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The Relationship Between Social Identity, Descriptive Social Norms and Eating Intentions and Behaviors

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Abstract

Social factors, particularly social norms, have been reported to influence eating behaviors. From the perspective of Social Identity Theory, a strong association between a person and the norm referent group is key to the effectiveness of descriptive social norms on behavior. The general aim of the studies presented in this paper was to examine the effects of descriptive social norm based messages on eating intentions and behaviors, and whether social identity moderates these effects. Study 1 and Study 2 examined whether the effect of a descriptive social norm message promoting vegetable intake (or limiting junk food intake) was moderated by the extent to which participants identified with the norm referent group. We found that centrality of social identification with the norm referent group moderated the effect of descriptive social norm messages on intentions to eat vegetables and intentions to limit junk food intake. Study 3 built on those findings by examining whether priming social identity enhanced the effects of a descriptive social norm message on actual food intake in a laboratory setting. We found that intake of fruit and vegetables was enhanced after exposure to a descriptive social norm message (versus a health message) but this effect was only significant for participants whose identification with the norm referent group had been primed. Taken together, these data add to the suggestion that acting in line with group norms is more likely when individuals regard their membership of the group as being important to their identity.

Key words: Social Norm, Eating Behavior, Social Identity, Moderation, Manipulation.

Introduction

The social context of eating exerts a strong influence on food choices (Cruwys, Bevelander, & Hermans, 2015; Herman, Roth, & Polivy 2003; Vartanian, Spanos, Herman, & Polivy, 2015). People tend to match their food intake to that of a dining partner in a social eating context, probably because other people provide a norm of appropriate intake (Herman et al., 2003; Salvy, Jarrin, Paluch, Irfan, & Pliner, 2007). A body of evidence has accumulated to suggest that social norms can influence dietary behaviors (Burger et al., 2010; Croker, Whitaker, Cooke, & Wardle, 2009; Robinson, Fleming, & Higgs, 2014; Stok, Ridder, Vet, & Wit, 2014) and health-related behaviors more generally (Ball, Jeffery, Abbott, McNaughton, & Crawford, 2010; Perkins, 2002). Providing descriptive social normative information that most other people eat fruit and vegetables has been reported to increase intentions to eat fruit and vegetables (Croker et al., 2009; Stok Verkooijen, Ridder et al., 2014) and purchase of vegetables in restaurant settings (Collins et al. 2019; Mollen, Rimal, Ruiter, & Kok, 2013; Thomas et al., 2017). In addition, it has been reported that exposure to a descriptive social norm message stating that others consume relatively high amounts of fruits and vegetables increases the consumption of fruit and vegetables in low but not high usual consumers of fruit and vegetables in laboratory settings (Robinson et al., 2014). Descriptive social norm messages about the intake of junk food have also been reported to reduce high calorie snack food consumption in the laboratory (Robinson, Harris, Thomas, Aveyard, & Higgs, 2013).

There is evidence to support the idea that social norms operate in the context of group dynamics. Social identity theory (Tajfel, 1972) argues that people derive value and a sense of well-being from their social groups. Group membership provides people with a sense of social identity (Tajfel & Turner, 1986). Social groups are categorized into frameworks that allow people to determine which others are like themselves (in-group members) and which are not (out-group members). The sense of belonging to a social group serves an important purpose in that it allows people to embed the norms of the social group. Group norms are internalized into one's self-concept, which in turn increases the motivation to perform specific behaviors (Hogg & Vaughan, 2002). Importantly, individuals typically identify with multiple social groups and it has been reported that manipulating the salience of particular social identities can impact behavioural intentions. Tarrant and Butler (2011) reported that students viewed "healthy" behaviors as less congruent with their student identity than with their National identity and when student identity was made salient, weaker intentions to reduce salt and alcohol intake were reported than when National identity was made salient (Tarrant and Butler, 2011).

Based on the perspective of Social Identity Theory, a person is more likely to conform to a group's behavioral standards if this person has strong associations to the group (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). This is because people are usually behaving in the same way as other group members in order to express

belonging to the group and the strength of their social identity (Hornsey, 2008). There is evidence that norm effects can be enhanced when people identify with the norm referent group (Louis, Davies, Smith, & Terry, 2007; Stok, De Ridder, De Vet, & De Wit, 2012; Stok Verkooijen, Ridder et al., 2014). For example, participants who saw a majority descriptive norm conveying that most group members consume sufficient vegetables, subsequently self-reported eating substantially more vegetables than those who saw a minority descriptive norm conveying that only a few group members eat sufficient vegetables, but only when they strongly identified with the norm referent group (Stok Verkooijen, Ridder et al., 2014). However, Banas and colleagues (Banas, Cruwys, de Wit, Johnston, & Haslam, 2016) reported recently that participants who strongly identified with a norm referent group behaved in a manner that was opposite to the depicted norm. These results suggest that the relationship between social identity and normative effects on eating is complex and that under some circumstances ironic effects may be observed, such that people who identify highly with a social group may engage in behavior contrary to that of other group members (Banas et al., 2016).

A question that has yet to be addressed in relation to the moderating effect of group identification on eating norms is the role of specific components of in-group identification. Leach and colleagues have proposed a hierarchical, multicomponent model of in-group identification that distinguishes group-level self-definition (i.e., individual self-stereotyping, in-group homogeneity) from self-investment (solidarity,

satisfaction, and centrality). The dimension of 'group-level self-definition', indicates the extent to which people see themselves as similar to the group and group members as similar to one another, whereas 'group-level self-investment' indicates the extent to which people find group membership motivationally significant (Leach et al., 2008). Interestingly, Hackel and colleagues (Hackel, Wohl, Coppin, & Van Bavel, 2018) have reported that group-level self-investment, but not self-definition, is related to evaluations of identity relevant foods such that participants from the Southern United States with high group-level self-investment expected Southern foods to be tastier than non-Southern foods and Southerners with low group-level self-investment expected Southern foods to be less tasty than non-Southern foods. These data suggest that components of group-level self-investment might predict responses to social eating norms, but this remains to be tested.

There has also been little investigation of the mechanisms underlying the effects of descriptive social norms on eating behaviors (Stok et al., 2014, Stok Verkooijen, Ridder et al., 2014). The Theory of Planned Behavior (TPB) (Ajzen & Fishbein, 1980) suggests that perceived behavioral control, which is similar to Bandura's concept of self-efficacy, may underlie norm effects on behavior. It has been reported that self-efficacy for performing a behavior increases when a person feels they ought to be able to perform like other group members (Stok Verkooijen, Ridder et al., 2014). The TPB further suggests that there are gaps between behavioral intentions and behavior but the intention to perform a behavior is strong when there are positive attitudes,

subjective norms and greater perceived behavioral control towards that behavior. Preliminary evidence from Stok Verkooijen, Ridder et al., (2014) suggests that exposure to a majority norm for vegetable consumption from a salient group leads to increased self-identification, more positive attitudes and higher self-efficacy toward vegetable intake in comparison with a minority norm. These authors suggested that norm effects on vegetable eating intentions may be due to changes in self-identification, attitudes and self-efficacy towards vegetable consumption (Stok Verkooijen, Ridder et al., 2014). Based on this theoretical framework we used mediation analysis to assess the model assumption that exposure to normative information is associated with increased intentions to eat healthily and that self-identification as a healthy eater, attitude towards healthy eating and self-efficacy can account for a significant portion of variance. However, other models of health decision-making suggest that actions are guided not only by reasoned actions but also by automatic or reactive processes (e.g. Friese, Hofmann, & Wiers, 2011; Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008; see Sheeran, Gollwitzer, & Bargh, 2013 for a review). Therefore, we did not exclude the possibility that other causal models may account for the data.

To date, most previous research has investigated how existing social identity interacts with group norms on behavior and few studies have investigated whether manipulating norm identification has an effect on norm following behaviors (see Banas et al. 2016 for an example). This is important because manipulation of the

strength of identity allows for stronger inferences to be drawn about the causal nature of the relationships between eating norms, food intake and norm identification.

Research overview

This paper presents three studies that tested the moderating effect of group identification on the relationship between descriptive social norms, eating intentions and eating behavior. In Study 1, we predicted that exposure to a descriptive social norm but not a health message would be associated with an increase in intentions to eat vegetables and that this effect would be stronger for those participants who find membership of the referent group (British Nationals) motivationally significant, as reflected in their scores on components of group-level self-investment. Study 2 was similar to Study 1, but we tested the effect of a descriptive social norm message on intentions to reduce junk food consumption in a student population. We hypothesized that students exposed to a descriptive social norm message about limiting "junk food" intake would report greater intentions to reduce their "junk food" intake compared to those who are exposed to a control message, particularly among students who strongly identify with others in the same university as reflected in their scores on components of group-level self-investment. In both studies, we predicted that the effect of the social norm message on eating intentions would be mediated by individuals' attitudes, self-identification and self-efficacy. In Study 3, we expected that students would eat more fruit and vegetables when they were exposed to a social norm message about others' healthy eating behaviors, than when they were exposed to

a health message about the advantages of eating healthily. We also expected that the social norm effect would be enhanced when student identity was made salient. The studies report all measures, conditions, and participant exclusions, and explain how sample sizes were determined. For all studies there was no data collection after data analysis. All studies were conducted according to the guidelines laid down in the Declaration of Helsinki and approved by the Science, Technology, Engineering and Mathematics Ethical Review Committee at the University of Birmingham.

