Appetite 58 (2012) 864–872

Contents lists available at SciVerse ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Research report

Social norms in food intake among normal weight and overweight children ☆

Kirsten E. Bevelander *, Doeschka J. Anschütz, Rutger C.M.E. Engels

Behavioural Science Institute, Radboud University Nijmegen, P.O. Box 9104, 6500 HE Nijmegen, The Netherlands

ARTICLE INFO

Article history:
Received 28 November 2011
Received in revised form 16 January 2012
Accepted 3 February 2012
Available online 10 February 2012

Keywords:
Children
Overweight
Peer influence
Food intake
Social modeling
Food norms

ABSTRACT

This experimental study investigated whether children's food intake is influenced by a peer's intake directly and over time and whether this depends upon weight status. The study consisted of two sessions taking place at Dutch primary schools. During the first (social modeling) session, the participants ($N = 223$) were asked to solve a puzzle with a same-sex normal weight confederate who was instructed to either eat nothing, a small or large amount. In the second session (about two days later), the participants had to solve the puzzle alone while they could freely eat. The study involved a three (no, low, high confederate intake) by two (normal weight, overweight) between-participants design. An interaction effect in the first session suggested that overweight children might be triggered to (over)eat when a peer eats a high amount of snack food, whereas the food intake of normal weight children seemed to depend on whether the confederate did actually eat, regardless of the amount. The guideline set during the first session persisted over time and influenced food intake during the second session, while differences between normal- and overweight children became insignificant. Peers can set an example as to what food intake is appropriate which could affect long-term food intake.

Introduction

Childhood obesity leads to a higher risk of adult obesity and increases the probability of health problems such as diabetes and cardiovascular disease (Lobstein, Baur, & Uauy, 2004; Reilly et al., 2003). Children rarely eat alone, that is, they generally consume their meals and snacks in the presence of caretakers, siblings, or peers at home or at school (Birch & Fisher, 1998; Eccles, 1999). While a child's dietary intake is strongly influenced by parents and caregivers (Oliveria et al., 1992), it is also strongly influenced by peers at school (Feunekes, de Graaf, Meyboom, & van Staveren, 1998).

Children develop social competence and behavioral skills through observation and modeling behavior (Laible & Thompson, 2007). Modeling studies in food intake have examined whether a naïve participant adopts the food intake of an experimental confederate (e.g., an instructed peer). Studies in adolescents and adults have shown that people model eating behavior (Hermans, Larsen, Herman, & Engels, 2009). Nevertheless, they do not always match their confederates when it comes to amount and pace of food intake (Herman & Polivy, 2005). Therefore, it might be that people use others' food intake as a permissive guideline for how much they can eat (Herman & Polivy, 2005; Herman, Roth, & Polivy, 2003). No previous studies in adolescents and adults have investigated whether people adhere to these guidelines over time. Only few studies have examined long-term effects of social modeling in children by use of pre-instructed teachers or peers as role models (confederates), however, to promote intake of novel or healthy foods (Hendy, 2002; Reverdy, Chesnel, Schlich, Köster, & Lange, 2008). The studies did not find long-term effects of peer models. To our knowledge, long-term effects in social modeling studies were not investigated in relation to the intake of palatable snacks while individuals are often in company of others during snack occasions.

Empirical research has demonstrated that young girls consume more after seeing a video-confederate eat a large portion rather than a small portion of snack food (Romero, Epstein, & Salvy, 2009). A study by Salvy et al. in which overweight and normal weight dyads were tested in a free-eating setting, showed that young girl's snack intake was predicted by the co-eater's weight status (Salvy, Romero, Paluch, & Epstein, 2007). In general, the overweight dyads ate more than normal weight dyads. Moreover, overweight girls eating with an overweight peer were found to consume more than when eating with a normal weight peer whereas normal weight girls who ate with overweight girls did not eat more than when eating with a normal weight peer, presumably due to prejudicial attitudes towards overweight status. An additional study of Salvy et al. demonstrated that the presence of a normal weight peer affects the amount of food intake in

☆ *Acknowledgements:* The authors would like to acknowledge the teachers and school children of the primary schools and the students of the Hogeschool Arnhem and Nijmegen (HAN) for their help during the study. The present study was supported by a Grant of the Behavioural Science Institute of the Radboud University Nijmegen, The Netherlands.

* Corresponding author.
E-mail address: K.Bevelander@bsi.ru.nl (K.E. Bevelander).

0195-6663/$ - see front matter © 2012 Elsevier Ltd. All rights reserved.
doi:10.1016/j.appet.2012.02.003

normal weight and overweight children (Salvy, Coelho, Kieffer, & Epstein, 2007). In general, overweight children consumed more than normal weight children when they were alone. Also, overweight children were found to consume more when alone than when in the presence of a normal weight peer whereas normal weight children consumed more in presence of others than when alone. Both studies provided evidence that the participant's consumption was influenced by the co-eater and that overweight children inhibited their food intake when in the presence of a normal-weight peer. Herman et al. (2003) explained these differences by referring to social facilitation and stigmatization, i.e. in the presence of others, individuals consume more (de Castro & Brewer, 1991; Redd & de Castro, 1992) or less than when eating alone, depending on circumstances such as the presence and appearance of co-eaters (Hermans, Larsen, Herman, & Engels, 2008).

The present study tested whether the food intake of a normal weight peer had an immediate effect on the food intake of normal-weight and overweight children and whether the influence of the peer's intake on consumption was maintained over time. The study combined a social modeling experiment with a free-eating session held a few days later at school. It was hypothesized that in the first session (the modeling experiment), normal weight as well as overweight children would adapt their intake to the food intake of a normal weight peer confederate. A second aim of the study was to test whether the guideline or intake norm established during the first session would affect children's food intake when they ate alone in the second session (the free-eating session). Based on literature that showed differences in food intake between normal weight and overweight children when in presence of a peer or alone, it was tested whether there was an interaction effect between weight status and the peer's food intake. In the second (free-eating) session, it was expected that normal weight children kept to the social guideline that was previously set by a peer whereas overweight weight children would not keep to this guideline and have a higher food intake than normal weight children due to the absence of a normal weight peer.

Methods

Design and participants

This study involved a 3 (experimental condition: no, low, high confederate intake) by 2 (participant weight status: overweight, normal weight) between-subjects experimental design testing the effect on participant's food intake directly in the first (social modeling) session and over time in the second (free-eating) session.

