (i.e., meatless options) are integrated and not segregated in a separate section (e.g., Bacon and Krpan, 2018; Gravert and Kurz, 2019) and default interventions that place meatless items as the option automatically received unless otherwise specified (see Meier et al., 2022 for a review). Notably, any intervention needs to be acceptable and feasible for all stakeholders involved, by (1) having minimal operational costs to commercial partners, (2) incorporating

components that embed the intervention into usual business practices (e.g., the integration of social media and/or marketing), and (3) having the ability to easily scale (Attwood et al., 2020; Graham et al., 2020; Skivington et al., 2021).

5 Conclusion

To conclude, the descriptive dynamic social norm interventions reported in this paper did not significantly reduce meat item purchases across two university settings. These results confirm previous studies that social norm messages delivered via signs in naturalistic settings are ineffective for reducing meat purchases. Further research is required to compare and identify the most effective delivery modes and framing of social norm messages, as well as exploring other types of interventions to reduce meat intake for improved human, animal, and planetary outcomes.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the University of Sheffield Psychology Ethics Committee and the University of Otago Human Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

VP: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. MM: Resources, Project administration, Writing – review & editing, Conceptualization. NB: Supervision, Writing - original draft, Writing – review & editing, Conceptualization.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2024.1260343/full#supplementary-material>

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