Study 1

Methods

Participants

Three hundred and fifty-four British participants participated in the study. Participants were excluded after completing the study if they were unable to recall the contents of messages provided. Based on the recall of messages, of the original 354 participants, 87.6% reported the information correctly. 44 participants who recalled the message incorrectly were excluded (descriptive social norm=14, Health=15, control=15). Thus, a final sample comprised 310 British participants (80% females) aged between 18 and 65 (Mean age=25.35, SD=9.78). The study was advertised as 'British Lifestyle Survey' through social media networks such as Facebook. Participants were informed that they would be asked their opinion of some posters and would be asked to complete some questionnaires on personality, mood, physical activity styles and food preferences. Participants took part in the study via a website link that was displayed

on advertisements. There was an opportunity to win a £50 Amazon voucher, which was also mentioned in the advertisements. Informed consent was obtained online. Only British Nationals were eligible to take part in the study. The data for the first study was collected between September 2014 and September 2015. The completion rate was 70%.

Design

The study used a between-subjects design with 2 conditions: message type (descriptive social norm message vs. health message vs. control message) and norm referent group (high identifiers vs. low identifiers). Identification with the norm referent group was assessed before exposure to the messages. Participants were randomly allocated to one of the three message conditions.

Sample Size

We performed power calculations before data were collected using GPower 3.0.10 to determine the sample size. We took a conservative approach and predicted a small effect size. To achieve 85% power with a $p < 0.05$ and a small effect size ($f = 0.20$) in an ANCOVA test, the minimum sample was estimated as 277 participants. Our final sample included 310 participants. A sensitivity power analysis (ANCOVA) revealed that the study was powered to detect a small effect size ($f = 0.19$) assuming an alpha significance criterion of 0.05, two-tailed, and 85% power criterion.

Messages

In the descriptive social norm condition, participants were exposed to a factually correct social norm message about the daily vegetable intake intentions of British people: 'Did you know that 80% of people in Britain try to eat at least 5 portions of vegetables a day? (Consumer and Attitudes to Food Survey, 2008)'. In the health condition participants saw a health message about the health benefits of eating vegetables: 'Did you know that people in Britain who eat 5 or more portions of vegetables a day have a lower than average risk of heart disease and cancer? (World Cancer Research Fund, 2007)'. In the control condition, they saw a message about internet access information in Britain 'Did you know that 36 million (73%) people in Great Britain access the Internet every day? (Office for National Statistics, 2013)'. The messages were matched for word length. For all three conditions, participants viewed two posters containing one of above messages displayed in the middle of the poster. For each condition, two posters were presented. The messages on the two posters within each condition were the same, but different pictures were presented on poster 1 and poster 2. There were four images on each poster. The images used for poster 1 were: a flag of Great Britain, a map of the United Kingdom, Big Ben and British Royal Guard and the images used for poster 2 were: London red buses, Elizabeth II, Stonehenge and British coins. The images were selected based on a pilot study asking about images that people associate with Britain. On viewing the posters, the participant was informed that she/he would be asked about his/her preferences for the different posters and to study them carefully as she/he would be asked questions

about them later. This task was to ensure that the participant studied the posters and to distract the participant from the main purpose of the study which was to examine the effect of poster message exposure on vegetable eating intentions.

Measures

Participant characteristics

Demographics Participants' background details (e.g. age, sex, smoker or not and ethnicity) were assessed using a demographic questionnaire. These questions were included to provide information about the sample and to be consistent with the cover story that mentioned the study was a "British Lifestyle Survey".

Ten-Item Personality Inventory (TIPI) The TIPI is a 10-item scale measuring the Big Five trait dimensions, assessed on a 7-point Likert scale ranging from 'strongly disagree' to 'strongly agree' (Gosling, Rentfrow, & Swann, 2003). This scale was used as a filler to distract from the true purpose of the study and was not analysed further.

Mood and Appetite and mood was assessed before and after the exposure of the posters using 100mm Visual Analogue Scales where 0 means 'not at all' and 100 means 'very much' (Stubbs et al. 2000). Four types of appetite and mood were considered: 'How hungry/alert/anxious/happy are you right now?'. This was to check for possible baseline differences between the groups.

Usual Vegetable Intake Usual vegetable intake was assessed using two open-ended questions asking 'How many servings of vegetables do you normally eat a day?' and 'Think back carefully - How many servings of vegetables did you eat yesterday?' (Robinson et al., 2014). This measure was included to allow us to control for habitual eating patterns in the main analysis.

Usual exercise The short form of the International Physical Activity Questionnaire (IPAQ-SF) was used to measure three specific types of activity undertaken by adults in everyday life. The IPAQ-SF includes 9 items assessing the frequency and duration of walking, moderate-intensity activities and vigorous intensity activities (Craig et al., 2003; Lee, Macfarlane, Lam, & Stewart, 2011). The volume of activity was computed as MET (metabolic equivalent) -minutes.

Outcome variables

Vegetable eating intentions Participants were asked to report the number of portions of vegetables they intended to eat per day the following week as the primary measure of eating intentions. Four additional questions assessed participant intentions towards future vegetable eating based on the study of Stok and colleagues (Stok Verkooijen, Ridder et al., 2014). The questions asked participants to rate on a 5-point scale whether they intended/planned/wanted/expected to eat sufficient vegetables in the near future (next week)' (Stok Verkooijen, Ridder et al., 2014). These items were highly correlated and so an average score was computed.

Exercise intentions Participants were also asked about their intentions regarding future exercise. They answered one question on exercise intentions derived from the study by Marcus & Forsyth (2003): 'I intend to be more physically active in the next two months' using a 5-point scale. It was expected that the effect of exposure to the descriptive social norm poster should be specific to vegetable eating intentions. The purpose of this questionnaire was to test for the possibility that any health-related intention, rather than just eating intentions, might be affected by exposure to the poster due to demand characteristics. In other words, we tested the possibility that participants might have responded to the messages because they thought they should report healthy intentions (social desirability bias).

Moderator variable

Identification with the Norm Referent Group The Multicomponent In-Group Identification Scale (Leach et al., 2008) was used to measure identification with the British norm referent group. It is a 14-item scale including five subscales of Solidarity, Satisfaction, Centrality, Individual Self-Stereotyping and In-Group Homogeneity. In addition, we also included two items asking about motivation to identify with the norm group (data not reported).

Mediating variables

Self-Identification toward Eating Vegetables Two items derived from previous studies assessed self-identification towards eating vegetables (de Bruijn, Verkooijen, de Vries, & van den Putte, 2012; Sparks & Shepherd, 1992; Stok Verkooijen, Ridder et al.,

2014), e.g.: 'Eating sufficient vegetables is something that fits with who I am'. The items were presented with a 5-point likert scale ranging from 'strongly disagree' to 'strongly agree'.

Attitude toward Vegetable Consumption For this measure, four pairs of words were presented on both sides of a 5-point scale (nice-stupid, wise-unwise, pleasant-unpleasant, good-bad) and participants rated their attitudes towards vegetable consumption (de Bruijn et al., 2012; Stok Verkooijen, Ridder et al., 2014).

Self-Efficacy for Eating Sufficient Vegetables Perception of self-control over vegetable consumption was assessed using two items using a 5-point scale ranging from 'not at all like me' to 'just like me' (de Bruijn et al., 2012; Stok Verkooijen, Ridder et al., 2014). e.g. 'Eating sufficient vegetables is in my own hands'.

Demand checks

Participants were asked what they thought was the purpose of the study and were also asked to write down the contents of norm messages (e.g. both contexts and pictures) to check that they were aware of the message content. They also completed a poster evaluation questionnaire, rating the poster on key aspects (believability, relatability, meaning, clarity, and professional appearance) using a 5-point Likert scale with the response scale ranging from 'strongly disagree' to 'strongly agree' (based on a similar measure used by Robinson et al., 2014) in order to see if there were any differences in the evaluation of the posters.

Procedure

Participants took part in the study online via Qualtrics (an online survey platform). After reading the participant information sheet and giving consent to take part, participants filled in their demographic information such as age, sex, smoking status and ethnicity. Then they were asked to report habitual vegetable consumption, attitudes towards vegetable eating and habitual physical activity. After that, participants stated the extent to which they identify themselves as British. In this part of the online study, there was a catch question (Please click 'Neither Agree nor Disagree' button) to test that whether participants were paying attention to the questions or not. They then completed the personality questionnaire as a filler. The posters were then presented to participants according to the condition to which they were randomly assigned and they were asked to evaluate them and recall the content. Participants' mood and hunger status was assessed immediately before and after seeing the posters. Participants' self-reported vegetable eating intentions and physical activity intentions in the near future were then assessed and they self-reported their weight and height so that their body mass index (BMI) could be calculated by the researcher. Finally, they were asked to state what they thought the study was about and separately asked if they thought exposure to the posters had affected their responses and if so how. All participants were debriefed and thanked at the end of the study. On average, the study took approximately 30 minutes to complete.

Analysis Strategy

Participant Characteristics

One-way ANOVA was used to assess whether the groups differed on basic demographic variables and significant differences were explored using Bonferroni corrected tests.

Multicomponent identification scales and poster evaluation scales

To establish a factor structure for each of these scales (separately), principal components analyses (PCA) were run with varimax rotation. Analysis of the 14 items of identity scales yielded 5 factors with eigenvalues > 1 and loadings > 0.5, accounting for 83.4% of the total variance: solidarity, satisfaction, centrality, individual self-stereotyping and in-group homogeneity, which is consistent with original dimensions from the multicomponent identification scale (Leach et al., 2008). The same PCA analysis described above was run on the 5-item poster evaluation scale. Two factors were generated with eigenvalues > 1 and loadings > 0.5, accounting for 60.6% of the total variance: clarity (clarity of posters and meaning of posters) and credibility (professional appearance, believability and relatability of posters).

