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Short communication

Effects of social modeling on young women's nutrient-dense food intake

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ABSTRACT

We examined whether a same-sex peer's vegetable consumption would predict the number of vegetable pieces eaten by the participant. A total of 116 Dutch women (*M* age = 20.28; *M* BMI = 21.68) participated. Their nutrient-dense food intake was measured during a 15-min break between two tasks, consisting of rating television advertisements. Participants consumed more vegetables when exposed to a peer eating a large number of vegetables than when exposed to a peer eating a small number or nothing. These findings suggest that social modeling processes may be relevant to interventions aimed at encouraging young women's nutrient-dense food intake.

An individual's food intake is affected by a wide array of external factors such as temperature, smell, color, and time (see for a review Stroebele & De Castro, 2004). Among the most powerful factors affecting intake is others' eating behavior. Numerous studies have shown that participants eat very little when their eating companion (i.e., a confederate or actor who pretends to be a participant but actually works for the researcher) eats minimally. When the confederate eats a large amount of food, however, the participant also eats a large amount (Conger, Conger, Costanzo, Wright, & Matter, 1980; Herman, Roth, & Polivy, 2003; Nisbett & Storms, 1974). These modeling effects have proven to be very powerful; people will track the intake of the confederate even after being food deprived for 24 h (Goldman, Herman, & Polivy, 1991) or when they are already sated (Herman et al., 2003). In sum, the amount of food that people consume does not always correspond to their own hunger or satiety level, but often to the amount consumed by those with whom they eat.

So far, studies on modeling of food intake have focused on high-energy-dense[1] palatable foods, with strong modeling effects irrespective of the type of palatable food offered. Young women ate more cookies (Pliner & Mann, 2004; Roth, Herman, Polivy, & Pliner, 2001), mini-pizzas (Herman, Koenig-Nobert, Peterson, & Polivy, 2005), crackers (Conger et al. 1980; Rosenthal & Marx, 1979) or chocolate-coated peanuts (Hermans, Larsen, Herman, & Engels, 2008) when their eating companions ate more of these foods. One area that has not been examined among adults is whether these modeling effects would obtain if the available foods were nutrient-dense foods.[2] Studies conducted among children have demonstrated that the eating behaviors of peers can affect children's food choices and preferences; repeated exposure to a peer eating vegetables may increase the child's preference for this food item (Hendy, 2002). A study by Salvy, Kieffer, and Epstein (2008) found that children's nutrient-dense snack consumption was predicted by their eating companion's consumption of nutrient-dense snack food. Although these studies were designed to examine the effects of social context on food intake in general rather than social modeling of nutrient-dense food intake, their results suggest that modeling effects might influence children's nutrient-dense food intake. Insight into factors that may explain why people eat more (or less) when others eat more (or less) and whether this effect is affected by the energy value (or the perceived healthiness) of the food may be relevant to interventions aimed at promoting healthy eating.

We report here an attempted replication of our previous study, but this time with nutrient-dense foods. We made use of an observational-experimental design using confederates varying in weight status and intake (cf. Hermans et al., 2008). Young women's nutrient-dense food intake was compared under three conditions: with a same-sex model eating nothing (no-intake), with a same-sex model eating a small amount (low-intake), or with a same-sex model eating a large amount (high-intake). It was predicted that women would eat more in the presence of a high-intake peer than in the presence of a low-intake peer. Moreover, since the weight status of the eating companion might be an important factor in the

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[1] Energy density is defined as the amount of available dietary energy per unit of weight (expressed in kcal/g or kJ/g). High-fat foods tend to be high-energy-dense, whereas foods high in water/and or fiber are low-energy-dense.

[2] Nutrient-dense foods are foods that provide substantial amounts of vitamins and minerals and relatively few calories (Dietary Guidelines for Americans, 2005).

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magnitude of modeling effects, we also examined the moderating effects of the confederate's weight status on young women's social modeling of food intake.

Method

Design

We employed a between-participants design with three experimental conditions in which the confederates differed in their food intake: a no-eating condition, a low-intake condition, and a high-intake condition. Female participants were exposed to same-sex confederates who were instructed to eat nothing (no-intake), 3 pieces of vegetables (low-intake) or 10 pieces of vegetables (high-intake). We included a control condition in our design, in which participants ate alone, to test whether the presence of an eating companion increased or suppressed participants' food intake (cf. Levine & Zentall, 1974; Zentall & Levine, 1972). To partly control for the potentially confounding effects of confederates' weight status, we manipulated the appearance of the rather slim confederates to a more normal-weight appearance by letting them wear a soft silicon belt beneath their clothes, making them visibly thicker around their waist (cf. Hermans et al., 2008). Table 1 shows the distribution of the participants over the study's experimental conditions.