For the first (modeling) session, overweight and normal weight participants were paired with normal weight confederates. To avoid a confederate effect, each confederate was paired with a participant only once. The confederates were instructed to eat 10 chocolate-coated peanuts (high-intake condition), 3 chocolate-coated peanuts (low-intake condition) or nothing (no-intake condition). The dyads were randomly assigned to one of the three intake conditions. Overweight children were only included as participants, but normal weight children could be either participant or confederate. The experimenters randomly assigned participants to confederates on an ad hoc basis at school with the criteria that they were the same sex but not classmates. Next, the pairs were randomly assigned to the experimental conditions. This matching procedure did not affect the outcomes (see Table 1 for randomization checks).

Figure 1 depicts a flow diagram of the recruitment procedure of the study. All schools that participated in this study were schools of which more than 70% of the children had a West-European or Dutch background. Further inclusion criteria for this study were that the children were without medical conditions that affected their intake and were old enough to understand the questionnaire. The sample consisted of 474 children (237 participants) who participated in this study once as participant or as confederate. The majority of children had two Dutch caregivers (93%), 2.9% had one Dutch caregiver and one caregiver from another Western-European country, 2.7% had one Dutch caregiver and one caregiver from the United States, Canada, Nigeria, Indonesia or Morocco and the remaining 1.4% had both parents of similar foreign nationality (Turkey, Dominican Republic). Fourteen dyads were excluded from the analyses because the confederate did not follow instructions, the participant became aware of the aim of the study, or the participant could not participate in the second (free-eating) session. Therefore, the final sample consisted of 223 participants.

The present study was approved by the ethical committee of the Faculty Social Sciences, Radboud University Nijmegen. The study was registered at the Dutch Trial Register as NTR2055. Written informed consent was obtained from all caregivers.

Setting and procedure

From February through July 2009, experimental sessions were conducted in the children's primary schools. All experimental sessions took place within one week and on schooldays between 8:30 h and 15:30 h. Each session took 10 min and was videotaped. In the first session, a room was furnished with at least one table and two chairs, each chair on opposite sides of the table. Also, two glasses of water, two bowls of chocolate-coated peanuts, and one 100-piece children's puzzle were provided. The room for the second session was furnished for one person and contained six bowls of snacks (savory snacks and sweet snacks). The experimenters made sure that all the bowls with food were filled up over the brim of the food bowl before each session. The video camera was placed on a tripod at the side of the table and was connected to a transmitter-sender 2.4 GHz audio/video device and remote LCD monitor that enabled the experimenters to observe the children in another room. The experimenters checked the children's activities at random times and when the confederate received a signal to pick a chocolate peanut to see whether the confederate followed instructions. At the end of each session, the experimenter administered a questionnaire. To avoid effects that might be triggered by suspicion about the research topic, a cover story was created and delivered before starting the experiments in each school, that is, each class was told that the experimenter was interested in different strategies used to solve a puzzle while working together or alone. In addition, the confederates were told that they would be involved in a secret mission to make even more fun out of the puzzle task. So, the experimenters were also interested whether they could keep a secret while cooperating with someone else. After the experimental session ended, the experimenters asked the confederates if they could keep their secret for another one or two days so it was possible to also surprise other children with a secret mission. Before each session, the experimenters came to pick up the confederate or participant out of their classroom and checked whether the participant was not already aware of the actual aim of the study before participating. The children who inquired about the video camera were told that the session was videotaped to recapture their cooperation and technique for solving the puzzle. The participants and confederates were debriefed after the completion of data collection.

For the first session, each normal weight confederate was instructed before the participant entered the room. The confederates were told about their secret mission: They were asked to eat a chocolate-coated peanut only when they were signaled by "the

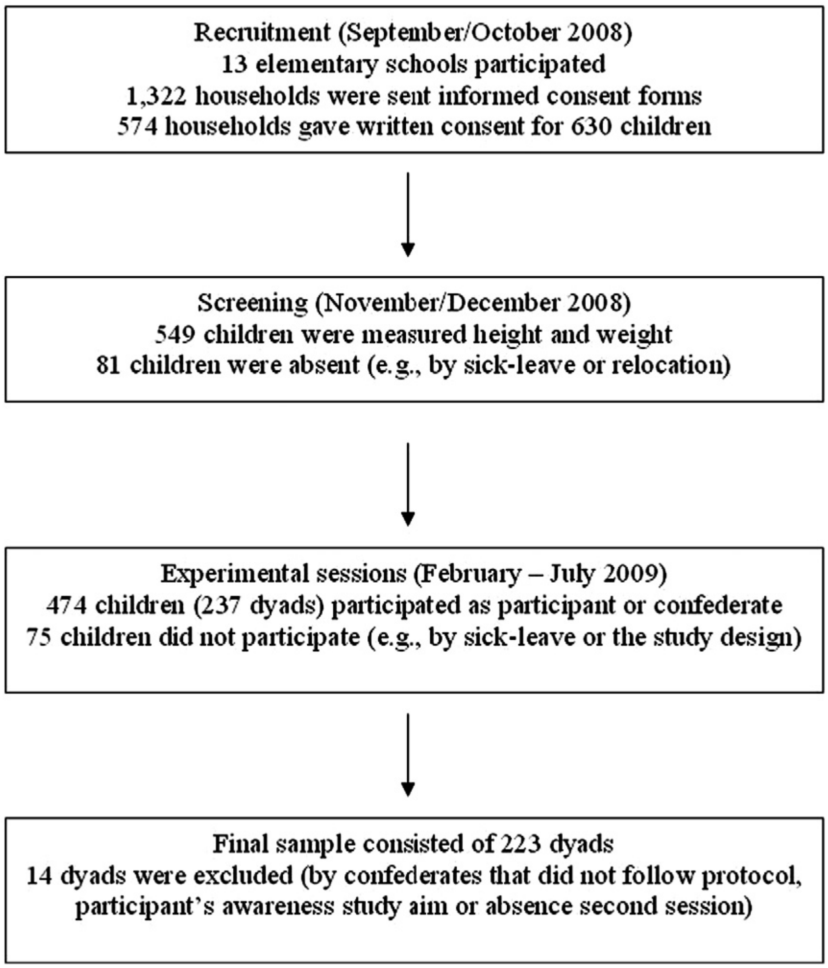

Fig. 1. Flow diagram of the recruitment procedure.

buzzer." The experimenter signaled them with a small vibrating device (buzzer), which the confederates wore in either their pocket or sock. The experimenter set the buzzer interval to control the timing of food intake. In the various food intake conditions, the confederates were buzzed immediately after the experiment started and every minute (high-intake) or every three minutes (low-intake) thereafter. Before the participants entered the room, they were told there would be food and water available and that they could eat as little or as much of the food as they desired. After 10 min, two experimenters entered the room and asked the children how they were moving along with the puzzle. The participants were then led to another room where the questionnaire was administered. The participants were informed that their answers would be kept confidential and their anonymity was ensured. The experimenter read all the questions aloud, and the participants could also read the questions and give the answers.