Correlations

Habitual vegetable intake measures were correlated to determine whether a single measure could be used. The vegetables that participants eat per day was significantly and positively associated with vegetables that participants ate the day before (r=0.77,

p<0.001). Therefore, habitual daily vegetable intake was determined by averaging the two scores above. The average amount of vegetables that participants habitually consumed daily was 2.67 (SD=1.64) portions. Correlations between baseline factors such as hunger, BMI and habitual food intake and intentions were also performed to check if any of these factors should be controlled for in the main analysis. Habitual vegetable intake was positively correlated with intentions to eat vegetables (r=0.49, p<0.001). Therefore, habitual vegetable intake was controlled in the main analysis.

Main Analyses (moderation and mediation analysis)

The main regression analyses were conducted using the PROCESS macro in SPSS. The variables entered into the model were dummy variables of conditions (descriptive social norm versus health and descriptive social norm versus control) and subcategory of identification as the moderator, and the dependent variables were intention to eat vegetables, attitudes towards eating vegetables in the future, and intentions to exercise. A multiple mediation analysis was also conducted in PROCESS to investigate whether the influence of the descriptive social norm message (or health message) on vegetable eating intentions (the number of portions of vegetables they intended to eat per day the following week) was mediated by self-identification, attitudes and self-efficacy toward eating vegetables. The indirect effect of the descriptive social norm on vegetable consumption intentions via self-identification, attitude, and self-efficacy was tested using the multiple mediation bootstrap procedure for indirect effects outlined in Preacher and Hayes (2008). Using 5,000 bootstrap resampling, 95

per cent bias-corrected bootstrap confidence intervals were derived for the total indirect effect as well as for each mediator separately. A moderated mediation model was also run as a post hoc test to investigate whether identification with the norm moderated any of the indirect effects.

Results

Participant characteristics

The mean age for the sample was 25.35 years old (SD= 9.78) and mean BMI was 23.26 (SD= 4.05). The mean multicomponent identification score was 4.64 (SD=0.98) (mean scores for subscales: solidarity=4.85 (SD=1.31), satisfaction=5.49 (SD=1.10), centrality=4.20 (SD=1.35), self-stereotyping=4.29 (SD=1.24) and in-group homogeneity=3.65 (SD=1.26)). Mean scores were also calculated for the assumed mediators: self-identification (M= 3.39, SD=1.01), attitudes (M=1.58, SD=0.65) and self-efficacy (M=3.45, SD=0.62).

The number of participants, mean age, BMI and the distribution of sex and ethnicity were relatively equal across three conditions (see Table 1). One-way ANOVA revealed there were no significant differences between conditions for the baseline variables, except for the poster credibility scores (F (2,307) =9.40, p<0.001). T-tests showed that credibility scores of the posters was slightly but significantly lower in the descriptive social norm condition than in the control condition. In addition, the posters containing health messages were reported as significantly less credible than

those containing control messages (see Table 1). Inclusion of credibility scores as a covariate did not affect the norm effect on intentions to eat, therefore, poster credibility was not controlled in the main analysis.

Table 1. Participants' characteristics and baseline measures across three conditions. Data are shown as Mean (SD).

	Control (N=127)	Health (N=96)	Social (N=87)
Age (years)	26.13 (10.48)	25.42 (9.85)	24.14 (8.57)
Sex	Male=25	Male=23	Male=21
Self-reported BMI (kg/m^2)	23.37 (4.27)	23.74 (4.43)	22.63 (3.21)
Ethnicity	White=122 Minority =20	White=94 Minority =17	White=83 Minority =18
Habitual veg intake (servings/per day)	2.75 (1.80)	2.75 (1.56)	2.48 (1.49)
Hunger Baseline (0-100mm)	32.38 (31.22)	31.18 (29.44)	32.94 (29.53)
Identification Subscales (1-7):			
Solidarity	4.65 (1.54)	4.94 (1.13)	5.05 (1.12)
Satisfaction	5.31 (1.35)	5.60 (0.85)	5.62 (0.91)
Centrality	4.06 (1.48)	4.36 (1.14)	4.22 (1.34)
Self-Stereotyping	4.26 (1.35)	4.22 (1.14)	4.40 (1.17)
In-group Homogeneity	3.76 (1.28)	3.69 (1.29)	3.44 (1.17)
Personality Subscales (1-7):			
Extraversion	4.03 (1.46)	4.06 (1.34)	3.87 (1.57)
Agreeableness	4.74 (1.17)	4.65 (0.93)	4.80 (1.17)
Emotional Stability	4.08 (1.48)	4.13 (1.35)	4.11 (1.48)

Consciousness	5.09 (1.32)	5.15 (1.21)	5.19 (1.29)
Openness	4.96 (1.15)	4.90 (1.04)	4.92 (1.06)
Physical Activity MET (mins)	2207.51 (2446)	2099.76 (1710)	2356.92 (2567)
Poster Evaluations (0-5):			
Clarity	4.20 (0.54)	4.11 (0.49)	4.10 (0.53)
Credibility	3.06 (0.67)	2.82 (0.69) *	2.64 (0.75)***
Mediation Variables:			
Self-identification (1-5)	3.40 (1.14)	3.42 (0.90)	3.33 (0.94)
Attitudes (1-4)	1.66 (0.70)	1.50 (0.63)	1.56 (0.57)
Self-efficacy(1-5)	3.48 (0.60)	3.39 (0.66)	3.49 (0.59)

Asterisk indicates significantly different from control condition *$p<0.05$, ***$p<0.0001$

Intentions and attitudes towards the consumption of vegetables

Moderation analysis

When comparing the effect of the descriptive social norm and control messages, a significant regression model was generated that accounted for 61.0% of variance ($F_{(5, 302)}=109.09$, $p<0.001$). The main effect of the descriptive social norm message (vs. control) on intention to consume vegetables (number of intended portions per day) was significant (b=0.31, t=2.06, p=0.04). In addition, there was a significant interaction between the descriptive social norm message and the centrality identification subscale scores on vegetable eating intention (b=0.25, t=2.37, p=0.018).

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Breaking down the interaction revealed that there was a greater intention to eat vegetables after being exposed to the descriptive social norm message versus the control, but only among participants who reported a high level of centrality (p=0.004) (Figure 1). There was no effect of the health message (versus control) (b=-0.02, t=-0.13, p=0.89) and no interaction effect for the health message on intentions to consume vegetables (b=0.01, t=0.05, p=0.96).
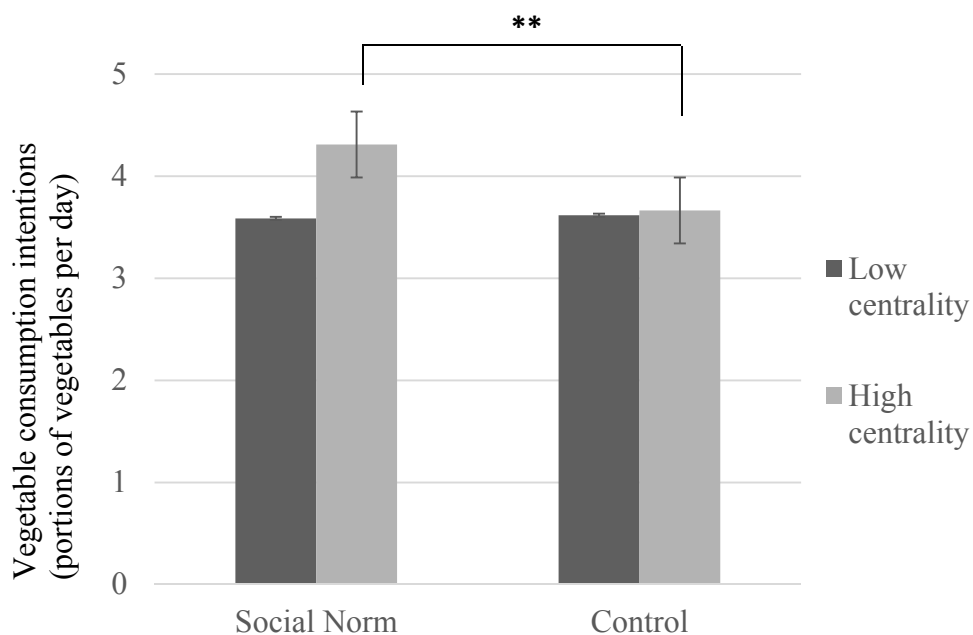

Figure 1. The interaction effect of condition (descriptive social norm vs. control) and centrality on vegetable eating intentions (portions per day). Data are presented as mean $\pm$ SD. Asterisk indicates significantly different from control condition **p<0.01

When compared directly to the health message, there was also a significant effect of the descriptive social norm message on vegetable eating intentions (b=0.30, t=2.04, p=0.043) and a significant interaction between descriptive social norm message and centrality (b=0.25, t=2.37, p=0.018), such that vegetable consumption intentions were higher in the descriptive social norm versus the health condition, but only among participants who reported a high level of centrality (p=0.004) (Figure 2).
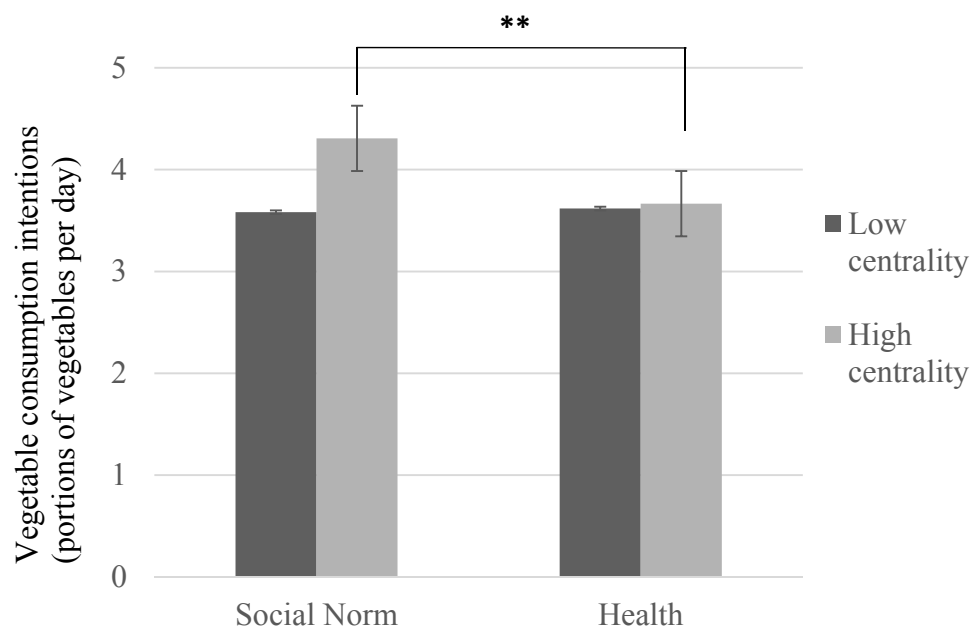