Participants

Participants were 141 female undergraduate students (mainly psychology or educational science) aged 16–31 ($M = 20.50$; $SD = 2.64$). Participants were tested either alone ($N = 20$) or together with a previously unknown same-sex peer ($N = 121$). Twenty-five participants were excluded afterwards: four underweight (BMI = kg/m^2, <18) and 18 overweight (BMI > 25) participants, one participant who expressed suspicion about the actual aim of the study, and three participants who recognized the confederate as a fellow student. (One of these participants was also overweight.) The final sample, then, consisted of 116 female students of whom 17 were in the control condition. They had a mean age of 20.28 ($SD = 2.49$) and a mean BMI of 21.68 ($SD = 1.65$).

Confederates

Confederate models were recruited by e-mail advertisements calling for female research assistants for a new research project. After a short interview, we selected nine female students as confederates, all of whom were rather slim and sociable. They had a mean age of 22.22 ($SD = 1.99$) and their BMIs ranged from 18.69 to 22.38 ($M = 20.30$; $SD = 1.45$). Before the start of each session, the confederate was told to eat nothing, or a small amount, or a large amount of vegetables during the break and to wear the tummy belt or not. Confederates were randomly assigned to the experimental conditions.

Table 1
Distribution of participants over the study's experimental conditions.

Weight status conditions	Eating conditions			
	No-intake	Low-intake	High-intake	Total
Slim	17	14	17	48
(Manipulated) normal weight	16	17	18	51
Total	33	31	35	99

Note: In the control condition 17 women participated; in the whole study 116 women participated.

Procedure

All participants were recruited via the internet sign-up program of the Behavioural Science Institute of the Radboud University Nijmegen. Participants registered for a study on evaluation of TV commercials, which was a cover story to prevent the participants from becoming aware of the true aim of the study. Registration for our study was restricted to those female students who had not participated in our previous study on modeling of food intake (Hermans et al., 2008).

The experiment took place in a laboratory furnished as an ordinary living room. We created a relaxing atmosphere by using dimmers and furnishing the room with two comfortable couches that were positioned at a 90° angle, a coffee table, and a side-table on which we placed a pitcher of water, four glasses, and a bowl of vegetables. The food and drinks were easily reachable by both persons. A wall unit with a projector, a DVD player and a sound system was located behind one of the couches.

The experimental sessions took place on weekdays from 10 a.m. until 5 p.m. in the period from November 2007 to February 2008. All sessions took about 60 min in total. The sessions started with a 5-min task, in which the participant and the confederate individually evaluated five neutral commercials (none of which included women or references to weight or food). After this task was completed, there was a 15-min break. Participants could spend their time as they wished but were obliged to stay in the room. The experimenter pointed out that they were free to help themselves to water and vegetables. Before leaving the room, the experimenter put on some light background music (Novastar, 2000). The confederate was instructed to take a piece of vegetable immediately at the beginning of the break if she had been instructed to eat 3 or 10 pieces of carrot or cucumber. The confederates were free to choose between the two vegetables. Standardized time instructions were given by a small light in the corner of the room. When the confederate saw the light flashing, she had to pick a piece of carrot or cucumber (cf. Hermans et al., 2008). Behavior during the break was recorded by unobtrusive video cameras hidden in the corners of the room.

After the break, the participant and the confederate had to evaluate the same commercials again, but now they were free to engage in a discussion. This task took approximately 5 min. Next, the confederate went into a different room and the participant stayed in the experimental room to complete extensive questionnaires about the atmosphere of the break, the person with whom the break was spent, her own and the other person's body figures, hunger, liking of vegetables, and dieting intentions. Filling in these questionnaires took approximately 25 min. After the participant had completed the questionnaire, the experimenter measured her height and weight. Finally, the participant was thanked and received payment (€8) or course credits (for educational requirements). Debriefing took place after the data collection for the entire experiment was completed.

Measures

Food intake

Food intake was measured by counting the total number of pieces of vegetables consumed by each participant. Since the two kinds of snacks offered differed both in weight and caloric value, we measured the single pieces of vegetables consumed. Before starting our study, we asked 15 female undergraduate and graduate students what kind of vegetables they liked to consume as nutrient-dense 'snack food'. They could choose between cherry tomatoes, cucumber, small carrots, cauliflower, blanched celery, radish, and gherkin. Cucumber and small carrots were the most preferred snacks among these women. The snacks were bite-sized

so that they were easy to eat. Both vegetable pieces (i.e., the cucumber slices or the pieces of carrots) were of approximately the same size and weight.

