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What Everyone Else Is Eating: A Systematic Review and Meta-Analysis of the Effect of Informational Eating Norms on Eating Behavior

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ABSTRACT

There is interest in the hypothesis that social norms are a determinant of healthy and unhealthy dietary practices. The objective of our work was to assess the weight of evidence that experimentally manipulated information about eating norms influences food intake and choice. This systematic review of experimental studies examined whether providing information about other peoples' eating habits influences food intake or choices. To inform the review, three electronic databases (PsycINFO, MEDLINE, and the Social Sciences Citation Index) were searched during July 2012. A narrative approach was used to synthesize studies that examined the influence of norms on food choice and meta-analyses were used to synthesize the effect that informational eating norms have on quantity of food consumed. Fifteen experimental studies were reviewed. There was evidence that both high intake norms ($Z=3.84$; $P=0.0001$; standardized mean difference 0.41, 95% confidence interval 0.20 to 0.63) and low intake norms ($Z=2.78$; $P=0.005$; standard mean difference -0.35 , 95% confidence interval -0.59 to -0.10) exerted moderate influence on amounts of food eaten. There was consistent evidence that norms influenced food choices; norm information indicating that others make low-energy or high-energy food choices significantly increased the likelihood that participants made similar choices. Information about eating norms influences choice and quantity of food eaten, which could be used to promote healthy changes to dietary behavior.

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OBESITY SEEMS TO SPREAD THROUGH SOCIAL networks,¹ suggesting that social factors might influence weight gain. Weight loss may also be under social influence. It has been reported that people who work with a partner to try to lose weight are more successful than people who try with the same support, but in isolation.² One explanation for these phenomena is the social transmission of eating habits. There is a strong relationship between social context and amounts of food consumed. Individuals tend to eat more in company and alter their food intake to match the intake of dining companions.^{3,4} Moreover, recent findings indicate that socially connected individuals show strong concordance in eating habits over time.⁵ Thus, there is reason to believe that eating is strongly governed by social factors and the eating behaviors of those around us may be particularly influential.

It will be important to understand which specific processes underlie the spread of weight gain and eating behaviors through social networks. One explanation could be the operation of eating norms. Human beings are social creatures who tend to conform to the group standard, and social norms have long been thought to exert a powerful influence on behavior.^{6,7} Findings in social psychology suggest that people will use the behavior of others as a guide for how they should

behave (informational social influence), and such effects are observed even when individuals believe they are not being watched.^{8,9} In relation to eating behavior, it could be that people observe norms regarding the eating behavior of other people and use this to inform their own dietary behavior. Thus, the extent to which someone believes others are eating healthfully or unhealthfully could influence his or her own eating habits and explain why concordance in eating habits are observed in social networks.⁵

There has been no systematic review of whether eating norms act as a form of informational influence on food intake and choice. Yet, this may have important implications for understanding the spread of unhealthy eating habits and the development of novel public health interventions to tackle obesity.¹⁰ Informational social influence is when individuals make use of the behavior of those around them to decide whether a course of action is adaptive⁸ (eg, if everyone else is doing it, it will probably be a good idea for me to do it). The term *informational eating norms* means information about the eating habits of people, which could be communicated through explicit written information or cues about the typical eating behavior of others.^{11,12} In line with research in social psychology,^{6,8} in our work we conceptualize the influence of informational norms as being

RESEARCH

distinct from other types of social influence such as normative influences. A companion diner provides an eating norm to follow, but he or she may also exert a normative social influence (also known as people pleasing). In such scenarios, additional processes that are unrelated to informational influence, such as automatic mimicry or ingratiation concerns, may influence eating.^{13,14} Thus, this review did not include studies where a present diner provided the eating norm because separating out different types of social influence on eating behavior will be important to understanding causal mechanisms.

Our work aimed to answer two questions: (1) What is the strength of the causal evidence that information about eating norms affects food intake and/or food choice? and; (2) What evidence is there for moderating or mediating factors that can explain when or how informational eating norms influence food intake and/or choice?

METHODS

Eligibility Criteria

Studies with human participants were included. Studies manipulating and examining the effect of information about an eating norm on eating behavior were eligible for inclusion. To be eligible for inclusion all studies were required to include a control or comparison condition. Studies measuring the quantity of food consumed, food type chosen, or intended consumption after a manipulation of eating norm information were included. Experimental designs were either repeated-measures or between-subjects. The study must have manipulated an eating norm through exposing participants to information about the eating behavior of others. Studies in which the influence of information about the eating behavior of others was not directly manipulated were excluded. For example, studies were not included if the consequences of dining with another person who ate a lot or a little were examined. This was to ensure that only the effects of information about eating norms were examined. Studies were included if they examined the effect of providing information about eating norms on eating when participants ate alone vs with others. The reasoning for this was that the results of these studies may inform understanding of context-dependent effects of informational eating norms.

Information Sources and Search Strategy

The search process was guided by Preferred Reporting Items for Systematic Review (PRISMA).¹⁵ Three electronic databases were searched: Ovid PsycINFO, Ovid MEDLINE, and the Social Sciences Citation Index. Searches took place during July and August 2012. Searches included a combination of key words and search categories relevant to social norms, social influence, eating, diet, food intake, food selection, and food choice. Search limiters included human subjects and studies reported between 2001 and the search date, based on the authors' knowledge of the earliest reported relevant study. Language eligibility criteria were not specified during the search process. (See [Figure 1](#) for example full search strategy.) These electronic searches were supplemented by a manual search of reference sections in included articles. To identify any further relevant published or unpublished manuscripts, lead authors of eligible manuscripts were contacted. After

removal of duplicates, initial search results were screened using titles and abstracts (see Results for more information) by two of the authors. Studies that appeared relevant were then full-text screened. Unpublished manuscripts were also full-text screened. Selection of included studies was performed independently by the same two authors. Selections were made unblinded and any inclusion disagreements were resolved after discussion between the same two authors. All authors were responsible for suggesting other relevant additional articles for inclusion outside of the formal searches.

Extraction of Data

Data extraction was conducted by one author and then independently checked by a second author. No disagreements occurred. If the data needed for meta-analyses were only partially reported (eg, total study sample size was reported but sample size of each experimental condition was missing), the corresponding author of the manuscript was contacted and the necessary data were requested.