The second session took place at least a day ($M = 2.0$; SD = 1.7) after the first session. Before entering the room, the participants were told that they would be given the same puzzle they had in the first session and that snacks and water were available. As in the first session, the experimenter entered the room after 10 min and administered a second questionnaire.

Measures

Body weight

The experimenter measured individual height and body weight according to standard procedures (without shoes but fully clothed). Height was measured to the nearest of 0.5 cm using a stadiometer (Seca 206, Seca GmbH & Co., Hamburg, Germany) and weight was measured to the nearest of 0.1 kg using a digital scale (Seca Bella 840, Seca GmbH & Co.). The body mass index (BMI) for each child was calculated using the formula: weight [kg]/height^2 [m]. It was determined whether the children were underweight, normal weight, overweight or obese using a relative measure for BMI (*z*-BMI) and internationally based overweight and obese cut off points for boys (>94.5 BMI centile with z-score > 1.60) and girls (>93.5 BMI centile with z-score > 1.52) (Cole, Bellizzi, Flegal, & Dietz, 2000; Cole & Roede, 1999). Underweight boys (<2nd BMI centile with z-score <−2.2) and girls (<3rd BMI centile with z-score <−1.9) were excluded from participation (Cole, Flegal, Nicholls, & Jackson, 2007). These cutoff points were representative of current z-BMI standards for Dutch children (StichtingVoedingscentrumNederland., 2011). This study refers to overweight as well as obese children due to the small number of obese children ($n = 11$) in the study sample.[1]

Food intake

The experimenter weighed the bowls of snack food before and after each session using a digital scale (Kern 440, Kern & Sohn, Balingen, Germany). For both sessions, actual food intake was

[1] The sample was tested by excluding obese participants from the analyses to determine whether they affected the findings but this was not the case.

calculated by subtracting the weight in grams of the bowls of test food at the start and end of each session. The consumed grams of test food were converted into kilocalories (kcal) and used as the dependent variable in the analyses. In the first session, the children were offered one kind of test food (chocolate-coated peanuts) (Hermans et al., 2009). In the second session, the children were offered both sweet (chocolate-coated peanuts, chocolate cookies, banana-flavored sweets) and savory (chips, seasoned coated peanuts, salty biscuits) snacks.[2] A variety of foods was used to examine whether a social norm for food intake that might have been set during the first session would be maintained or spillover into other palatable food products in the second session.

Measurements questionnaire

Hunger

To prevent participants from guessing the research topic, they were allowed to eat freely in their daily routine. The state of hunger was controlled for since it might influence the participants' food intake. After both sessions, the participants had to indicate their hunger on a Visual Analogue Scale (VAS) (0 cm, *not hungry at all*; 15 cm, *very hungry*). Visual analogue scales have been proven to be as reliable as Likert scales, and they have been used in samples with young children (Anschütz, Engels, & Van Strien, 2009).

Time of day

Participants' food intake might be related to time of day. Afternoons are more commonly snack time than mornings (Cross, Babicz, & Cushman, 1994). In practice, it was impossible to test the children at the same time of day in the first and second sessions. Therefore, the actual time of day on which the participant started the session was controlled for in the analysis.

Liking of the test food

In the first session, liking of the test food was controlled for since this might affect the participants' food intake. The participants were asked to indicate how much they liked the snack food on a VAS (0 cm, *not at all*; 15 cm, *very much*) (Anschütz et al., 2009). For the analysis of the second (free-eating) session, the mean scores for sweet and salty foods were computed.

Liking of the task

To measure the extent to which the participants liked the task, a VAS was used (0 cm, *do not like at all*; 15 cm, *like it a lot*) for both sessions (Anschütz et al., 2009; Hermans et al., 2008).

Liking and familiarity of the confederate

Liking and familiarity of the confederate has been shown to influence food intake (Salvy, Vartanian, Coelho, Jarrin, & Pliner, 2008). To measure the extent to which the participants liked the confederate, a VAS was used (0 cm, *do not like at all*; 15 cm, *like him/her a lot*). Furthermore, participants were asked whether they knew the confederate using the with answers *not at all*, *have seen him/her in the neighborhood/at school*, *I sometimes play with him/her* or *he/she is a good friend*. Next, they were asked to rate their familiarity with the confederate on a VAS (0 cm, *not at all*; 15 cm, *very good*).

Grade difference between participant and confederate

Children might model older peers more frequently than younger peers and differentially affect each other (Schunk, 1987). Children who differ in age but are in the same grade might not be perceived by another to be older or younger. Therefore, the grade of the confederate was considered in the analysis by rating whether the confederate was in a lower (0), the same (1), or higher grade (2) than the participant.

Analytical strategy

Randomization checks were performed by using one-factor analysis of variance to test for differences among the three experimental groups. Next, Spearman's rank and Pearson's correlations were performed for the model variables of age, sex, BMI (*z*-scores), hunger, liking of the test food, liking of the task, liking of the confederate, familiarity with the confederate, grade difference between the participant and the confederate (Spearman's rho), time of day and food intake to determine which variable had to be controlled for in the main analyses.

For first session, analyses of covariance was performed to examine the main effects for experimental condition (no, low, high confederate intake) and BMI (*z*-score) on the total food intake (kcal) and the interaction effect between the BMI (*z*-score) groups and the experimental conditions on the total food intake (kcal). Hunger, liking for the test food, and time of day were statistically controlled for since these variables correlated significantly with food intake. For the second session, analysis of covariance was performed to examine the main effects for experimental condition (no, low, high confederate intake) and BMI (*z*-score) on the total food intake (kcal) and the interaction effect between the BMI (*z*-score) groups and the experimental conditions on the total food intake (kcal). The variable of hunger, liking of sweet and salty test foods and time of day were statistically controlled for in the second session. Additional analysis (MANCOVA) was performed for the second session, testing the main effects for experimental condition (no, low, high confederate intake) and BMI (*z*-score) on sweet and salty food intake (kcal) and the interaction effect between the BMI (*z*-score) groups and the experimental conditions (kcal). Hunger, liking of sweet and liking of salty test foods, and time of day were statistically controlled for.