Figure 2. The interaction effect of condition (descriptive social norm vs. health) and centrality on vegetable eating intention (number). Data are presented as mean $\pm$ SD. Asterisk indicates significantly different from control condition **p<0.01

Regression models showed no significant interaction effects when other components of identity were examined. In other words, solidarity, satisfaction, individual self-stereotyping, in-group homogeneity or identification with norm referent group scores did not moderate the effect of the descriptive social norm message on intentions to eat vegetables (all p>0.05). No significant main effects of the descriptive social norm message on attitudes towards eating sufficient vegetables were observed, nor were there any significant interactions with identification components.

Mediation analysis

The descriptive social norm did not significantly predict self-identification, attitudes or self-efficacy toward eating vegetables; all ps>0.05 (path a). The three mediators did not predict vegetable eating intentions; all ps>0.05 (path b), although there was a significant direct effect of the descriptive social norm on vegetable eating intentions, $F(3,304)=174.21$, $p=0.042$, $R^2 =0.60$ (path c) (Figure 3). The indirect effect of descriptive social norm on intentions to eat vegetables through the three mediators was non-significant: self-identification (B=-0.01, CI[-0.07,0.03]), attitudes (B=0.02, CI[-0.01,0.10]), and self-efficacy (B=0.00, CI[-0.01,0.05]). See Table 2 for bias-corrected 95% confidence intervals from a bootstrap procedure using 5000 bootstrap resamples. Adding centrality as a moderator did not change this pattern of results.
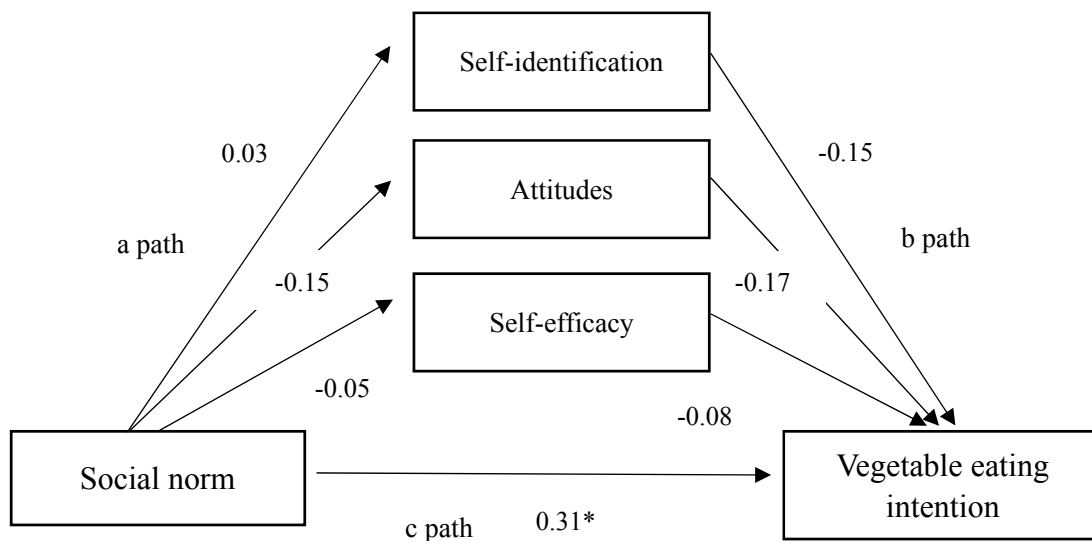
Figure 3. Mediation direct and indirect paths. *p<0.05

Table 2. Multiple mediation analysis.

Direct path		Coefficients and significance levels (standard errors)	
Mediation analysis	a paths (descriptive social norm→ mediators)	(1) self-identification	B=.03 (.11)
		(2) attitude	B=-.15(.08)
		(3) self-efficacy	B=-.05 (.08)
	b paths (mediators → intention)	(1) self-identification	B=-.15(.11)
		(2) attitude	B=-.17 (.13)
		(3) self-efficacy	B=-.08 (.11)
	c path (Descriptive social norm→ intention)		B=.31 (.15)*
	c′ path (Descriptive social norm→ intention corrected for indirect effect)		B=.29 (.16)
Indirect path		**Bootstrapped coefficients and confidence intervals**	
Bootstrap	a*b paths (Norms→ intention via mediators)	1) self-identification	B=-.01 CI[-.07,.03]
		(2) attitude	B=.02 CI[-.01,.10]
		(3) self-efficacy	B=.00 CI[-.01,.05]
		total effect	B=.02 CI[-.02,.09]
	Pairwise contrasts between mediators	(1) vs (2)	B=-.03 CI[-.14,.02]
		(1) vs (3)	B=-.01 CI[-.09,.03]
		(2) vs (3)	B=.02 CI[-.02,.09]
Asterisk indicates significant path *p<0.05			

Intention to engage in physical activity

Compared to the control condition, there was no significant main effect of descriptive social norm or interaction between descriptive social norm and identification (subcategories of identity) on intentions to be more physically active (all ps>0.05). However, significant effects of identity on physical activity intentions were observed in all models (all ps<0.05). High level of identity was associated with greater intentions to engage in physical activity than low level of identity. Similarly, when compared to the control condition, there was no significant main effect of health message or interaction on physical activity intentions (all p>0.05), although there were significant effects of identity on physical activity intentions (all p<0.05). High levels of identity were also associated with greater intentions to engage in physical activity than were low level of identity.

Study 2

Methods

Participants

The total sample comprised 568 students (85% females) aged between 18 and 55 (mean age=19.87, SD= 3.36) from the University of Birmingham. Participants were recruited through campus advertising, a student-facing university web portal, and social media such as Facebook. The study was advertised as a 'Student Lifestyle Survey' investigating students' lifestyle at University of Birmingham. Only students at University of Birmingham (UoB) were eligible to sign up. Similar to Study 1,

participants consented to take part in the study and all of them had the opportunity to win a £50 Amazon voucher. All participants included in the study were able to recall the message they saw. The data were collected during the Autumn of 2016. The completion rate was 81%.

Design

The study used a between-subjects design, with 2 conditions: message type (descriptive social norm message vs. control message) and norm referent group (high identifiers vs. low identifiers). Participants were randomly allocated to one of the two message conditions.

Sample Size

Given that no previous studies have examined the effect of social norms on "junk" food intentions we took an even more conservative approach in determining the sample size than in Study 1 and powered the study to be able to detect a smaller effect size than that predicted for Study 1. Based on the calculations from GPower 3.0.10, to achieve 85% power with $p<0.05$ and a small effect size ($f=0.15$) in an ANCOVA test, a minimum sample size of 489 participants was required. Our final sample was 568 participants and the sample size was determined before the main data analysis. A sensitivity power analysis in G*Power indicated the study was powered to detect a small effect size of $f=0.14$ assuming an alpha significance criterion of 0.05, two-tailed, and 85% power criterion.

Messages

One of two messages was randomly presented to each participant: a descriptive social norm message about UoB students' junk food intake (descriptive social norm condition) or a neutral message about students' accommodation costs in Birmingham (control condition). In the descriptive social norm condition, the factually correct message was 'Students eat less junk food than you might realise. Most students at University of Birmingham limit how much junk food they are eating to 1 or less than 1 serving a day (based on a 2012 study)' (Robinson et al., 2014). In the control condition, the message was 'Students spend less money on accommodation than you might realise. Most students in Birmingham spend less than £100 in rent per week with the cheapest rent at £62 per week (Survey from NUS, 2012)'. The descriptive social norm messages and control messages were matched for word length and marked with the data source. As in Study 1, for each condition, two posters were presented. The messages on the two posters within each condition were the same, but different pictures were presented on poster 1 and poster 2. There were four images on each poster. The images on poster 1 were landmarks (buildings on the campus) of University of Birmingham. The images on poster 2 were pictures of University logos and maps.

Measures

Participant characteristics

Participants were asked to complete the same demographic questionnaire as in Study 1. To measure usual junk food intake, participants were asked to indicate how many servings of junk food they usually consumed each a day. Similar to Study 1, participants also completed the short version of International Physical Activity Questionnaire (IPAQ - Craig et al., 2003), the Ten-Item Personality Inventory (TIPI) as well as Visual Analogue Mood and Appetite Scales and the poster evaluation scale.

Outcome variables

As for Study 1, we assessed both eating intentions and intention to engage in physical activity.

Moderator variables

As for Study 1, student identity was assessed using a modified 14-item multicomponent identification scale.

Mediator variables

Three mediators were measured in a series of questions: self-identification as a person who eats less junk food (e.g. 'Not eating a lot of junk food is something that fits with who I am'); attitudes toward eating junk foods and self-efficacy for eating less junk foods (e.g. 'Not eating a lot of junk food is in my own hands') (details see Study 1). Moreover, intention for eating junk food was assessed with four items (scores): 'I intend/plan/want/expect to limit my intake of junk food in the near future' and an

open question (number): 'please write down how many servings of junk food you intend to eat per day next week'.