Data Extracted for Individual Studies

Population from which the participants were recruited, sample size, age, body mass index (BMI), sex, and exclusion criteria were all extracted. Eating norm type, experiment conditions, and procedure for experiment condition were extracted. The type of comparison/control group and the procedure used were extracted. Type of measure was extracted; that is, food intake (in units relevant to food type) or food choice. Whether a mediating or moderating variable was tested, whether a cover story was used, and whether there was any evidence of any demand awareness were extracted.

EXAMPLE SEARCH STRATEGY (31/07/12)

Source: Psych Info (Ovid)

1. *food intake/ or *eating behavior/ or *food
2. *food preference/
3. food choice.mp.
4. *appetite/
5. *social norms/ or *social influences/
6. conformity.mp.
7. *social identity/
8. *reference groups/
9. *peers
10. identity signalling.mp.
11. descriptive norm.mp.
12. injunctive norm.mp.
13. 1 or 2 or 3 or 4
14. 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12
15. 13 and 14
16. limit 15 to (human and yr = "2001 – Current")

Figure 1. What everyone else is eating: A systematic review of the effect of perceived eating norms on food intake and choice.

Quality Assessment

The usual quality filters for randomized trials or observational epidemiologic studies did not apply because only short-term laboratory studies were found (see the PRISMA statement¹⁵). However, study designs were examined to assess whether participants would have been unlikely to be aware of the true purpose of the experiment and whether participants' awareness of the true purpose of the study was assessed. The type of control/comparison group used for each study was also assessed, along with whether there were any methodologic limitations that could explain the observed results.

Synthesis of Results

Food Intake Studies. For studies in which the outcome measure was the quantity of food consumed, the results were combined using inverse variance meta-analysis. Revman version 5.1 (2011, Cochrane Group) was used to calculate the weighted mean standardized difference between experimental and control groups and its 95% CI, assessing heterogeneity with the I^2 statistic. Two study types were identified: studies that assessed the effect of information about a high intake norm vs control and studies that assessed the effect of information about a low intake norm vs control. Standardized mean differences (SMD) were calculated for each of these subgroups separately. A positive SMD indicates the experimental group ate more than the control group. A negative SMD indicates the experimental group ate less than the control group. The larger the SMD, the bigger the difference between the control and the experiment group. Where heterogeneity of effects was found, the random effects weighted mean difference was calculated.

Some studies included multiple experiment conditions (ie, both a low intake and high intake condition), and these contributed comparisons to both the meta-analyses of high intake studies and low intake studies. Some studies also tested additional independent factors; for example, Pliner and colleagues¹² tested the effect of intake norms when both palatable and unpalatable foods were available. Thus, these studies also contributed more than one comparison to the analyses (see Table 1). One food intake study consisted of only high and low norm intake conditions (there was not a control condition that received no norm information), making it unsuitable to be included in the meta-analysis. The results of this study are described separately.

Food Choice Studies. Due to the heterogeneity of study methodologies and measures of eating behavior, the food choice studies were synthesized in a narrative form and each study is individually described. For example, the outcome measures were highly variable, and included the mean number of food items chosen of a specific type (ie, high vs low energy), the percent of participants choosing a type of food item, the percent of the meal derived from fat, and intended choice over the following 6 months.

Moderators. Data were extracted on all studies that reported moderation analyses, but there were few of these. These studies were synthesized narratively.

RESULTS

Study Selection

Please refer to Figure 2 for a flow diagram of the search and inclusion process, as guided by PRISMA guidelines for systematic reviews and meta-analyses. Eleven publications, reporting on 15 studies were included in the final review. Some articles included multiple studies, so each individual study is labelled numerically in Tables 1 and 2. So they can be easily identified from the Tables and Figures, these numbers are referred to when describing individual studies in the Results section.

Overview

All studies described their sampling procedures. Fourteen of 15 studies sampled university students. One study¹³ recruited a representative sample of the UK population. Age was available in 10 out of 15 studies,^{1-9,13} with mean age ranging from 18 to 51 years in those studies (median age=19 years). The remaining five studies sampled university students who were likely to have a mean age of 18 to 25 years. Mean BMI was reported in 5 out of 15 studies and was in the healthy range (18.5 to 24.9) for all of these studies,^{3,5-8} with the median study BMI being 21.7. Sex information was available in 12 out of 15 studies.^{1-9,13-15} Of these, nine included female subjects only^{1-6,9,14,15} and three included male and female subjects.^{7-8,13}

Eight studies examined the influence of information about a food intake norm on the quantity of food consumed.¹⁻⁸ Seven studies examined the influence of information about a food choice norm on food choice.⁹⁻¹⁵ All studies exposed participants to information about eating norms of people not known to participants (eg "other students" and "other people in the United Kingdom").

A control condition in which no norm information was provided was used in 13 out of 15 studies. Two studies used a comparison condition in which participants were exposed to norm information, resulting in two norm conditions. In one study, this was exposure to either a high or low intake norm³ and in the other, the groups differed because the norms were reported to emanate from different social groups.¹⁰

All studies examining food intake allowed for the calculation of the difference in food intake between experiment and comparison/control conditions. For studies examining choice, food choice measures used varied across studies (see Results).

Cover stories were used in 14 out of 15 studies (Study 13 being the exception). Six studies reported additional evidence that suggested demand awareness was unlikely,^{1,5-8,13} whereas nine studies did not include any such information. Some minor methodologic limitations were observed in 7 out of 15 studies (see Tables 1 and 2).^{1,2,5,6,9,10,14} Ten of 15 studies tested a moderating factor. Seven of 10 examined whether participant characteristics moderated the effect an informational eating norm had on eating behavior.^{1,6-8,11-13} The remaining four studies manipulated an experimental variable to investigate contextual effects of the norms.^{1-3,5} No studies conducted mediation analysis.