Pairwise comparisons with Bonferroni correction were carried out to determine significant differences between the three experimental conditions. Following a significant interaction, simple contrast comparisons were carried out to determine which differences within (normal weight compared to overweight children for each of the three experimental conditions) and across (no-intake compared to low-intake compared to high-intake for each of the two weight groups) experimental condition means were significant. The simple contrast analysis breaks down an interaction term and looks at the effect of one independent variable at individual levels of another independent variable. The test uses the error term and degrees of freedom from the entire design (Field, 2005). For both sessions, Cohen's f^2 effects size was calculated to assess the effect size over the three conditions (Cohen, 1988). Cohen's f^2 is used for three or more groups, and effect sizes .02, .15, and .35 are termed small, medium, and large, respectively. The effect size quantifies the size of the difference between groups. In a between-subjects design, approximately 20 participants per group are required to detect a moderate to large effect size (Cohen, 1992). In addition, the effect sizes between the experimental conditions and weight groups were calculated with Hedges *g*, which takes into account sample size and accordingly adjusts to the overall effect size (Hedges & Olkin, 1985). Effect sizes .20, .50, and .80 are termed small, medium, and large, respectively.

[2] Presenting more or less food might influence intake. Therefore, all the bowls were filled up over the brim of the food bowl before each session: (M = 685.90 ± 87.06 g chocolate-coated peanuts; M = 444.66 ± 47.20 g banana-flavored sweets; M = 377.54 ± 34.62 g chocolate cookies; M = 435.14 ± 43.85 g seasoned coated peanuts; M = 261.45 ± 21.11 g salty biscuits; M = 252.05 ± 17.26 g chips).

Table 1
Randomization checks of variables measured by experimental condition[a] for the first session.

Weight status / Variables	No-intake confederate ($n = 74$) Normal ($n = 48$)	Over ($n = 26$)	Total ($n = 74$)	Low-intake confederate ($n = 77$) Normal ($n = 51$)	Over ($n = 26$)	Total ($n = 77$)	Hig-intake confederate ($n = 72$) Normal ($n = 46$)	Over ($n = 26$)	Total ($n = 72$)	*P* value[b]
Age (y)	8.70 ± 0.90	8.80 ± 0.90	8.80 ± 0.90	8.60 ± 1.00	8.40 ± 1.10	8.50 ± 1.00	8.70 ± 1.00	8.60 ± 0.90	8.64 ± 0.97	0.217
	7–10	7–10	7–10	7–10	7–10	7–10	6–11	7–10	6–11	
Boys/girls (n/n)	28/20	13/13	41/33	27/24	12/14	39/38	22/24	15/11	37/35	0.822
BMI (z-score)	0.60 ± 0.70	2.00 ± 0.40	1.10 ± 0.90	0.50 ± 0.80	2.30 ± 0.50	1.10 ± 1.10	0.50 ± 0.60	2.10 ± 0.60	1.10 ± 1.00	0.956
	−1.30–1.59	1.53–3.24	−1.30–3.24	−1.13–1.53	1.62–3.20	−1.13–3.20	−0.96–1.58	1.53–3.80	−0.96–3.80	
Hunger[c]	3.90 ± 3.80	2.40 ± 3.70	3.40 ± 3.80	3.10 ± 3.30	3.30 ± 3.50	03.10 ± 3.30	3.70 ± 3.90	3.50 ± 3.70	3.60 ± 3.77	0.758
	0.00–13.20	0.00–14.90	0.00–14.90	0.00–13.00	0.00–12.50	0.00–13.00	0.00–15.00	0.00–14.90	0.00–15.00	
Liking test food[c]	12.10 ± 3.50	10.50 ± 4.70	11.50 ± 4.00	10.80 ± 4.60	11.20 ± 4.60	10.90 ± 4.50	12.00 ± 3.70	11.60 ± 4.10	11.86 ± 3.81	0.365
	0.10–15.00	0.00–15.00	0.00–15.00	5.00–15.00	5.50–15.00	0.00–15.00	0.00–15.00	5.50–15.00	0.00 – 15.00	
Liking of task[c]	11.90 ± 2.20	11.40 ± 2.90	11.70 ± 2.40	11.50 ± 2.50	12.40 ± 2.50	11.80 ± 2.50	11.80 ± 3.30	12.00 ± 2.50	11.87 ± 3.00	0.919
	7.00–15.00	5.50–15.00	5.50–15.00	5.00–15.00	5.50–15.00	5.00–15.00	0.00–15.00	5.50–15.00	0.00–15.00	
Liking confed[c]	13.50 ± 1.40	13.60 ± 1.80	13.50 ± 1.50	13.30 ± 2.40	13.60 ± 1.40	13.40 ± 2.10	13.40 ± 2.10	12.80 ± 2.40	13.20 ± 2.20	0.558
	8.90–15.00	8.00–15.00	8.00–15.00	3.00–15.00	9.50–15.00	3.00–15.00	7.00–15.00	6.00–15.00	6.00–15.00	
Familiarity confed[c]	9.00 ± 3.60	9.40 ± 3.20	9.10 ± 3.50	8.50 ± 4.30	6.90 ± 3.70	8.00 ± 4.10	08.60 ± 4.10	09.10 ± 4.10	8.79 ± 4.11	0.187
	1.00–15.00	5.00–15.00	1.00–15.00	0.00–15.00	0.50–15.00	0.00–15.00	0.00–15.00	0.70–15.00	0.00–15.00	
Grade confed[d] (n/n/n)	17/17/14	12/7/7	29/24/21	15/18/18	8/11/7	23/29/25	20/13/13	4/15/7	24/28/20	0.584
Time of day	11:11 ± 1:58	10:21 ± 1:47	10:53 ± 1:56	10:56 ± 1:49	10:52 ± 1:39	10:55 ± 1:45	11:29 ± 1:52	10:55 ± 1:47	11:17 ± 1:51	0.745
	8:45–15:00	8:30–14:55	8:30–15:00	8:35–14:45	8:40–14:25	8:35–14:45	8:35–14:55	8:40–14:40	8:35–14:55	

[a] Values are in means ± SDs, minimum–maximum.
[b] Reflects the differences in total means between intake conditions by one-factor ANOVA or Pearson's chi square test.
[c] cm on VAS.
[d] Coded as lower/similar/higher grade.

Results

Descriptives

The study sample consisted of 223 participants of which 145 children (53% boys) were normal weight and 78 (51% boys) were overweight. The mean (SD) age of the children in grade 2 ($n = 81$) was 7.70 (0.60) *y*, in grade 3 ($n = 66$) 8.65 (0.54) *y*, and in grade 4 ($n = 76$) 9.61 (0.52) y.