Hunger

Participants rated their subjective hunger on a 10-point scale from 'not at all hungry' to 'extremely hungry' (Hermans et al., 2008). Although the best option to control for individual variations in hunger is to ask participants to refrain from eating for a certain period of time before the experiment (Polivy, Heatherton, & Herman, 1988), we assumed that this requirement would have disclosed the actual aim of the study and thereby distorted participants' natural eating behavior (see Anschutz, Engels, Becker, & Van Strien, 2008). To avoid this bias, we controlled for individual differences in hunger afterwards.

Liking of cucumber and carrot

Participants reported their liking of the available nutrient-dense food snacks on a 10-point scale from 'did not like it at all' to 'like it very much'.

Confederate's body figure

Participants' perceptions of the confederate's body figure were measured using nine drawings with female figures (based on Stunkard, Sorensen, & Schulsinger, 1983). We split the figures into upper- and lower-body drawings, so that the participant could also choose the figure that corresponded most closely with that part of the confederate.

Perception of the break

Participants' perception of the atmosphere of the break was assessed by asking about how they experienced the break. The following components were included: 'relaxing', 'boring', 'nice', 'annoying', and 'uncomfortable'. The responses ranged from *not at all* to *very much*.

Perception of the confederate

Participants' perceptions of the personal characteristics of the confederate were measured on a Likert scale with responses ranging from 1 to 7. An example of an item is 'The impression the other is conveying is 1 – boring to 7 – enjoyable'.

Height and weight

The research assistant measured each participant's height and weight following standard procedures (Lohman, Roche, & Martorell, 1998). Height was measured to the nearest 0.5 cm using a stadiometer (Seca 206, Seca GmbH & co. kg., Hamburg, Germany) and weight was measured to the nearest 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & co. kg., Hamburg, Germany).

Restrained eating

Restrained eating was measured by the dietary restraint subscale of The Dutch Eating Behavior Questionnaire (DEBQ; Van Strien, Frijters, Bergers, & Defares, 1986).

Statistical analysis

Before performing our main analyses, we first examined whether participants differed with respect to potential confounding variables. BMI, dietary restraint, and participants' liking of the vegetables did not significantly correlate with the total intake ($p > 0.1$) and therefore were not included in the model as potential confounds. Using analysis of variance, we also examined whether participants in the different conditions differed with respect to how they judged the break or the personal characteristics of the confederates. To answer our main question, an ANOVA was used to examine the main effect of the modeling conditions. Additionately, we checked, by using *t*-tests, whether the participants perceived the confederate's figure as different in the slim and the normal-weight conditions. Subsequently, we investigated with an ANOVA whether there was an interaction between the confederates' intake and appearance on the participants' total intake. All analyses were performed with SPSS 15.0 (SPSS for Windows, Rel. 15.0.1.2006. Chicago: SPSS Inc.).

Table 2
Total number of nutrient-dense food snacks consumed by the participants.

Modeling condition	*N*	*M*	*SE*
No-intake	33	1.39	0.42
Low-intake	31	1.48	0.43
High-intake	35	2.71	0.40
Alone (control)	17	2.35	0.59

Results

Manipulation checks

Participants in the different conditions did not differ in BMI, dietary restraint, and hunger ratings or liking of the vegetables available (p's > 0.10); implying that randomization over conditions was successful. Further, no differences were found between participants in their perceptions of the atmosphere of the break in the different conditions. More than 80% very much liked being engaged in the experiment and perceived the break as relaxing and comfortable. Participants did not differ in their ratings of the confederates' characteristics (e.g., friendliness or kindness). No differences were found among confederates in how they were perceived by the participants ($p > 0.05$).

Food intake

Table 2 shows the amounts consumed in the various conditions. Differences in the overall intakes of vegetables among the three modeling conditions were found $F(2, 96) = 3.24$, $p < .05$.[3] When exposed to a high-intake confederate, participants consumed significantly more vegetables than when exposed to a low-intake confederate $t(64) = -2.43$, $p < 0.05$ or a no-intake confederate, $t(66) = -2.09$, $p < 0.05$. The size of the modeling effect of nutrient-dense food, however, was rather small (Cohen's $f^2 = 0.08$).