Food Intake (Studies Where Quantity of Food Consumed Was the Outcome)

Effect of a High Intake Norm. Six studies examined whether a high intake norm increased food intake relative to

Table 1. Study information and method for low and high intake norm studies

Authors and study	Participants and design	Norm manipulation	Food intake measure reported	Test for moderation	Methodologic considerations
1. Roth and colleagues, 2001 ¹¹	Sample=Psychology undergraduate students N=134 Age=23 y (mean) BMI ^a =N/reported Sex=Females only Exclusions ^b =None Between-subjects design	Remote confederate design: Participants led to believe prior 10 participants ate a lot of cookies, 12-16 cookies (high intake condition), 2-6 cookies (low intake condition), or were given no indication of prior participants' intake (control condition)	Participants had free access to cookies for 10 min, during a taste test Main outcome measure=Number of cookies consumed	Presence of experimenter manipulated: Eating alone vs eating with experimenter watching Dieters vs nondieters examined	Cover story used Evidence of no demand awareness. Participants reported not having been influenced by social norm information Number of cookies selected as low intake norm was similar to control condition's intake. Therefore, effect of low norm not testable in this experiment
2. Pliner and Mann, 2004 ¹² Study 1	Sample=Psychology undergraduate students N=72 Age 19.9 y (mean) BMI=N/reported Sex=Females only Exclusions=None Between-subjects design	Remote confederate design: Participants led to believe prior 10 participants ate a lot of cookies, 12-16 cookies (high intake condition), 2-6 cookies (low intake condition), or were given no indication of prior participants' intake (control condition)	Participants had free access to cookies for 10 min during a taste test Main outcome measure=Number of cookies	Palatability of food manipulated: Palatable vs unpalatable cookies	Cover story used No info on demand awareness Number of cookies selected as low intake norm was similar to control condition's intake. Therefore, effect of low norm not testable in this experiment Palatability of cookies was confounded by energy content of cookies Palatability of unpalatable cookies was extremely low (continued on next page)

Table 1. Study information and method for low and high intake norm studies (*continued*)

Authors and study	Participants and design	Norm manipulation	Food intake measure reported	Test for moderation	Methodologic considerations
3. Yamasaki and colleagues, 2007 ¹⁶	Sample=Psychology undergraduate students N=45 Age=18.9 y (mean) BMI=19.6 (mean) Sex=Females only Exclusion criteria=None Between-subjects design	Remote confederate design: Participants led to believe prior 12 participants had eaten a lot of doughnuts, 12 doughnuts (high intake condition) or 2 doughnuts (low intake condition)	Participants had free access to doughnuts during a taste test Main outcome measure=Grams of doughnut consumed	Experimenter awareness: Participants led to believe experimenter would see number of doughnuts eaten vs would not see	Cover story used. No info on demand awareness. No true control group, both conditions shown norm information
4. Feeney and colleagues, 2011 ¹⁷	Sample=Psychology students N=32 Age=18.6 y (mean) BMI=N/reported Sex: Females only Exclusions=None Between-subjects design	Remote confederate design: Participants led to believe 10 prior participants ate a small amount of pizza, 3 slices (low intake condition), or were given no indication of prior participants' intake (control condition)	Participants had free access to 30 mini pieces of pizza. They could eat as much as they liked while watching a television episode Outcome measure=Number of pizza slices consumed	None	Cover story used No info on demand awareness
5. Cruwys and colleagues, 2012 ¹⁸	Sample=University students N=119 Age=19.4 y (mean) BMI=21.7 (mean) Sex=Females only Exclusions=None Between-subjects design	Before eating, participants found out previous participants had eaten a full portion of popcorn (high intake condition), no popcorn (low intake condition), or given no information (control condition)	Participants had free access to popcorn while viewing television Outcome measure=Grams of popcorn consumed	Identity of previous participants manipulated: in-group (same University) vs out-group (rival University)	Cover story used Evidence of no demand awareness. Participants were not aware of the study aims Participants in all conditions were primed with the in-group identity before eating

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Table 1. Study information and method for low and high intake norm studies (*continued*)

Authors and study	Participants and design	Norm manipulation	Food intake measure reported	Test for moderation	Methodologic considerations
6. Robinson and colleagues, 2013 ¹⁹	Sample=Psychology undergraduate students N=64 Age=19.2 y (mean) BMI=23.3 (mean) Sex=Females only Exclusions=Participants guessing aims of study removed Between-subjects design	Remote confederate design: Participants led to believe 4 prior participants ate a lot of cookies, 8-10 cookies (high intake condition), 1-2 cookies (low intake), or were given no prior information (control condition)	Participants had free access to cookies for 10 min during a taste test Main outcome measure=Number of cookies consumed	Trait empathy: High vs low empathic individuals	Cover story used Evidence of no demand awareness. Participants were not aware of the study aims
7. Robinson and colleagues, (in press) ²⁰ Study 1	Sample=Psychology undergraduate students N=71 Age=19.6 y (mean) BMI=21.7 (mean) Sex=Males and females Exclusions=Nonmeat eaters, due to food served Between-subjects design	Participants exposed to a poster and flyer about vegetable intake, displaying either a message suggesting other students eat 3 portions of vegetable a day (social norm condition) or a health message (control condition)	Participants rated flyers and posters then selected and consumed a lunch from a buffet Main outcome measure: Grams of vegetables consumed	Habitual vegetable intake: High vs low consumers	Cover story used Evidence of no demand awareness. Participants were not aware of the study aims

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Table 1. Study information and method for low and high intake norm studies (*continued*)

Authors and study	Participants and design	Norm manipulation	Food intake measure reported	Test for moderation	Methodologic considerations
8. Robinson and colleagues, (in press) ²⁰ Study 2	Sample=Psychology undergraduate students N=70 Age=19.1 y (mean) BMI=22.0 (mean) Sex=Males and females Exclusions=Only regular between-meal snackers Between-subjects design	Participants exposed to a poster and flyer about fruit and vegetable intake, displaying either a message suggesting other students eat 5 portions of fruit and vegetables a day (descriptive norm condition), other students approve of eating 5 portions of fruit and vegetables a day (injunctive norm condition), or a health message (control condition)	Participants rated the poster and then selected and consumed a snack from a buffet Main outcome measure: Grams of fruit and vegetables consumed	Habitual fruit and vegetable intake: High vs low consumers	Cover story used Evidence of no demand awareness. Participants were not aware of the study aims

^aBMI=body mass index.

^bExclusions refer to exclusion criteria.