Procedure

The procedure of this study was similar to that used in Study 1. Participants were first informed about the study and then filled in the consent form. Participants then completed the questionnaires mentioned above. They were then exposed to two posters that both contained either the descriptive social norm message or the neutral control message and asked to remember and recall the contents of the messages. Finally, participants completed measurements of eating intentions and physical activity intentions and height was self-reported for BMI calculation by the researcher. All participants were thanked and debriefed at the end of the study.

Analysis Strategy

Participant Characteristics

We firstly examined whether the groups differed significantly (e.g. on age, BMI, usual junk food intake) using independent sample t-tests. Any variables that correlated with the main outcome measurements were used as covariates in subsequent analyses. Baseline hunger and usual junk food intake were both significantly correlated with intentions to eat junk food ($r=0.11$, $p=0.009$ and $r=0.48$, $p<0.001$, respectively), therefore, both variables were included as covariates in the main analysis.

Multicomponent identification scales and poster evaluation scales

PCA was run for the modified multicomponent in-group identity scale with varimax rotation, yielding 5 factors (items loaded > 0.5), accounting for 82.1% of the variance. Factors included solidarity, satisfaction, centrality, self-stereotyping and homogeneity and were consistent with the categories of identity in the original paper (Leach et al., 2008) and with study 1. Similarly, PCA was run for the poster evaluation scale and 2 factors emerged with eigenvalues above 1 and loadings > 0.5, accounting for 61.4% of the variance: legitimacy (believability and relatability of posters) and understanding (clarity and meaning of posters). Ratings of how professional the posters were did not load onto those two factors and was analysed separately.

Main Analyses (moderation and mediation)

The main regression analyses were conducted using the PROCESS macro in SPSS. For the moderation analysis the variables entered into the model were the dummy variable of condition (descriptive social norm versus health) and subcategory of identification as the moderator, and the dependent variables were intention to eat junk food and intentions to exercise. A multiple mediation analysis was also conducted to examine whether self-identification, attitudes and self-efficacy mediated the influence of descriptive social norm (or health information) on intentions to eat junk food.

Results

Participant characteristics

The mean age of the sample was 19.87 years old (SD=3.36) and the mean BMI was

22.11 (SD=3.74). The mean score for each subcategory of identification was: solidarity (M=5.30, SD=1.12), satisfaction (M=6.09, SD=0.83), centrality (M=5.01, SD=1.22), self-stereotyping (M=4.61, SD=1.32), in-group homogeneity (M=4.20, SD=1.23). In addition, mean sores for mediators were: self-identification (M=3.18, SD=1.11), attitudes (M=3.06, SD=0.67) and self-efficacy (M=2.70, SD=0.59). No significant differences were found between the descriptive social norm and control condition in terms of participants' characteristics and baseline measurements (Table 3).

Table 3. Participants' characteristics and baseline measures in the descriptive social norm and control condition. Data are presented as Mean (SD).

	Control (N=286)	Social (N=282)
Age (years)	19.74 (2.99)	20.00 (3.69)
Sex	Male=44	Male=37
Self-reported BMI (Kg/m^2)	22.06 (3.60)	22.17 (3.88)
Ethnicity	White=206 Minority=80	White=201 Minority=81
Usual junk food intake (serving/per day)	1.50 (0.99)	1.48 (0.89)
Hunger Baseline (0-100)	35.62 (29.38)	34.78 (29.57)
Identification Subscales (1-7):		
Solidarity	5.32 (1.11)	5.27 (1.12)
Satisfaction	6.11 (0.79)	6.07 (0.86)
Centrality	5.05 (1.21)	4.96 (1.24)
Self-Stereotyping	4.65 (1.30)	4.58 (1.33)

In-group Homogeneity	4.21 (1.25)	4.20 (1.20)
Personality Subscales (1-7):		
Extraversion	4.36 (1.45)	4.31 (1.42)
Agreeableness	5.02 (1.02)	5.05 (0.99)
Emotional Stability	4.03 (1.39)	4.15 (1.39)
Consciousness	5.10 (1.14)	5.14 (1.16)
Openness	4.97 (1.08)	4.93 (1.11)
Physical Activity MET (mins)	2563.30 (1914.36)	2696.50 (1834.88)
Poster evaluation (1-5)		
Legitimacy	3.16 (1.01)	3.15 (0.89)
Understanding	4.37 (0.56)	4.29 (0.62)
Professional	3.07 (1.31)	2.87 (1.17)
Mediation Scores:		
Self-identification (1-5)	3.16 (1.13)	3.20 (1.09)
Attitudes (1-4)	3.00 (0.65)	3.11 (0.68)
Self-efficacy (1-5)	2.67 (0.60)	2.72 (0.58)

Main analysis: Intentions and attitudes to consume junk food

Moderation analysis

The regression model including the centrality subscales scores was significant ($F_{(5, 550)}=22.96$, $p<0.001$) and explained 25.0% of the variance. There was a significant main effect of the descriptive social norm message (versus control) on intention to eat junk food (b=-0.16, t=-2.21, p=0.027) and a significant interaction between the descriptive social norm message and centrality (b=-0.13, t=-1.99, p=0.047). Breaking

down the interaction, intentions to eat junk food were lower in the descriptive social norm condition than the control condition but only among participants scoring high on centrality (p=0.003) (Figure 4). There were no main effects or interactions with other sub-categories of identity for intentions to consume junk food (all ps>0.05).
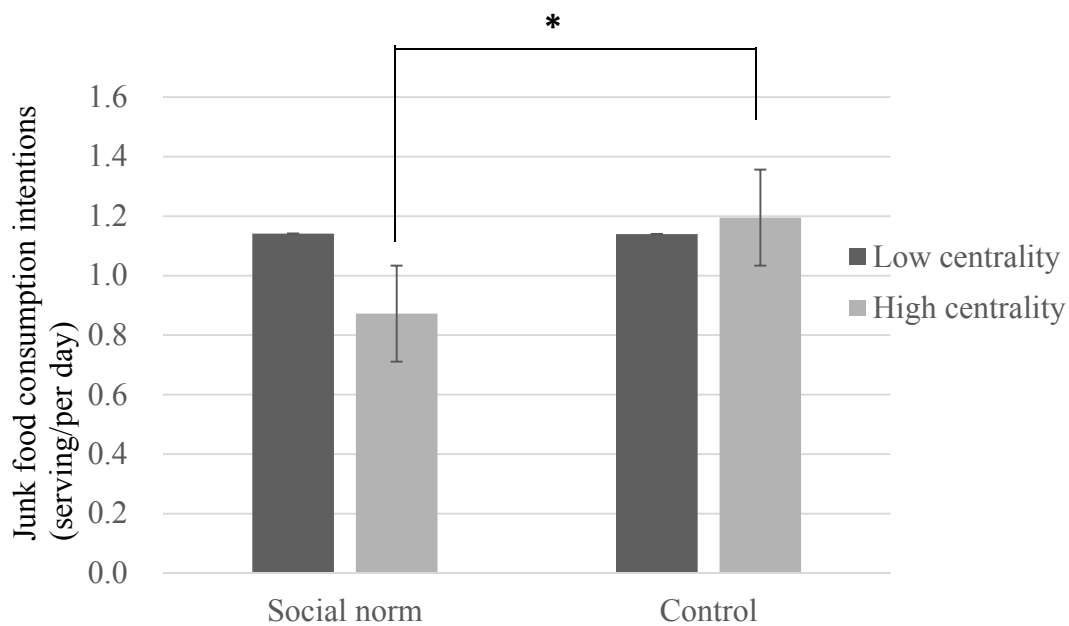
Figure 4. The interaction effect of condition (descriptive social norm vs. control) and centrality on intention to consume junk food. Data are presented as mean $\pm$ SD. Asterisk indicates significantly different from control condition *p<0.05.

Also, there was no main effect of descriptive social norm (versus control) (b=0.09, t=-1.30, p=0.195) nor any interaction with centrality for attitudes towards limiting junk food (b=-0.11, t=-1.60, p=0.11). Similarly, when entering other subcategories of identity as moderators in each model, no main effect or interactions on intentions to limit junk food were observed (all p>0.05).

Mediation analysis

A multiple mediation analysis was conducted to examine whether the influence of the descriptive social norm on intentions to eat junk food was mediated by self-identification, attitudes and self-efficacy. The a, b, c, c' paths from the mediation results are presented in Table 4 and Figure 5. The descriptive social norm message did not significantly predict any of the mediators (all ps>0.05 - a path). Attitudes significantly predicted intention to consume junk food, b=-0.20, t=0.80, p<0.001, but self-identification and self-efficacy did not (all ps>0.05 - b path). The descriptive social norm message did predict intention to eat junk food directly, (F(3,552)=34.91, b=-0.16, t=-2.12, p=0.034, R² =0.24), however, there was no evidence of an indirect influence of the effect of descriptive social norm on junk food intentions via the mediators (b=-0.14, t=-1.94). Adding centrality as a moderator did not affect the pattern of results.
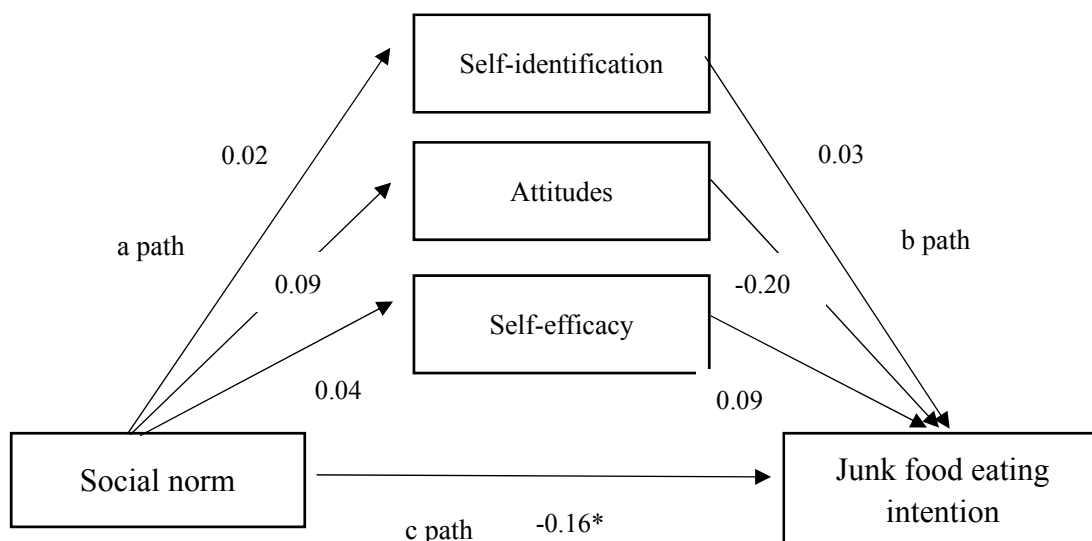
Figure 5. Mediation direct and indirect paths. Asterisk indicates significant pathway
*p<0.05

Table 4. Multiple mediation analysis.