Randomization checks

Randomization checks were performed to test for differences between the conditions in age, sex, BMI (*z*-scores), hunger, liking of test food, liking of the task, liking of and familiarity with the confederate, grade difference between the participant and confederate, and time of day in the first session. Table 1 summarizes the means and standard deviations (SDs) for all variables for the first session across each condition. No differences ($P > 0.10$) were found between the conditions, which indicated that randomization was successful. Additionally, differences were tested between the conditions for the variables of liking of the task, hunger and time of day for the second session. No differences were found between conditions ($P > 0.10$).

Food intake

Spearman's rank and Pearson's correlations were performed for the model variables and food intake. For the first session, age ($r = -0.24$, $P = 0.72$), sex ($r_s = -0.08$, $P = 0.25$), BMI (*z*-scores) ($r = -0.03$, $P = 0.67$), liking of the task ($r = 0.12$, $P = 0.08$), liking of the confederate ($r = -0.06$, $P = 0.34$), familiarity with the confederate ($r = -0.01$, $P = 0.91$) and grade difference with the confederate ($r_s = 0.01$, $P = 0.86$) did not correlate significantly with food intake. Hunger ($r = 0.39$, $P < 0.001$), liking of the test food ($r = 0.30$, $P < 0.001$), and time of day ($r = 0.13$, $P = 0.05$) were related to food intake and entered into the model as covariates. Similar to the first session, these covariates were also used in the analysis for the second session.

Main analyses

The main goal of this study was to test whether the participants' food intake when eating with a peer (first session) or alone (second session) is influenced by the food intake of the confederates and whether this influence depends upon the child's weight status and is persistent over time.

First session

The covariates hunger ($F_{1,214} = 33.43$, $P < 0.001$, Cohen's $f^2 = 0.54$), liking of the test food ($F_{1,214} = 11.28$, $P = 0.001$, Cohen's $f^2 = 0.30$), and time of day ($F_{1,214} = 5.11$, $P = 0.025$, Cohen's $f^2 = 0.19$) had a significant effect on the food intake of children. A significant main effect was found for the experimental condition on the consumed kcal intake ($F_{2,214} = 7.77$, $P < 0.001$, Cohen's $f^2 = 0.25$) with a significant difference between the no- and high-intake condition ($P < 0.001$) but not between the no- and low-intake condition ($P = 0.25$) or the low- and high-intake condition ($P = 0.08$). There was not a main effect of BMI (*z*-score) ($P > 0.05$), however, a significant interaction was found between the experimental condition and BMI (*z*-score) on food intake ($F_{2,214} = 3.70$, $P = 0.026$, Cohen's $f^2 = 0.16$). In this analysis, the model explained 30% of the variance in food intake.[3] Table 2 shows the amount

[3] It was tested whether there was an effect of gender or grade difference on food intake, but this was not the case ($P = 0.18$ and $P = 0.18$, respectively).

Table 2
Total amount food intake in kcal for session 1 and session 2.

	N	Instructed intake confederate (kcal)	Intake normal weight (kcal)	Intake overweight (kcal)	Mean intake normal and overweight (kcal)
			Adjusted mean (SEM)*		
Session 1					
No intake	74	0	35.18 $(11.24)_a$	76.50 $(15.41)_{a,b}$	55.83 $(9.47)_a$
Low intake	77	33	92.22 $(10.88)_b$	65.93 $(15.20)_a$	79.07 $(9.36)_{a,b}$
High intake	72	108	93.52 $(11.52)_b$	124.13 $(15.20)_b$	108.82 $(9.53)_b$
Session 2					
No intake	74	–	106.64 (15.50)	121.32 (21.17)	113.98 $(13.08)_a$
Low intake	77	–	134.73 (15.02)	123.68 (21.03)	129.20 $(12.94)_{a,b}$
High intake	72	–	149.24 (15.96)	175.56 (21.15)	162.40 $(13.24)_b$

* Vertical means which are not sharing common subscripts are significantly different at the .05 level.

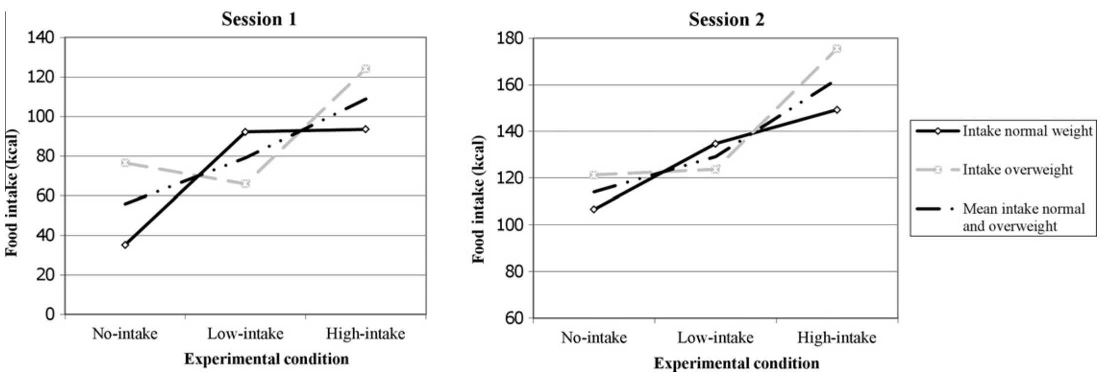

Fig. 2. Food intake of normal weight and overweight children by experimental condition for session 1 and 2.

of kcal consumed during session one, adjusted for hunger, liking of the test food and time of day. The experimental condition differently impacted children based on their weight status. Simple contrast comparisons within the three experimental conditions showed a significant difference between food intake of the normal weight and overweight children in the no-intake condition only ($P = 0.03$, $g = 0.53$). Across the experimental conditions, the simple contrast comparisons showed significant differences among normal weight children between the no- and low-intake condition ($P < 0.001$, $g = 0.73$) and no- and high-intake condition ($P < 0.001$, $g = 0.76$) whereas it only showed a significant difference between the low- and high-intake condition ($P < 0.05$, $g = 0.76$) among the overweight participants. Figure 2 depicts the food intake of normal weight and overweight children by experimental condition. The figure illustrates that the normal weight children consumed less kcal in the no intake condition and an equal amount in the low and high intake condition whereas overweight children consumed an almost equal amount in the no and low intake condition but consumed more in the high intake condition.