RESEARCH

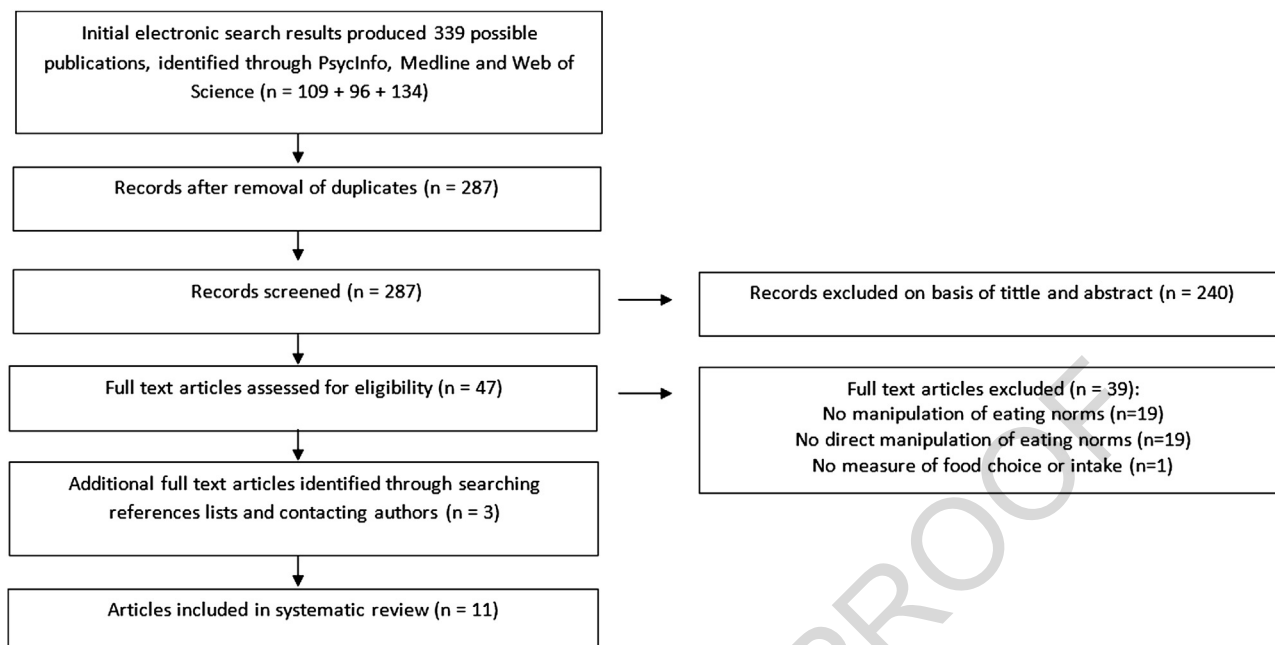


Figure 2. Search and inclusion process flowchart. Preferred reporting items in systematic reviews and meta-analyses flow diagram of study selection, inclusion, and exclusion of studies.

a no-norm control.^{1,2,5-8} The norms that were presented were about previous study participants^{1,2,5-6} and other students.^{7,8} High-energy snack intake was measured in three studies,^{1,2,6} popcorn intake in one study,⁵ fruit and vegetable intake during a snack in one study,⁸ and main meal intake vegetable intake was measured in the other.⁷ In two studies, participants in the control condition were exposed to health information about the benefits of eating fruit and vegetables^{7,8} and in the remaining studies participants were not exposed to any information. From the six studies, 11 comparisons were entered into the analysis. See Figure 3 for individual comparison results (significant comparisons at $P < 0.05$ are indicated by studies with CIs that do not overlap 0). An overall effect was observed, suggesting that high intake norms increased intake relative to control ($Z = 3.84$; $P = 0.0001$; SMD 0.41, 95% CI 0.20 to 0.63; $I^2 = 47\%$), suggesting some heterogeneity across comparisons. Thus, SMD was calculated using the random effects weighted mean difference and found comparable results to the fixed effects weighted mean analysis ($Z = 2.98$; $P = 0.003$; SMD 0.45, 95% CI 0.15 to 0.74).

Effect of a Low Intake Norm. Five studies examined whether information about a low intake norm decreased food intake relative to control.^{1,2,4-6} The norms that were presented were about previous study participants in all studies. Sweet snack food intake was measured in three of four studies,^{1,2,6} popcorn intake in one study,⁵ and pizza intake in the remaining study.⁴ A no-norm control condition was used in all studies, in which participants were not exposed to any information. From the five studies, eight comparisons were entered into the analysis. See Figure 4 for individual comparison results. An overall effect was observed suggesting that low intake norms were associated with

decreased intake ($Z = 2.78$; $P = 0.005$; SMD -0.35 , 95% CI -0.59 to -0.10 ; $I^2 = 56\%$), suggesting some evidence of heterogeneity. SMD was also calculated using the random effects weighted mean difference and comparable results to the fixed effects weight mean analysis was found, although this was not statistically significant at the conventional P value cutoff ($Z = 1.79$; $P = 0.07$; SMD -0.34 , 95% CI -0.72 to 0.03).

One study compared information about a high intake norm to a low intake norm condition (there was not a no-norm control) and found a 40% greater intake ($P < 0.05$) of snack food in the high norm condition compared with the low norm condition.³ The norm concerned previous study participants' intake.

Food Choice Studies (Studies Where Type of Food Chosen Was the Outcome)

Seven studies examined the influence of information about a food choice norm on food choice⁹⁻¹⁵ (see Table 2). Three studies exposed participants to norm information by having them read a fictional news article about other students' food choices.¹⁰⁻¹² Three studies exposed participants to norm information by providing fictional information about the food choices made by previous participants in the same experiment.^{9,14,15} One study asked participants to read the results of a survey that reported information about others people's habitual food intake.¹³ Measurement of food choice varied across studies. Two studies examined the number of "junk food" items chosen.^{10,12} The criteria adopted for classifying foods as "junk food" was not provided. Another study examined the percentage of energy derived from fat in choices.¹¹ Three studies examined the percentage of participants choosing a low- vs a high-energy food choice.^{9,14,15} A final study examined how many times a day participants intended to choose to eat fruit and vegetables during the next