Additional analyses

Participants' ratings of the confederate's appearance did not vary significantly as a function of the appearance manipulation, $t(96) = -1.60$, $p = 0.18$. The slim confederates' figures were rated 3.09 ($SD = 0.75$), whereas the figures of the (manipulated) normal-weight confederates were rated 3.31 ($SD = 0.91$) (Stunkard et al., 1983). No differences were found for the participants' upper- or lower-body ratings of the confederate's figure in the two appearance conditions. Thus, participants did not notice the difference between the slim and (manipulated) normal-weight confederate. Additionately, we found no main effect of confederates' weight status on participants' total intake, $F(1, 97) = 0.12$, $p = 0.73$. Further, we found no interaction between modeling condition and confederates' weight status on participants' total intake, $F(2, 93) = 0.43$, $p = 0.65$.

We also tested whether the use of different confederates affected our findings. To test whether participants consumed

[3] When comparing the three separate modeling (i.e., no-, low-, and high-intake) conditions with the control condition, no significant differences were found between participants eating with a confederate and participants eating alone.

significantly more or less vegetables when in the presence of a particular confederate, we used the confederates as factor in our ANOVA. However, no differences were found among confederates; no confederate individually induced higher or lower intake. We also checked whether variations in participants' BMIs or dieting intentions influenced the effects found. However, there were no significant two- or three-way interactions between participants' BMI (continuous variable) or dietary restraint and eating and weight conditions.

Discussion

The current study examined social modeling effects of nutrient-dense foods in young women. It confirmed previous findings that normal-weight young women model other people's food intake (Conger et al. 1980; Herman et al., 2005; Roth et al. 2001); young women adapted their intake of vegetables to that of their eating companion. To our knowledge, this is the first study in which social modeling is linked to young women's nutrient-dense food intake. A comparison between the size of the modeling effects of this study and a study with energy-dense foods using a similar paradigm and population (cf. Hermans et al., 2008), however, reveals larger effects in the study with high-calorie snacks (Cohen's $f^2 = 0.08$, and Cohen's $f^2 = 0.47$, respectively). That is, young women are more likely to model a same-sex peer when the food is energy-dense than when the food is nutrient-dense. We propose that when the food is perceived as being typically healthy and low in energy, young women may be less concerned about the appropriateness of the quantity they consume than when the food is energy-dense, limiting the use of food-related impression-management strategies. They may think that they can eat as much as they would like without gaining weight or conveying negative impressions, so matching the other's intake becomes less important. On the other hand, when the food is energy-dense it may be more important for young women not to endanger their feminine identity. Therefore, matching their intake to that of the other person might be a good solution to avoid negative judgments regarding their intake. More specifically, they can afford to eat a lot only when the other person eats a lot.

A few limitations warrant discussion. First, although we tried to create a setting that was as naturalistic as possible (i.e., a living-room setting), this context may be still not be representative for young women's daily nutrient-dense food consumption. Even though this study found that young women modeled the intake of a same-sex stranger, future studies are needed to examine whether young women would model the nutrient-dense food intake of strangers, acquaintances or relatives in more natural (i.e., less controlled) eating settings, such as restaurants or cafeterias. Second, because the current study used a snack situation to examine social modeling of food intake, the modeling effects may have been accentuated. That is, for snack situations there are few guidelines (other than other people's intake) that can be used as an indicator of how much you should eat (Herman & Polivy, 2005). Therefore, the young women may have been more vulnerable to the intake of a same-sex peer insofar as they used her intake for guidance as to the appropriate amount to consume (Herman et al., 2003). Future studies might include serving young women with complete meals at a mealtime, which might provide us with useful information on social modeling in situations for which a pre-existing intake norm already exists. Third, as participants did not notice the difference between the slim and (manipulated) normal-weight confederates, we conclude that our weight manipulation was too weak to produce any effects in this context. Therefore, this study cannot address whether models' weight status affects modeling of nutrient-dense food intake. Although it is difficult to manipulate the confederates' physical appearance substantially within an experimental design, future research might use more realistic presentations of varying weight status for the confederates who serve as models to increase the possibility that the participants will notice any weight differences between the models.

In conclusion, our results suggest that modeling also occurs for nutrient-dense foods. However, the magnitude of the modeling effect in the present study (using nutrient-dense food) was considerably smaller than was the effect found in a previous study (using energy-dense foods). Hence, with regard to practical implications, the current findings might inform strategies to improve young women's eating behaviors. We propose that interventions should focus more on the prevention of modeling of energy-dense foods instead of encouraging the modeling of nutrient-dense foods. Future intervention studies should examine which strategies work best to improve young women's eating behaviors.

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