Direct path			Coefficients and significance levels (standard errors)	
Mediation analysis	a paths (descriptive social norm→ mediators)	(1) self-identification	B=.02 (.08)	
		(2) attitude	B=.09(.06)	
		(3) self-efficacy	B=.04 (.05)	
	b paths (mediators → intention)	(1) self-identification	B=.03(.04)	
		(2) attitude	B=-.20 (.05)***	
		(3) self-efficacy	B=.09 (.07)	
	c path (Descriptive social norm→ intention)		B=-.16 (.07)*	
	c′ path (Descriptive social norm→ intention corrected for indirect effect)		B=-.14 (.07)	
Indirect path			**Bootstrapped coefficients and confidence intervals**	
	a*b paths (Norms→ intention via mediators)	1) self-identification	B=.00 CI[-.00,.02]	
		(2) attitude	B=-.02 CI[-.05,.00]	
		(3) self-efficacy	B=.00 CI[-.00,.02]	
		total effect	B=-.01 CI[-.04,.01]	
	Pairwise contrasts between mediators	(1) vs (2)	B=.02 CI[-.00,.05]	
		(1) vs (3)	B=-.00 CI[-.02,.01]	
		(2) vs (3)	B=-.02 CI[-.05,.00]	
Asterisk indicates significant pathway *p<0.05, ***p<0.001				

Main analysis: Intention to engage in physical activity

There was no significant difference between the descriptive social norm and control condition for intentions to do physical activity ($p>0.05$) and identification (sub-categorical components of identity) did not interact with the descriptive social norm message (versus control) on physical activity intentions (all $p>0.05$). However, physical activity intentions differed between high and low level of identity (solidarity, satisfaction, centrality and self-stereotyping) (all $ps<0.05$); a high level of identity was associated with greater intentions to do physical activity than low level of identity.

Study 3

Methods

Participants

171 participants were recruited to the study, however, 11 participants did not complete the study, so their data was removed. 160 participants (mean age= 20.12, SD=2.36; mean BMI=21.79, SD=3.31) remained in the study. All participants were students at University of Birmingham. Exclusionary criteria were: smoking habits (due to the influence of nicotine on appetite (Grunberg, 1985), the presence of eating disorders or food allergies for the food items provided for health and safety. Participants were recruited from the Research Participation Scheme (RPS – this scheme allows Psychology students to take part in research), a student-facing university web portal, and posters placed around the University campus.

Design

A between-subjects design was used that included 2 conditions: message type (descriptive social norm message vs. health message) and identity priming (priming vs. non-priming). The outcome variables were fruit and vegetable intake and snack food intake. Participants were randomly allocated to one of the four possible groups: descriptive social norm plus priming, descriptive social norm plus non-priming, health plus priming, health plus non-priming. Randomisation was achieved using a randomisation website: www.randomizer.org.

Sample Size

The sample size was calculated based on the medium to large effect sizes observed in previous similar studies (Robinson et al. 2014 and Thomas et al. 2016). Based on the calculations from GPower 3.0.10, to obtain significant main effects and interactions with a 2 x 2 ANCOVA based on a medium effect size (f=0.25), the estimated sample size was 146 participants. Our final sample included 160 participants and the sample size was determined before the main data analysis. The sensitivity power analysis revealed the study was powered to detect a medium effect size of f=0.24 assuming an alpha significance criterion of 0.05, two-tailed, and 85% power criterion.

Cover story

To reduce the likelihood of participants guessing the study aims the study was set up to appear as two separate experiments conducted by different researchers (Thomas et

al., 2016). The study was advertised as: (1) An attitude and poster study to collect feedback on eating advertisements that are being developed; (2) A mood and food study to examine the effects of eating on mood. Participants were compensated with either course credits for students recruited via the RPS or £5 cash upon the completion of the study. Participants were required to sign up for both studies before taking part.

Messages

Messages were presented either in a poster or a flyer (mini poster). In the poster, the message was placed in the centre surrounded by pictures of fruit and vegetables (e.g. oranges, strawberries, tomatoes, corns, peppers and squashes). In the flyer, images of fruit and vegetables were placed in the middle with the message above and below images. Participants were exposed to both the poster and flyer that presented either a descriptive social norm or a health message. The descriptive social norm message in the poster read: 'Did you know most UoB students eat a lot more fruit and vegetables than you might realise? Although a lot of people aren't aware, most UoB students eat over 5 servings of fruit and vegetables each day'. The descriptive social norm message in the flyer read: 'Most UoB students eat more fruit and vegetables than you'd expect. A lot of people aren't aware that most UoB students eat over 5 servings of fruit and vegetables each day'. The health message in the poster read: 'Did you know eating a lot of fruit and vegetables is good for your health? Although a lot of people aren't aware, heart health and cancer risk can be improved by eating over 5 servings of fruit and vegetables each day'. Finally, the health message in the flyer read:

'Eating a lot of fruit and vegetables is good for your health. A lot of people aren't aware that heart health and cancer risk can be improved by eating over 5 servings of fruit and vegetables each day'. The statistics for the descriptive social norms message was derived from a pilot study on undergraduates in 2011.

Buffet

Participants were provided with a buffet consisting of four types of food items (purchased from the supermarket chain Tesco): carrot sticks (200g, 84 calories), green grapes (250g, 163 calories), crisps (50g, 270 calories) and chocolate cookies (150g, 746 calories). Four bowls each containing one of the food items, a glass of water and napkins were provided. Food weights were different in order to visually match bowls for the amounts provided and to provide enough food so that participants could eat as much as they liked without finishing the bowl. To measure how much food the participant ate, each bowl of food was weighed before and after the test session. Any food that was selected from the bowl but not eaten was removed from the total amount eaten. Total fruit and vegetable intake and total snack food intake was calculated.

Measures

Demographic Questionnaire

Questions were asked about age, sex, ethnicity, and student category (international or home student) in the first part of the study and asked about age, sex, ethnicity,

smoking, eating habits (breakfast, lunch, disorders), medical illness and psychological issues, drinking habits and dietary restriction in the second part of study.

Visual Analogue Scales (VAS)

Mood and appetite were assessed using the following VAS items: alert, drowsy, light-headed, anxious, happy, nauseous, sad, withdrawn, faint, hunger, full, desire to eat and thirsty. Participants indicated their appetite and mood status on a 100mm horizontal line. The anchors were 'not at all' and 'very'.

Student Identity Scale

A two-item scale derived from a previous study (Stok Verkooijen, Ridder et al., 2014) was used to measure the strength of identification with the norm referent group before and after the priming manipulation (e.g. 'I identify with/feel a connection to University of Birmingham students). Participants indicated the extent to which they agreed or disagreed with the identification statement on a 100mm horizontal line from 'not at all' to 'very much so'. An average score of the two items was calculated to indicate the strength of identification (correlation between items: r=0.69, p<0.001).

Poster/ Flyer Evaluation Scale

To maintain the cover story for the first part of the study, and to gather data on perceptions of the posters, participants provided ratings about the poster/flyer separately on a range of features (e.g. clarity, understanding, professional appearance, comprehension, believability, trustworthiness, and relatedness) on a 5-point likert

scale. Participants also indicated their preference for either the poster or flyer.

Food Liking Questionnaire (FLQ)

Participants indicated how much they liked individual food items from the buffet foods on a 100mm scale with anchors 'not at all' and very much'.

Three Factor Eating Questionnaire (TFEQ)

The 21-item short version TFEQ was used to measure eating styles including dietary restraint (Stunkard and Messick, 1985).

Habitual Fruit/Vegetable Intake

Two-items asking 'how many servings of vegetables/fruits do you normally eat a day?' and 'think back carefully- how many servings of vegetables/fruits did you eat yesterday?' (Robinson et al., 2014) were used to assess habitual vegetable intake.

Demand Check

Questions were used to check: (1) what participants thought was the purpose of the study; (2) whether they thought anything from the first study (Attitudes and Poster) affected their behavior in the second study (Mood and Food); (3) whether they could recall the content of the messages in the poster/flyer from the first study; (4) whether and how they were explicitly aware of the links between the two studies. All questions used open-ended response formats.