Table 2. Study information and method for food choice norm studies

Authors and study	Participants and design	Norm manipulation	Food intake measure reported	Test for moderation	Methodologic considerations
9. Pliner and Mann, 2004 ¹² Study 2	Sample=Psychology undergraduate students N=37 Age=19.3 y (mean) BMI ^a =Not reported Sex=Females only Exclusions ^b =None Between-subjects design	Remote confederate design: Participants led to believe 8 of 10 prior participants selected palatable (palatable norm condition) or unpalatable cookies (unpalatable norm condition). Control condition was given no information about prior participants' selection	Participants chose a bag of either palatable or unpalatable cookies to consume during a taste test. Participants also chose bags to take away with them for extension of experiment. Outcome measures: 1. Cookie type chosen in the laboratory 2. Cookie type chosen to take away	None	Cover story used No info on demand awareness Palatability of cookies was confounded by energy content of cookies Ceiling effect for palatable cookie condition
10. Berger and Rand, 2008 ²¹ Study 1	Sample=Undergraduate students N=50 Age=Not reported BMI=Not reported Sex=Not reported Exclusions=None Between-subjects design	Participants assigned to read paper articles that suggested junk food was consumed in high volumes by a social group on campus. An undesirable social group (graduate students) or a neutral group (undergraduate students)	Participants read articles and then completed a pseudo shopping task: Participants chose healthy vs unhealthy food items from pairs (eg, brownie vs apple), in the presence of other participants Main outcome measure=Number of junk food items selected Description/nutritional content of "junk food" items not available	None	Cover story used No info on demand awareness No true control group, both conditions shown norm information
11. Berger and Rand, 2008 ²¹ Study 3	Sample=University students N=75 Age=Not reported BMI=Not reported Sex=Not reported Exclusions=None Between-subjects design	Participants assigned to read articles that suggested junk food was consumed in high volumes by a social group on campus. An undesirable social group (online gamers). Or read article about a neutral topic unrelated to food (control condition)	Participants read news articles, and then selected food to eat from a university cafeteria while their food selection was covertly monitored Main outcome measure=% of energy from fat in food choices	Self-monitoring: High self-monitors vs low self-monitors	Cover story used No info on demand awareness No check on if any of the participants were members of the undesirable social group

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Table 2. Study information and method for food choice norm studies (*continued*)

Authors and study	Participants and design	Norm manipulation	Food intake measure reported	Test for moderation	Methodologic considerations
12. Berger and Heath, 2008 ²² Study 3	Sample=Undergraduate students N=76 Age=Not reported BMI=Not reported Sex=Not reported Exclusions=None Between-subjects design	Participants assigned to read article that either suggested junk food was consumed in high volumes by an undesirable social group (graduate students), neutral social group (undergraduate students), or read a neutral article not related to junk food (control condition)	Participants read the articles, and then selected food items in a pseudo shopping task Main outcome measure=Number of junk food items selected Description/nutritional content of "junk food" items not available	Context choices made in manipulated: Private (alone) vs public (in front of participants) Self-monitoring: High self-monitors vs low self-monitors	Cover story used No info on demand awareness
13. Croker and colleagues, 2009 ²³	Sample=UK adults N=1,083 Age=51.0 y (males) 51.9 y (females) BMI=Not reported Sex: Males and females Exclusion: Age <16 y Between-subjects design	Participants exposed to health, cost, or social norms statement outlining the intention of UK residents to eat fruit and vegetables. A control condition was used with no information about fruit and vegetables	Participants read statement and then recorded their intended daily fruit and vegetable intake for the next 6 mo was recorded Main outcome measure=Number of portions of fruit and vegetables intended to eat a day	Sex: Males vs females	No cover story used Evidence of no demand awareness. Participants rated that the social norms information was not affecting their responses
14. Burger and colleagues, 2010 ²⁴ Study 1	Sample=Psychology undergraduate students N=120 Age=Not reported BMI=Not reported Sex=Females only Exclusion=None Between-subjects design	Participants were either led to believe prior previous participants chose a low-energy snack (healthy norm), high-energy snack (unhealthy norm), or given no prior information (control condition)	Participants had to choose between a high- or low-energy snack to eat during a taste-rating task (in the presence of, but not being observed by, the experimenter) Main outcome measure=Percentage of participants choosing low-energy food	None	Cover story used No info on demand awareness Impression-management possible confound, as experimenter in the same room

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Table 2. Study information and method for food choice norm studies (continued)

Authors and study	Participants and design	Norm manipulation	Food intake measure reported	Test for moderation	Methodologic considerations
15. Burger and colleagues, 2010 ²⁴ Study 2	Sample=Psychology undergraduate students N=75 Age=Not reported BMI=Not reported Sex=Females only Exclusion=None Between-subjects design	Participants were either led to believe prior previous participants chose a low-energy snack (healthy norm), high-energy snack (unhealthy norm), or given no prior information (control condition)	Participants had to choose 3 snack bars from high-energy or low-energy options, for a taste-rating task, alone Main outcome measure=Percentage of participants choosing low-energy food	None	Cover story used No info on demand awareness

^aBMI=body mass index.^bExclusions refer to exclusion criteria.

6 months.¹³ The studies can be classified into two types; studies testing whether norms can promote a food choice or inhibit a food choice.

Effect of a Norm Promoting a Food Choice. Four studies tested whether information about others choosing a food influenced actual or intended choice.^{9,13-15} One study¹⁴ found a main effect of condition ($P<0.05$), in that 28% more participants chose a low-energy option when they were led to believe the norm was to select a low-energy food option (115 kcal) than when they were led to believe the norm was to select a high-energy food option (230 to 285 kcal). Neither of these conditions differed significantly from the no-norm control condition, although an intermediate number of participants selected the low-energy food option in the control condition, which follows the expected direction of results. Another study¹⁵ examined the effect of a low-energy choice norm, high-energy choice norm, and no norm. A main effect of condition was observed ($P<0.05$), whereby the percentages of participants choosing the low-energy option in each group were 57%, 22%, and 35%, respectively. The difference between the low-energy choice norm condition and the other two conditions was statistically significant ($P<0.05$), whereas the high-energy choice norm and no-norm control condition did not differ significantly.

One study¹³ found that a norm outlining the intent of others to eat fruit and vegetables did not significantly increase intended choice of fruit and vegetables in the overall sample. The message significantly increased mens' intended choice of fruit and vegetables ($P<0.05$; 18%), but did not affect the intentions of women. Finally, one study⁹ examined whether a norm suggesting that others had chosen an unpalatable cookie influenced choice of unpalatable cookies when both unpalatable and palatable cookies were offered. The norm did not significantly influence food choice.