Second session

The covariate hunger had a significant effect on food intake ($F_{1,213} = 22.61$, $P < 0.001$, Cohen's $f^2 = 0.31$). Moreover, there was evidence that the effect of the experimental condition persisted over time. The results showed a significant main effect of the experimental condition (of the first session) on the total consumed kcal intake during the second session ($F_{2,213} = 3.50$, $P = 0.03$, Cohen's $f^2 = 0.15$).[4] Figure 2 illustrates a similar intake pattern for the first and second session. In this session, however, there was not a statistically significant interaction between BMI (*z*-score) and experimental condition ($P = 0.59$) nor a main effect on BMI (*z*-score) ($P > 0.05$). The pairwise comparisons with Bonferroni correction showed significant differences between participants in the no-intake and the high-intake condition ($P = 0.03$, $g = 0.21$). Table 2 shows the amount of kcal consumed during session two, adjusted for hunger and time of day. In this analysis, the model explained 17% of the variance in food intake.

The participants in the second session did not eat one kind of test food but ate from several bowls. In additional analysis, a MANCOVA, with hunger status, liking of sweet and liking of salty test foods, and time of day as covariates, was performed to test whether the effect of the confederate remained and spilled over to other test foods. The covariates hunger status had a significant effect on the participant's sweet food intake ($F_{1,213} = 14.01$, $P < 0.001$, Cohen's $f^2 = 0.25$) as well as on salty food intake ($F_{1,213} = 13.61$, $P = 0.001$, Cohen's $f^2 = 0.24$), liking of sweet test foods had a significant effects on sweet food intake ($F_{1,213} = 11.04$, $P = 0.001$, Cohen's $f^2 = 0.21$) as well as salty food intake ($F_{1,213} = 10.99$, $P = 0.001$, Cohen's $f^2 = 0.21$), and liking of salty test foods had a significant effect on salty food intake ($F_{1,213} = 10.37$, $P = 0.001$, Cohen's $f^2 = 0.21$) only. Moreover, there was a significant main effect of experimental condition on sweet foods only ($F_{2,213} = 3.26$, $P = 0.04$, Cohen's $f^2 = 0.14$) with a significant difference between the no-intake ($M = 94.15$; SEM 11.80 kcal) and high-intake ($M = 134.63$; SEM 11.95 kcal) condition ($P = 0.05$, $g = 0.19$). There was no main effect for BMI (*z*-score) on sweet or salty food intake ($P > 0.05$). This indicates that the guideline that was set during the first session was carried over to the intake of sweet foods in the second session.[5]

Discussion

The present study was the first to investigate a social modeling effect on food intake among 6- to 11-year-olds by combining a

[4] We also tested whether the number of days between the first and second session affected the main findings but this was not the case.

[5] It was also tested whether this was caused by the test food of the first session (chocolate-coated peanuts), but this was not the case ($P > 0.05$).

social modeling experiment with a later free-eating session. This enabled to test both the immediate effect and the prolonged effect of a peer on the food intake of normal weight and overweight participants. Findings indicated that a guideline in food intake that was set by a peer might persist over time. Furthermore, normal weight and overweight children differed in their overall food intake pattern with regard to eating with a peer who ate nothing, little or much.

Consistent with results of earlier studies, the findings of the first session confirmed our hypothesis that the food intake of the confederate peer strongly affects the child's own food intake (Herman et al., 2003). The occurrence of similar findings in the second session, without the peer being present, provides new evidence for a possible prolonged effect of a social norm on eating behavior (Herman & Polivy, 2005). Thus, the intake guideline that was initially set by a peer might have remained active in a later phase.

Herman and Polivy (Herman & Polivy, 2005) proposed a normative approach that distinguishes personal from situational norms. A person endorses personal norms to make a decision on eating the appropriate amount of food in a given situation based on their prior experience. On the other hand, situational norms, such as eating behavior of others, are derived from the eating situation itself. The few studies that addressed the effect of social norms and normative information on the amount of food intake (Leone, Pliner, & Herman, 2007; Pliner & Mann, 2004) examined immediate but not prolonged effects. In the present study, situational norms can explain the child's food intake in the first session i.e., eating behavior of the peer determined the food intake of the other children. In the second, free-eating session, this situational norm might have turned into a personal norm. One could argue that this can still be seen as a situational norm because the children returned to the same situational context. Nevertheless, there were different kinds of food and, what is even more relevant, there was no peer present. Therefore, we argue that our findings support the assumption that children base their food intake on a personal norm they learn from prior experiences with peers (Laible & Thompson, 2007).

Furthermore, the findings revealed that food intake of normal weight children differed from that of overweight children. Compared to normal weight children, overweight children ate more than normal weight children when the peer was not eating only. Opposite to the findings of studies in 'tweens' (girls aged between childhood and adolescence) (Salvy, Romero et al., 2007) and adolescent females (Hermans et al., 2008), the presence of a slimmer peer did not inhibit the food intake of the overweight participants compared to normal weight participants. A possible explanation might be found in the misperception of their own weight status among young children (Maximova et al., 2008). Young children showed greater underestimation of higher weights (Saxton, Hill, & Wardle, 2009) than children at older age (Zeller, Ingerski, Wilson, & Modi, 2001). It might be that the overweight participants did not encounter prejudicial comments about their weight status by their peers (yet) and they therefore did not feel the need to inhibit their food intake. The fact that their food intake was relatively high compared to normal weight children when the confederate ate nothing might be explained by the fact that overweight children in general eat more than normal weight children (Jansen et al., 2003; Salvy, Coelho et al., 2007). Nevertheless, this reasoning remains speculative as it is possible that children might have encountered some level of teasing about their weight status. Therefore, further research is needed to investigate inhibition by conducting social modeling studies, for example, with overweight or obese confederates or with an older children sample.

An additional difference between normal and overweight children can be seen when focusing on the overall food intake pattern (across the three experimental conditions) of the two weight groups. Unlike overweight children, normal weight children behaved in line with previous findings obtained from modeling experiments in that they ate a little amount of food when a similar weight peer ate nothing at all and did not exceed the peer's intake when exposed to a high food intake (Herman & Polivy, 2005; Herman et al., 2003) whereas overweight children slightly exceeded the peer's intake. More importantly, normal weight children ate a small amount of food when the peer ate nothing whereas when the peer ate something (either a little or large amount) their intake increased substantially. Overweight children consumed almost equal amounts of food when the peer ate nothing and when the peer ate little whereas their intake increased significantly when the peer ate a substantial amount of food. This might suggest that the intake of normal weight children was principally determined by whether the confederate ate at least something (regardless of the amount of food) whereas the intake of overweight children seemed to be determined by whether the confederate ate a considerable amount of food. The additional cue of an eating peer on top of the sight of palatable food might have triggered normal weight children to eat whereas the amount eaten was less important (they ate a comparable amount of food in the low and high intake condition). Overweight children might have been triggered already by just the presence and sight of the snack food (they ate similar amounts in the no and low intake) whereas the generous intake of the peer functioned as an extra cue that triggered them to (over)eat. Further research is needed and should replicate the present study to unravel these mechanisms, e.g. with confederates as well as participants with a different weight status.