Manipulation of Student Identity

Participants in the identity priming condition were asked to indicate their attitudes and experiences as University of Birmingham (UoB) students by answering three questions: (1) 'list three things that you and most other UoB students do relatively often'; (2) 'list three things that you and most other UoB students generally do well'; (3) 'list three things that make you proud to be a UoB student'. There were an additional four questions measuring how participants feel about University of Birmingham compared to other universities in terms of education quality, resources, prestige, and level of status, on a 7-point likert scale. In the non-priming condition participants were provided with the same questions but were asked to assess personal attitudes and experience: the words 'you and most other UoB students' were replaced by 'you personally'. Four questions measuring how they feel about themselves in terms of education quality, resources, dignity and level of status were also assessed. The manipulation was based on that used by Haslam, Oakes, Reynolds, & Turner (1999).

Procedure

The experimental sessions took place in a laboratory between 9:30 and 12:00 in the morning and between 13:30 and 17:00 in the afternoon on weekdays (see Figure 6 for an overview of the study procedure).

'Study 1 - Poster Study'				
Information sheet & Consent form	Questionnaires	Poster/Flyer	Poster/Flyer evaluation	Debrief
'Study 2 - Mood and Food Study'				
Information sheet & Consent form	Questionnaires	Food buffet	Questionnaires	Debrief

Figure 6. Flowchart of study procedure.

Participants were asked to refrain from eating or drinking anything except water for two hours prior to the study session (checked on arrival). On arrival at the laboratory, participants were informed that they were taking part in a study on poster evaluations. Participants were asked to sit alone in a testing room. After reading the information sheet and signing the consent form, participants were asked to complete the demographics questionnaire, the VASs and the student identity scale. Then, the participant was asked to complete the identity manipulation task. Next, the posters/flyers containing either a control or a descriptive social norm message were presented to the participant and an evaluation questionnaire was completed. After this, the participant was told that the 'first study' was finished and she/he was asked to go to their 'second study' immediately.

When participants arrived at the second session, they were greeted by a different researcher and presented with a new information sheet that introduced the study on

'Mood and Food'. Consent was also obtained for the 'second study'. The participant was asked to complete another demographic questionnaire and rate mood and appetite. Then she/he was asked to select from the food buffet and was provided with a glass of water and a napkin. After eating, participants were asked to fill in another set of questionnaires about their liking of foods, the VAS assessing mood and appetite, and their usual fruit and vegetable intake. Finally, a demand awareness questionnaire was completed to assess whether the participant had guessed the study aims and whether she/he thought anything from the first study affected her/his behavior in the second study. The participant was also were asked to recall the messages she/he had seen in the first study and to state whether they thought the studies were linked. Height and weight were measured for the calculation of BMI by the researcher and the participant was thanked and debriefed. Researchers then weighed and recorded the amount of food that the participant had consumed in grams.

Analysis Strategy

Participant characteristics and baseline measures

Independent sample t-tests were conducted to examine differences between the descriptive social norm and health message conditions for participants' characteristics (e.g. age and BMI) and baseline measures (e.g. habitual food intake, baseline VAS and likeness of food items), and to determine additional covariates for inclusion in subsequent analyses. Age was found to be correlated with total fruit/vegetable and high calorie snack food intake and was controlled as a covariate in the analysis (both

ps<0.05). 'Usual vegetable intake' and 'intake of vegetables yesterday' were positively and significantly correlated with each other (r=0.69, p<0.001), hence they were averaged across. The same approach was also applied to reported fruit intake (r=0.69, p<0.001). The resulting measures were combined to provide a single measure of habitual fruit and vegetable intake. Habitual fruit and vegetable intake was significantly correlated with total high calorie food intake (r=-0.20, p=0.012), and marginally correlated with total fruit and vegetable intake (r=0.14, p=0.090), therefore habitual fruit and vegetable intake was controlled for in the main analysis.

Visual analogue scales and poster/flyer evaluation scales

PCA with varimax rotation was run for the 13-item VAS scales. Items loaded above 0.5 were included, resulting in 4 factors with eigenvalues >1, accounting for 68.4% of the variance: appetite (hunger, fullness [reversed], desire to eat and thirsty), mood (anxious, happy [reserved], sad, withdrawn), physical symptoms (light-headed, nausea and faint) and arousal (alertness and drowsiness). PCA was also run on the poster evaluation scale and three factors emerged with eigenvalues > 1 and loading > 0.5, accounting for 62.0% of the variance: clarity (clarity, meaning and easiness), legitimacy (believability, trustworthiness and relatedness of poster) and professional appearance. In addition, items that loaded > 0.5 on to a factor were included, resulting in two factors for the flyer evaluation scale with eigenvalues > 1, accounting for 65.2% of the variance: clarity (clarity, meaning, easiness) and credibility (professional appearance, believability, trustworthiness and relatedness of flyer).

Manipulation check and main analysis

To compare identification scores both before and after the priming manipulation, a two-way between-subjects ANOVA was conducted with identity priming (priming vs. non-priming) as a between-subject factor and time (pre vs. post) as a within- subject factor. Post-hoc Bonferroni tests were used to follow up significant main effects. The main analysis was a 3-way ANOVA, to examine food consumption (grams of food consumed) with the following factors: food type (fruit and vegetables and high calorie snack foods), message type (descriptive social norm message and health message) and identity priming (priming and non-priming). We added time of day as a factor in the analysis and this did not change the results and so the results are reported without time of day as a factor.

Results

Participant characteristics and baseline measures

The mean age of the sample was 20.12 years old (SD=2.36) and the mean BMI was 21.79 (SD=3.31). The mean baseline hunger was 60.53/100.00 mm (SD=23.30 mm) which shows that participants were generally hungry before consuming the food items. The mean cognitive restraint score was 9.13/21.00 (SD=2.88). The baseline student identity score was 70.40/100.00 mm (SD=16.74 mm), suggesting that most students identified themselves as UoB students.

Table 5 displays participants' characteristic in the descriptive social norm and health message conditions. Participants reported that the legitimacy of posters and the credibility of flyers which displayed the health message were significantly higher than those displaying the descriptive social norm message (all ps<0.001). Besides that, no significant differences in terms of participants' characteristics and baseline measures were observed.

Table 5 Participants' characteristics and baseline measures in the health and descriptive social norm condition. Data are presented as Mean (SD).

	Health (N=80)	**Social (N=80)**
Age (years)	20.35 (2.52)	19.89 (2.16)
Sex	Male=16	Male=22
BMI (Kg/m^2)	21.98 (3.29)	21.59 (3.34)
Ethnicity	White=36 Asian=32 Minority=12	White=33 Asian=39 Minority=8
Habitual fruit and vegetable intake (serving/per day)	2.12 (1.01)	1.92 (0.95)
Hunger baseline (0-100)	59.18 (25.06)	61.88 (21.46)
Liking of carrot (0-100)	49.60 (32.87)	47.75 (33.18)
Liking of green grapes (0-100)	86.93 (18.12)	83.54 (17.41)
Liking of crisps (0-100)	66.82 (28.27)	68.81 (27.92)
Liking of cookies (0-100)	68.89 (26.22)	69.91 (25.00)
Baseline identity (0-100)	72.01 (17.60)	68.80 (15.79)

Poster evaluation (1-5)		
Clarity	4.47 (0.59)	4.46 (0.45)
Legitimacy	3.86 (0.84)	2.90 (0.79) ***
Professional	2.88 (1.00)	2.75 (0.97)
Flyer evaluation (1-5)		
Clarity	4.35 (0.55)	4.34 (0.63)
Credibility	3.46 (0.70)	2.78 (0.78) ***

Asterisk indicates significantly different from health condition ***p<0.0001

Manipulation check

To examine whether the manipulation of identity changes student identification, a 2-way ANOVA was conducted. There was a significant effect of identity priming (F(1,158)=5.63, p=0.019), whereby the non-priming group showed significantly lower identity scores than the priming group (67.58 vs. 73.62).

Moderation analysis: Consumption of fruit and vegetables (F&V) and high calorie snack food (grams)

A mixed three-way ANOVA (food type, message type, identity priming) revealed a significant interaction between message type and identity priming (F (1,148)=4.7, p=0.031, η2 = 0.031) but no other significant main effects or interactions. Because, *a priori,* we expected only intake of F&V to be affected by the social norm manipulation, we performed ANOVA on the F&V and snack food types separately. This analysis revealed no significant effect of message type or priming on snack food

intake (F (1,148)=0.1, p=0.32 η^2 =0.007. For F&V there was a significant message type by priming interaction (F (1,148)=4.94, p=0.028 η^2 =0.032) which was then broken down to examine the effect of message type separately for the priming and non-priming conditions. There was a significant main effect of condition on F&V intake but only for the priming condition (F (1,73)=4.6, p=0.035 η^2=0.06) and not for the non-priming condition (F (1,73)=0.46, p=0.49 η^2 =0.006). Thus, exposure to the descriptive social norm message enhanced the consumption of F&V, compared to the health condition, but only after identity was primed (see Figure 7).
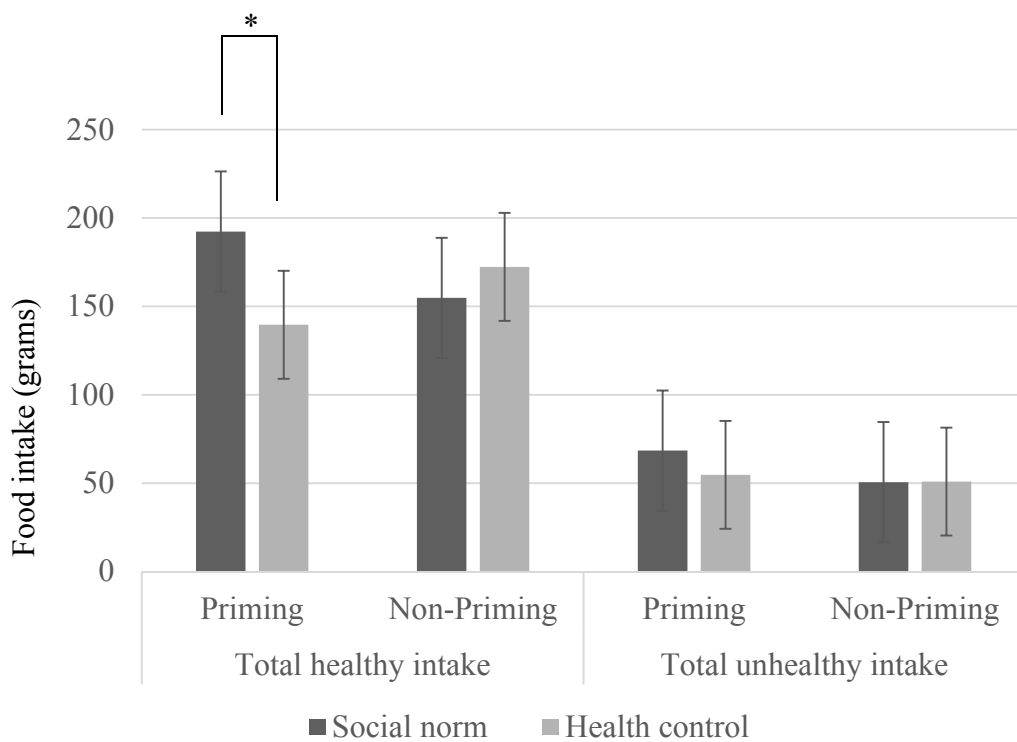