Effect of a Norm Inhibiting a Food Choice. Three studies tested the effect of providing information that a socially undesirable group ate a lot of junk food.¹⁰⁻¹² The first study¹⁰ found that this norm significantly reduced the number of junk food items chosen by 30%, relative to a condition in which participants were exposed to the same norm information about a more desirable social group ($P<0.05$). There was not a no-norm control condition in this study. However, a further study with a no-norm control condition¹² found a statistically significant lower choice of junk food items in the experiment group compared with the control group ($P<0.05$). The other study¹¹ measured percentage of fat in food choices and found a statistically significant 20% lower choice in the undesirable group condition, compared with a no-norm control condition ($P<0.05$).

Factors Affecting the Influence of Eating Norms

For information regarding how norms were presented in individual studies, please refer to [Tables 1](#) and [2](#). Examples included written information about what other people had been eating and visual cues denoting the popularity of a food choice (eg, making it appear as though participants had consistently chosen and consumed a healthier snack choice by leaving empty wrappers visible). Ten of 15 studies reported within-study tests of experiment manipulations or

RESEARCH

participant characteristics for moderation. Each section first addresses the within-study data for moderation.

Food Type. Two studies reported within-study data on whether food palatability (ie, how tasty the food was) moderated the affect of eating norm information. In one study,² participants were exposed to low and high intake norms about either palatable or unpalatable food intake vs a no-norm control condition. A nonsignificant interaction ($P=0.06$) was observed and follow-up analysis indicated a significant increase in intake as a result of high intake norm effect vs control ($P<0.05$), but only for the palatable food. A second study found no significant influence of a social norm on choice of unpalatable food.⁹ Two studies^{14,15} examined whether choice of either a low- or high-energy food item was affected by a food choice norm. In both studies, there was a significant increase ($P<0.05$) in number of low-energy food items chosen following the low-energy food choice norm and a nonsignificant decrease in choice of the low-energy option following a high-energy food choice norm, compared with the no-norm control. Different types of high-energy food were used as the test food in eight studies (eg, cookies and pizza),^{2-6,10-12} and low-energy foods were used in three studies.^{7-8,13} Significant effects on intake and choice were observed in all of these studies (P values <0.05). No studies compared norm effects on different food types. It appears that informational eating norms can influence people to eat more of a high-energy food than they might have, as well as influence people to choose a low-energy option over a high-energy option.

Norm Group Information. In one study⁵ participants were primed to think about a social group to which they belong. They were then exposed to information about the eating behaviors of a member of their group, or another social group to which they did not belong, or a control condition with no norm. Compared with the control condition, there were significant effects of high and low intake norms on consumption when the norm information referred to their own social group (both P values <0.05), but not to another social group.⁵ For the low intake norms, the difference between the exposed and unexposed conditions was statistically significant ($P<0.05$). For the high intake norms, the difference between the exposed and unexposed condition was not statistically significant ($P=0.07$). Across studies, the informational eating norms about consumption varied, relating either to previous participants in the experiment,^{1-4,6,9,14,15} other students,^{5,8-12} or other people in the same country.¹³ There was evidence that informational eating norms of all these social groups significantly influenced eating. For example, norms about fellow study participants resulted in significant increases in intake, as did norms about fellow university students. One other study⁹ showed that information about what others were eating ($P<0.05$), but not what others approved of eating, significantly influenced food intake. The findings indicate that norms about the behavior of similar others may be most powerful.

Presence of Others. Several studies have examined the influence of an informational eating norm on energy intake in the presence of another person. In one study,¹ a high-intake norm did not significantly increase consumption

when the experimenter was present but did so when participants were alone ($P<0.05$), and this interaction between condition and presence of experimenter was statistically significant at $P<0.05$. In another study,³ participants were led to believe that their food intake would or would not be observed by another person. There was not a significant interaction and the norm affected intake equally in both conditions. A third study¹² examined the effect of a norm on food choice when alone or in company. The norm related to the choices of an undesirable group and a significant interaction was observed, whereby norms only influenced food choice when others were present ($P<0.05$). One of the studies examining the influence of food choice norms used a procedure that involved the experimenter being present during food choice.¹⁴ The norm significantly increased ($P<0.05$) choice of the low-energy food option in this study (there was no corresponding “experimenter not present” condition). These studies provide somewhat mixed evidence but suggest that social norms can operate in the presence of others, although the effect may be overridden by concerns about social presentation in some contexts.

Participant Characteristics. One study¹ found no evidence that restrained and nonrestrained eaters differed in their response to an eating norm; both ate more in a high-intake norm condition than in a control condition. Another study⁶ found that trait empathy (high and low) did not moderate the effects of high and low intake norms. The same authors also tested whether habitual intake of vegetables⁷ and fruit and vegetables⁸ moderated whether an informational high intake norm about fruit and vegetables increased intake. In both studies, significant interactions were observed, whereby low habitual consumers increased their intake compared with a control condition ($P<0.05$), but high habitual consumers did not. A study¹³ tested the moderating effect of sex on the effects of a norm message about intended choice of fruit and vegetables. A significant ($P<0.05$) sex by norm condition interaction was observed. Men exposed to the norm intended to eat more fruit and vegetables than men who were not exposed to the norm ($P<0.05$), but the intentions of women in the norm and no-norm conditions were similar. However, women had high intentions to eat fruit and vegetables across all conditions. These studies suggest the extent to which a person is already adhering to a norm may determine whether exposure to a norm will affect eating behavior.

A study¹² examined whether the tendency to manage social impressions moderated the effect on food choice of information about an eating norm. In that experiment, participants were exposed to either a norm about food choice from an undesirable social group or a no-norm control. Overall, there was no main significant effect of the social norm. However, the results were qualified by a statistically significant interaction. High self-monitors (ie, individuals concerned about how they present themselves socially) but not low self-monitors chose less food in the norm condition than in the control condition, but only when making food choices in public ($P<0.05$). Low self-monitors did not respond to the undesirable group norm in either the public or private condition. This finding suggests individuals may sometimes make food choices if they wish to avoid social association with an undesirable group.