There was a prolonged modeling effect in the second session, but the difference in food intake between normal and overweight children disappeared. The amount of kcal in food intake of normal weight as well as overweight children increased dependent on which food(s) they consumed. The variety of foods offered or eating alone might have caused a different intake pattern for some children, explaining the absence of a significant interaction effect between weight status and confederate food intake in the second session. Nevertheless, in general the findings suggest that the situational norm that was set during the first session was used as an intake norm in the second session. Presumably, they kept their food intake by what was considered appropriate in accordance to the 'guideline' that was set previously. More importantly, the guideline that was set for one kind of food was spilled over to other sweet palatable snack foods. Studies indicated that in the school-food environment, peers exert major influence to conform to group norms and that children's snack foods were primarily associated with snack foods of their peers (see for review Story, Neumark-Sztainer & French(2002)). This might imply that children take over eating behavior of their peers at school and adhere to this norm in other, similar situations, regardless of whether the same peers are around or not. Previous studies that have used peer influence to encourage young children to change food preferences in favor of novel and/or healthy foods also found a longer-term effect, however, in conjunction with repeated exposure (Birch, 1980) and reward (Lowe, Horne, Tapper, Bowdery, & Egerton, 2004). Nevertheless, this might be different for palatable snack foods because there is less reluctance to eat these foods (Bevelander, Anschütz, & Engels, 2012). It would be interesting to further test the longer-term effects of snacking in a school environment on children's energy intake in general, as obesity research on social factors has focus so far mainly on the effect of the home environment(Strauss & Knight, 1999).

Although we used an experimental design to assess modeling in a large sample of young children that included girls and boys, some limitations should be mentioned. First, the time period between the two experimental sessions was approximately two days. Further research is needed to test the effect of repeated exposure to peer influence on children's food intake over a longer time period. Second, the sessions were videotaped, which might have affected the children's behavioral patterns. Nevertheless, qualitative impressions of the children's behavior during the session and after checking the video recordings indicated that they acted quite naturally after they adapted to the new setting. Third, we made use of different instructed peers in each session whereas it is more common to use a couple of trained confederates in adolescent research (Hermans et al., 2008, 2009). In practice, it was not possible to use only a few instructed peers because the children would miss out on their school lessons. In addition, as far as we know, this was the first social modeling experiment in children that made use of real instructed peers. Other modeling studies in children have used dyadic results of two naïve peers to investigate peer modeling behavior (Salvy, Howard, Read, & Mele, 2009; Salvy, Romero et al., 2007) or remote (video) confederates (Romero et al., 2009). Moreover, by use of different confederates it was possible to rule out a confederate effect. Fourth, the homogeneity of the study population can be seen as a limitation. It would be interesting to conduct further research on prolonged social norms in adolescents and adults or different nationalities such as the United States. In addition, this study includes only few obese participants. Future research should focus on this weight category as well. It might be that overweight children do not suffer from stigmatization as much as obese children who might have encountered more difficulties (Latner & Stunkard, 2003). Therefore, obese children might withhold their food intake more compared to overweight and normal weight children in presence of a lean peer or they might not hold back when eating alone. Fifth, this study focused on palatable food intake. Future studies need to assess whether normative guidelines in modeling behavior also apply to different kinds of food (e.g., healthy or unfamiliar food). Sixth, different and more test foods were used in the second session than in the first session. This might have interfered with the prolonged effect of social modeling, in that all children ate more during the second session (see also Hetherington (2007)) which might explain the less profound differences between normal weight and overweight children. However, we considered the use of different foods more similar to a real life situation in which children are confronted with all kinds of snack foods. Finally, all confederates were normal weight children. It is important to replicate this study with overweight confederates to examine any possible stigmatization effect in modeling behavior among young boys and girls.

In conclusion, this study provided more insight into the effect of eating norms of peers on palatable food intake in normal weight and overweight children. These findings might be of value in developing school health policies since children spend a lot of time at school. In the Netherlands, children bring their lunch and snacks from home to school, a tradition which ensures that parents are able to exert a certain amount of control over their children's food intake. However, in the United States and the United Kingdom, for example, children choose and eat their meals and snacks in school cafeterias. Given that this study shows an effect of a peer setting a norm during only one occasion, the effect of seeing peers eat on a daily basis might be even stronger. As peers can set an example to have a certain food intake or trigger overweight children to increase their food intake it would be interesting to investigate social influence in other settings such as in school cafeterias, day care or after school facilities. The implications for government and school policies could be, for example, to prohibit children or parents to bring palatable snack food to school and to offer healthy snacks at schools. Moreover, peers could be included into teaching and prevention programs to educate children about social triggers to eat and social influence in eating in and outside of school.

References

Anschütz, D. J., Engels, R. C. M. E., & Van Strien, T. (2009). Side effects of television food commercials on concurrent nonadvertised sweet snack food intakes in young children. *American Journal of Clinical Nutrition, 89*(5), 1328–1333.

Bevelander, K. E., Anschütz, D. J., & Engels, R. C. M. E. (2012). *The effect of a fictitious peer on young children's choice of familiar versus unfamiliar low and high energy-dense foods British Journal of Nutrition, 1*(1), 1–8.

Birch, L. L. (1980). Effects of peer models' food choice and eating behaviors on preschoolers' food preferences. *Child Development, 51*(2), 489–496.

Birch, L. L., & Fisher, J. O. (1998). Development of eating behaviors among children and adolescents. *Pediatrics, 101*(3), 539–548.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159.

Cole, T. J., Bellizzi, M. C., Flegal, K. M., & Dietz, W. H. (2000). Establishing a standard definition for child overweight and obesity worldwide. International survey. *British Medical Journal, 320*(7244), 1240–1246.

Cole, T. J., Flegal, K. M., Nicholls, D., & Jackson, A. A. (2007). Body mass index cut offs to define thinness in children and adolescents. International survey. *British Medical Journal, 335*(7612), 194–202.