Figure 7. Interaction between food type, message type and identity priming. Data are presented as mean + SD. Asterisk indicates significant difference between conditions *p<0.05.

Demand Check

When asked about the purpose of the study, 21% of participants guessed/partially guessed correctly. Exclusion of those participants did not change the overall pattern of the results. When asked whether posters in the 'first study' might have affected their eating behavior in the 'second study', 44% of participants reported that there was/they might have had an influence. When asked whether they were aware of the link between the 'two studies' 71% of participants reported awareness that the two studies might be linked to each other because they saw similar questions in both studies.

Discussion

Study 1 and Study 2 were conducted to investigate the effects of exposure to a descriptive social norms message about the eating habits of others on eating intentions and to investigate potential moderators and mediators. Exposure to a descriptive social norms message, but not a health-related or control message, was associated with increased intentions to eat vegetables (Study 1) and increased intentions to limit junk food intake (Study 2), but only for participants who scored highly on a measure of how central the norm referent group was to their identity. There was no effect of exposure to the norms message on intentions to exercise, suggesting that the manipulation did not induce a general increase in socially desirable responding. These findings are consistent with previous evidence that eating intentions are affected by exposure to social normative information (Croker et al., 2009) and that this effect may be moderated by strength of identification with the norm referent group (Stok

Verkooijen, Ridder et al., 2014). The results are also broadly consistent with evidence that the interplay of identity and (perceived) norms affects intentions towards health-related behaviors such as drinking, exercise and sun-protective behavior (Johnston & White, 2003; Terry & Hogg, 1996).

It should be noted that in both Study 1 and Study 2, only the centrality component of group identification with the norm referent group moderated the relationship between exposure to social normative information and eating intentions. This pattern of results suggests that specific aspects of self-investment in the norm referent group may be more important than self-definition as a group member in determining the degree of conformity with the norm. In other words, the moderating effect of identification with the norm may be driven by motivational components of social identity, such as how important the group is to my identity, rather than my perceived similarity with the group. This suggestion is supported by the findings of Hackel and colleagues, who found that group-level self-investment, but not self-definition, was related to the hedonic evaluation of identity relevant foods (Hackel et al., 2016). Acting in line with the presented group norm maybe more likely when individuals regard their membership of the group as being important to their identity (Masson and Fritsche, 2014).

There was no evidence that the effect of exposure to the descriptive social norm message on eating intentions was mediated by self-identification, attitudes or

self-efficacy toward eating vegetables/junk food. This pattern of results is in contrast to the findings of Stok and colleagues who reported that the effect of a majority eating norm about vegetable consumption increased self-reported vegetable consumption, relative to a minority eating norm, and that this effect was partially, but not fully, mediated by changes in self-identification and self-efficacy (Stok Verkooijen, Ridder et al., 2014). In addition, unlike Stok and colleagues, we found no effect of the descriptive social norms message on a measure of attitudes towards eating sufficient vegetables in the future (Stok Verkooijen, Ridder et al., 2014). A number of significant differences between the studies here and that of Stok and colleagues (Stok Verkooijen, Ridder et al., 2014) may explain the discrepant results. One possibility is that in the study by Stok and colleagues (Stok Verkooijen, Ridder et al., 2014) there was no comparison with a no norm control condition, and so it might have been that the effects were driven by the minority norm decreasing intentions to eat vegetables rather the majority norm increasing intentions. Further work is required to investigate whether different mechanisms underlie the responses to majority versus minority normative information. It is possible that the exposure to a majority norm (for people who see the norm group as important) influences the anticipated or actual evaluation/perception of food (Higgs, 2015), which was not assessed here, but has been reported to be influenced by salient social identity (Coppin et al., 2016). Alternatively, it may be that the majority norm signals appropriate behavior for the group, which then motivates consumption intentions, as has been reported for the effect of a social model on food intake (Vartanian, Sokol, Herman, & Polivy 2013).

For both Study 1 and Study 2, high levels of identification with the norm referent group were associated with greater intentions to exercise. This was an unexpected finding and the underlying reasons are unclear. One possibility is that there are some personality characteristics of the high identifiers that predispose them to think optimistically about their future intentions, but this remains to be tested.

Study 3 investigated whether manipulating salient social identity moderates the effect of a descriptive social norm versus health message on food intake. We found that exposure to a descriptive social norm message was associated with increased intake of fruit and vegetable items from a buffet, compared to a health message, but only in the primed and not the non-primed condition. We did not observe any effect of the descriptive social norm message on the consumption of high calorie snack food items. According to the social identity approach, group norms influence health-related behaviors, particularly for individuals who are strongly affiliated to the norm referent group (Louise et al., 2007; Terry & Hogg, 1996; Turner et al., 1987; Stok Verkooijen, Ridder et al., 2014). Previous research already suggested that high identifiers tend to align their eating behavior with their group norm to affirm their commitment to their shared group (Cruwys et al., 2012; Stok Verkooijen, Ridder et al., 2014). In Study 3, priming the participants' student identity salient may have increased their affiliation with the norm referent group making it more likely that their behavior was in line with the norm. Although exposure to the descriptive social norm message increased

fruit and vegetable consumption in the primed condition, and this was a medium effect size, the effect requires replication with a larger sample before strong conclusions can be drawn because our analysis was based on an *a priori* assumption that only fruit and vegetable and not snack food intake would be affected by the norm manipulation. Future work might attempt to enhance the identity manipulation strategy to produce a larger effect size.

A strength of the studies reported here is that we have assessed the moderating role of identification with a norm referent group on the relationship between norm messages and eating intentions and behaviors across three studies using different methods and different samples. However, a few limitations of the studies should be noted. Only intentions to consume foods were assessed in Studies 1 and 2 and the gap between behavioral intention and actual behavior should not be ignored (Ajzen & Fishbein, 1980). Future studies are required to examine whether similar results are obtained for measures of food consumption. We did not exclude participants who had taken part in Study 1 from Study 2. Study 2 was run one year after the completion of Study 1, but it is possible that some participants had taken part in both studies, which may have influenced their responses. In addition, in Study 2 we did not include a health control condition, only a neutral control condition and so we cannot exclude the possibility that the response to the descriptive social norms condition represents a response to a generic junk food message rather than a specific response to the descriptive social norm message. Although we found no effect of our manipulation on intention to

exercise in Studies 1 and 2, suggesting that social desirability was not an issue, we only measured exercise intention with one item and we did not control for exercise prior to the test session. All our samples comprised mainly young, white, women and so further work is required to extend the work to more representative and diverse samples. Because the number of men in the samples was small we were not able to examine whether men and women responded differently and so future studies with more balanced numbers of men and women should be conducted to be able to generalise the findings to men. In addition, the overall level of identification as a student was relatively high in Study 3 and so the increase in level of identification achieved by the manipulation was small and possibly subject to ceiling effects. Further work might seek to improve the priming strategy to maximize an increase in social identity. Moreover, other types of norm referent group with more variety in the strength of identification may be considered in future research.

The finding that identification with the norm referent group moderates the effects of social norm message on eating has implications for the design of social norm interventions aimed at encouraging healthier eating. It has been found that exposure to social norm messages may be effective in increasing the purchases of vegetables in restaurant settings (Thomas et al. 2017; Collins et al. 2019). The effectiveness of such messages might be enhanced if pilot studies were used to establish the wording for the most appropriate norm referent group for the population of interest, based on an assessment of centrality of identification with the norm.

The present results are a novel addition to research in the field of social norms. We found that social norms are more effective than health information in promoting healthy eating behavior (and intentions) and this effect is moderated by the strength of social identification with a norm referent group. In addition, we provide tentative evidence to suggest that manipulating salient social group identity influences how people adjust their eating behaviors based on the norms. Along with previous findings, these data suggest that norm effects on eating could be boosted if identification with the norm referent group is enhanced. Therefore, consideration of social factors might be useful in the development of interventions design to promote healthier eating.

Open Practices

The experiment in this article earned Open Materials and Open Data badges for transparent practices. Materials and data for Studies 1 and 2 are available at http://reshare.ukdataservice.ac.uk/852882/ and Study 3 at https://osf.io/n8v3c/

Declaration of Conflicting Interests

The Authors declare that there is no conflict of interest. The work described in this paper has not been published previously.

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