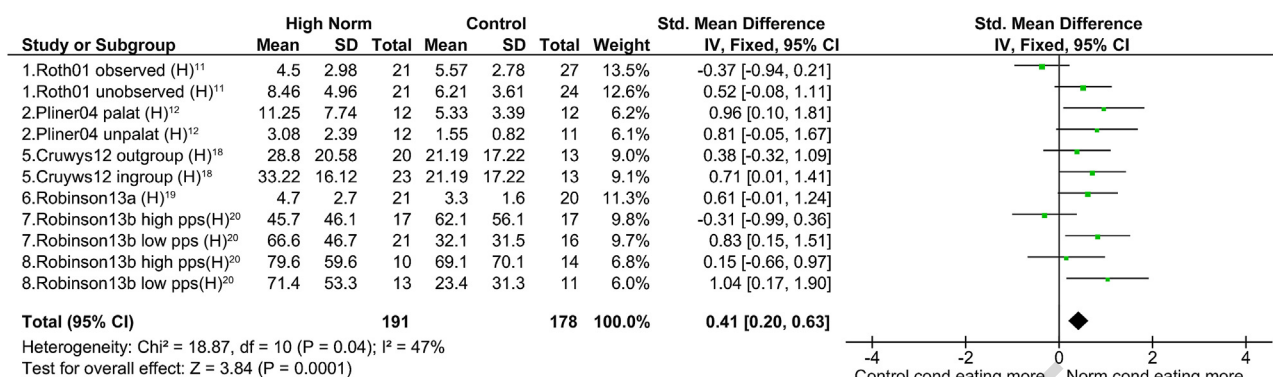


Figure 3. Forest plot for high intake norm studies. Total refers to sample size. SD=standard deviation. IV=independent variable.

Quality of Evidence

Overall, the studies reviewed were well designed, included a suitable control (13 out of 15) or comparison condition (2 out of 15), and used cover stories to detract from the aims of the research (14 out of 15). There was no evidence of demand awareness in any of the studies, although not all studies examined demand characteristics directly. A few studies had minor methodologic limitations. For example, the palatability of one of the cookies in one of the food choice studies⁹ was very low, which resulted in nearly all participants choosing the palatable cookie. This may have produced a ceiling effect, whereby it was not possible to see an increase in choice of the palatable cookie when participants were led to believe choice of the palatable cookie was the norm. In another study¹ the presented low intake norm was quite similar to the amount the control condition group ate, reducing the likelihood of a low intake norm decreasing intake. However, these limitations would probably underestimate size of observed effects, rather than overestimate them. The controlled laboratory settings and experimental approach suggest that the effects observed across these studies are caused by informational eating norms. Funnel plots of the food intake studies were inspected and no evidence to suggest publication bias was found. This was not possible for food choice studies due to the narrative syntheses. However, authors in the field were contacted to search for unpublished studies (the response rate was high, although no suggested studies met inclusion criteria), which suggests publication bias is unlikely to explain the consistent patterns of results observed. The

studies reviewed were of high quality and high methodologic rigour.

DISCUSSION

Overview

Studies that examined the effect of experimentally manipulating informational eating norms on food intake and food choice were reviewed. The studies were methodologically strong and used a range of methods to expose participants to norms about the behavior of others. Examples included written information about what other people had been eating or tended to eat and visual cues denoting the popularity of a food choice. Meta-analysis indicated that information suggesting that others eat large portions of food is associated with increased food intake. Analysis also indicated that small portion norms are associated with decreased food intake. The size of both of these effects was moderate, although there was some evidence of heterogeneity in the reviewed studies. In the reviewed studies, informational food choice norms were also shown to have a consistent effect on food choice. Norms were shown to influence intake of snack food, fruit and vegetables, and main meals.

Factors Affecting the Influence of Norms

Evidence was examined on when and how informational norms influence eating behavior. There was no research testing mediation, but moderating factors were identified. There was some evidence that identification with the norm reference group moderated the influence of norms on eating

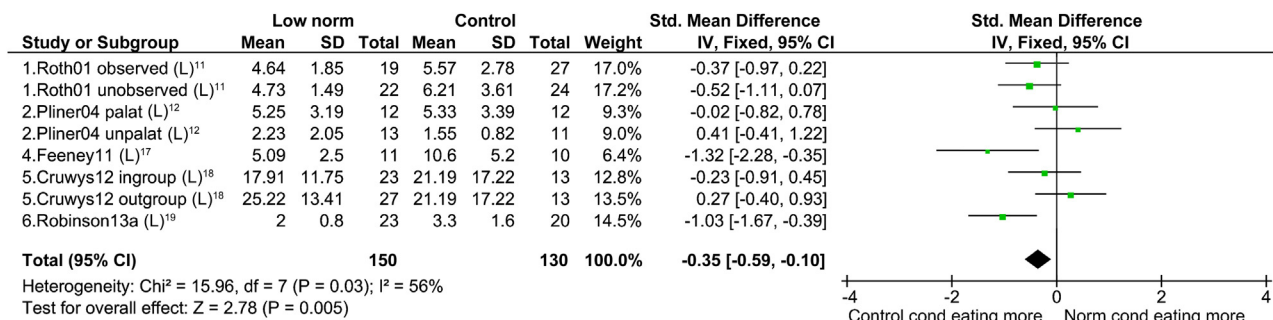


Figure 4. Forest plot for low intake norm intake studies. Total refers to sample size. SD=standard deviation. IV=independent variable.

RESEARCH

behavior. In one study,¹⁸ significant effects were reported when the food intake norm came from an in-group that participants identified with, but not when it came from an out-group. These findings are in line with other reviewed studies that showed participants would eat less of a food if they believed that it was the norm for an undesirable social group.^{21,22} Thus, it appears that in some contexts conforming to informational eating norms may be a way of reinforcing identity to a social group, which is in line with social identity theory.^{25,26} By this social identity account, if a person's sense of self is strongly guided by his or her identity as a member of the local community and that community is perceived to eat healthfully, then that person would be hypothesized to eat healthfully to maintain a consistent sense of social identity.

Research elsewhere²⁷ suggests that social proximity affects how social norms influence behavior. Presumably the people around us are perceived to be similar and so their behavior provides particularly useful information to follow. By this account, it might be expected that norms about close others are most influential on eating behavior. There was no direct examination of this in a single study, although one study²³ showed that an eating norm about other people in the United Kingdom produced a significant effect on food choice intentions. The data also suggest that eating norms describing the behavior of other participants in an experiment (a group that may or may not be perceived to be socially proximal to participants) influence food intake and choice.^{12,14,15} However, given that identity and proximity are likely to be related and no studies attempted to tease these two influences apart, further research testing their relative contributions is warranted.

Underlying Mechanism

As discussed, one explanation for normative influences on behavior is that acting in line with a perceived norm communicates identity to a specific social group. However, some studies here indicated that eating norms influence eating behavior when eating alone and unobserved and in these studies the informational eating norms participants conformed to were not always about the behavior of salient social groups (ie, the behavior of previous participants^{11,12}), so in these cases it seems unlikely that social identity is the only factor shaping behavior.