Cole, T. J., & Roede, M. J. (1999). Centiles of body mass index for Dutch children aged 0–20 years in 1980. A baseline to assess recent trends in obesity. *Annals of Human Biology, 26*(4), 303–308.

Cross, A. T., Babicz, D., & Cushman, L. F. (1994). Snacking patterns among 1800 adults and children. *Journal of the American Dietetic Association, 94*(12), 1398–1403.

de Castro, J. M., & Brewer, E. M. (1991). The amount eaten in meals by humans is a power function of the number of people present. *Physiology & Behavior, 51*, 121–125.

Eccles, J. S. (1999). The development of children ages 6 to 14. *The future of children, 9*(2), 30–44.

Feunekes, G. I. J., de Graaf, C., Meyboom, S., & van Staveren, W. A. (1998). Food choice and fat intake of adolescents and adults. Associations of intakes within social networks. *Preventive Medicine, 27*(5), 645–656.

Field, A. (2005). *Discovering statistics using SPSS*. London: Sage.

Hedges, L. V., & Olkin, L. (1985). *Statistical methods for meta-analysis*. San Diego, CA: Academic Press.

Hendy, H. M. (2002). Effectiveness of trained peer models to encourage food acceptance in preschool children. *Appetite, 39*(3), 217–225.

Herman, C. P., & Polivy, J. (2005). Normative influences on food intake. *Physiology & Behavior, 86*(5), 762–772.

Herman, C. P., Roth, D. A., & Polivy, J. (2003). Effects of the presence of others on food intake. A normative interpretation. *Psychological Bulletin, 129*(6), 873–886.

Hermans, R. C. J., Larsen, J. K., Herman, C. P., & Engels, C. M. E. (2009). Effects of social modeling on young women's nutrient-dense food intake. *Appetite, 53*(1), 135–138.

Hermans, R. C. J., Larsen, J. K., Herman, C. P., & Engels, R. C. M. E. (2008). Modeling of palatable food intake in female young adults. Effects of perceived body size. *Appetite, 51*(3), 512–518.

Hetherington, M. H. (2007). Cues to overeat. Psychological factors influencing overconsumption. *Proceedings of the Nutrition Society, 66*(1), 113–123.

Jansen, A., Theunissen, N., Slechten, K., Nederkoorn, C., Boon, B., Mulkens, S., et al. (2003). Overweight children overeat after exposure to food cues. *Eating Behaviors, 4*(2), 197–209.

Laible, D., & Thompson, R. A. (2007). Early socialization. A relationship perspective. In J. E. Grusec & P. D. Hastings (Eds.), *Handbook of Socialization: Theory and Research*. New York: The Guilford Press.

Latner, J. D., & Stunkard, A. J. (2003). Getting worse. The stigmatization of obese children. *Obesity Research, 11*(3), 452–456.

Leone, T., Pliner, P., & Herman, C. P. (2007). Influence of clear versus ambiguous normative information on food intake. *Appetite, 49*(1), 58–65.

Lobstein, T., Baur, L., & Uauy, R. (2004). Obesity in children and young people. A crisis in public health. *Obesity Reviews, 5*(1), 4–85.

Lowe, C. F., Horne, P. J., Tapper, K., Bowdery, M., & Egerton, C. (2004). Effects of peer modelling and reward-based intervention to increase fruit and vegetable consumption in children. *European Journal of Clinical Nutrition, 58*(3), 510–522.

Maximova, K., McGrath, J. J., Barnett, T., O'Loughlin, J., Paradis, G., & Lambert, M. (2008). Do you see what I see? Weight status misperception and exposure to obesity among children and adolescents. *International Journal of Obesity, 32*, 1008–1015.

Oliveria, S. A., Ellison, R. C., Moore, L. L., Gillman, M. W., Garrahie, E. J., & Singer, M. R. (1992). Parent-child relationships in nutrient intake. The Framingham Children's Study. *American Journal of Clinical Nutrition, 56*(3), 593–598.

Pliner, P., & Mann, N. (2004). Influence of social norms and palatability on amount consumed and food choice. *Appetite, 42*(2), 227–237.

Redd, M., & de Castro, J. M. (1992). Social facilitation of eating. Effects of social instruction on food intake. *Physiology & Behavior, 52*(4), 749–754.

Reilly, J. J., Methven, E., McDowell, Z. C., Hacking, B., Alexander, D., Stewart, L., et al. (2003). Health consequences of obesity. *Archives of Disease in Childhood, 88*(9), 748–752.

Reverdy, C., Chesnel, F., Schlich, P., Köster, E. P., & Lange, C. (2008). Effect of sensory education on willingness to taste novel food in children. *Appetite, 51*(1), 156–165.

Romero, N. D., Epstein, L. H., & Salvy, S. J. (2009). Peer modeling influences girls' snack intake. *Journal of the American Dietetic Association, 109*(1), 133–136.
Salvy, S. J., Coelho, J. S., Kieffer, E., & Epstein, L. H. (2007). Effects of social contexts on overweight and normal-weight children's food intake. *Physiology & Behavior, 92*(5), 840–846.
Salvy, S. J., Howard, M., Read, M., & Mele, E. (2009). The presence of friends increases food intake in youth. *American Journal of Clinical Nutrition, 90*(2), 282–287.
Salvy, S. J., Romero, N., Paluch, R., & Epstein, L. H. (2007). Peer influence on preadolescent girls' snack intake. Effects of weight status. *Appetite, 49*(1), 177–182.
Salvy, S. J., Vartanian, L. R., Coelho, J. S., Jarrin, D., & Pliner, P. P. (2008). The role of familiarity on modeling of eating and food consumption in children. *Appetite, 50*(2–3), 514–518.
Saxton, J., Hill, C., & Wardle, J. (2009). Weight status and perceived body size in children. *Archives of Disease in Childhood, 94*(12), 944–949.
Schunk, D. H. (1987). Peer models and children's behavioral change. *Review of Educational Research, 57*(2), 149–174.
StichtingVoedingscentrumNederland (2011). Retrieved 12 April 2011, 2011, from www.voedingscentrum.nl.
Story, M., Neumark-Sztainer, D., & French, S. (2002). Individual and environmental influences on adolescent eating behaviors. *Journal of the American Dietetic Association, 102*(3), S40–S51.
Strauss, R. S., & Knight, J. (1999). Influence of the home environment on the development of obesity in children. *Pediatrics, 103*(6), e85.
Zeller, M. H., Ingerski, L. M., Wilson, L., & Modi, A. C. (2001). Factors contributing to weight misperception in obese children presenting for intervention. *Clinical Pediatrics, 49*(4), 330–336.