Social desirability or approval seems unlikely to explain the effect of informational eating norms in the reviewed studies. Reno and colleagues,⁶ Schutz and colleagues,⁷ and others in social psychology have differentiated between the influence of injunctive and descriptive norms. The latter are akin to informational eating norms because they refer to information about what other people are doing, whereas injunctive norms refer to norms about social approval.⁶ Because participants in the reviewed studies ate alone, social approval would presumably be unlikely to be guiding behavior. Moreover, in one study,²⁰ messages about injunctive and descriptive norms had different effects. Leading participants to believe that others approved of eating fruit and vegetables (injunctive norm) had no effect on eating behavior, whereas the descriptive norm (information about others' fruit and vegetable eating) had a notable influence on food selection and intake.²⁰ In line with this, descriptive, but not injunctive,

norms have been shown to guide food in a recent cross-sectional study.²⁸

Given these considerations, eating norms may act as a form of informational social influence (eg, if others are doing it, I probably should be doing it). In line with Deustch and Gerard's⁸ conceptualization of informational social influence, beliefs about the eating behavior of other people may serve as information about perceived utility or social proof, which informs decisions about how much or what to eat. This is also in line with more recent decision-making theories about the influence of social norms.²⁹ In particular, Rimal and colleagues²⁹ propose that descriptive norms influence behavior by altering the extent to which an individual perceives the behavior in question to be beneficial to them (ie, a perceived benefits account). By this account it may be that informational eating norms lead individuals to believe that it would be beneficial to alter their eating behavior (eg, in terms of health or enjoyment) to be in line with the norm and so adapt their behavior appropriately.²⁹ This theory also fits with some of the results observed here and noted by others; that is, human behavior can be guided by a perceived group norm, even when people have little or no motivation to please other people.^{8,9}

Although an informational influence explanation for the findings observed in our review is offered, none of the reviewed studies tested this specific hypothesis. Thus, further studies testing this account will be needed. Another interesting question is whether informational eating norms guide behavior outside of conscious awareness, or are part of a more explicit decision-making process. Given that in some studies the participants did not believe that their behavior was influenced by the informational eating norms,^{11,23} it seems that participants may not have been consciously considering the norm information when making food choices. This might suggest that a nonconscious decision-making heuristic (ie, outside of awareness) could explain the influence of informational eating norms on behavior. In support of this, some preliminary data suggest that eating norms may influence behavior as part of a decision-making heuristic.³⁰

Social Transmission of Eating Behavior

The evidence reviewed here is consistent with the idea that eating behaviors can be transmitted socially. The studies reviewed only examined social influence immediately after exposure to norm information, but survey studies of the habitual intake of peers suggest that intentions to eat healthily are associated with beliefs about the eating habits of peers.^{31,32} It is suggested here that eating norms can guide behavior through informational social influence processes. However, in real-world contexts, it is likely that social desirability and social approval concerns will also explain how and when eating norms guide behavior.

Sociocognitive models of health behavior,^{33,34} including the Theory of Planned Behavior,³⁵ emphasize the importance of the social acceptability of behaviors and how approval from one's immediate peers' informs behavioral intentions. Similarly, the normative model of social eating¹⁴ proposes that during social eating, norms will guide behavior due to concerns over what is normal and therefore an appropriate way to behave.¹⁴

Strengths and Limitations

This review included controlled-experiment studies and the majority employed effective cover stories. Hence, there is little room for alternative explanations other than that social norms influence eating behavior. However, there were relatively few studies and when pooled together there was some inexplicable heterogeneity in the size of effect, even though the data on the direction of the effects were consistent. The majority of studies sampled young female students in the normal weight range from educated backgrounds (university students). If these findings are to be applied to healthy eating interventions, more research will be needed in people from more diverse backgrounds (eg, lower education levels), as well as in men and overweight and obese individuals. Similarly, whether norm effects on eating occur for diverse ethnic groups is not known. Another issue critical to the applied relevance of this work is whether norm effects on behavior are long lasting, because in the studies we reviewed eating behavior was observed immediately after exposure to eating norm information.

Applied Relevance

Taking these points into consideration, the findings of our review may have implications for the development of more effective public health campaigns to promote healthy eating. Policies or messages that normalize healthy eating habits or reduce the prevalence of beliefs that a lot of people eat unhealthily may have beneficial effects on public health. Application of these findings will need careful consideration. It is also possible that if a norm about a desirable eating behavior is poorly communicated, people already adhering to that norm or going beyond it could start to do that desirable behavior less, constituting a form of boomerang effect.⁷ A related intervention approach would be correcting normative misperceptions about the prevalence of unhealthy eating behaviors. This kind of approach has previously been studied in relation to alcohol consumption^{36,37} and using this literature to inform future work will be important.

Emerging Research

A number of important research questions will need to be answered in the future. It would be informative to understand whether overweight and obese individuals respond to eating norms in a similar manner to normal-weight peers. Also, do norms that are not directly related to actual behavior (eg, others' intentions, beliefs, or attitudes) also influence eating behavior? In the interim period between conducting the review and publication of this article, five additional articles have reported research that examines the influence of norm information on eating behavior. One study has shown that the frequency of choosing healthier food options can be increased by a norm message in a naturalistic field experiment.³⁸ In field settings, Prinsen and colleagues³⁹ have shown that providing a visual cue in the environment (ie, how many food items have been previously chosen) to make it appear that most other people choose healthier food options increases frequency of choice. Salmon and colleagues³⁰ reported that healthier food options are more likely to be chosen after it was suggested to participants that this choice was endorsed by the majority of other people and further evidence suggested that the norms provided a form of

decision-making heuristic. Finally, in two studies, Stok and colleagues^{40,41} have shown that providing participants with information about the fruit consumption of other young adults⁴⁰ and adolescents⁴¹ influences self-reported consumption in the subsequent days. These studies are in line with the food choice data formally reviewed here and confirm that making use of norms to promote healthier food options could be a promising public health approach.

CONCLUSIONS

Provision of information about eating norms has moderately sized effects on the quantity—and influences the types—of food people choose. These effects may be explained in part by informational social influence. Public health messages based on eating norms could motivate healthy changes to dietary behavior.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

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