Development and Aging

Emotional, external, restrained eating and overweight in Dutch adolescents

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The purpose of this study was to determine how emotional, external and restrained eating behavior and other health-related lifestyle factors were associated with being overweight in adolescents. Moreover, demographic and ethnic differences in eating behavior have been examined. The respondents were 10,087 Dutch adolescents aged 11–16 years (M = 13.0, SD = 0.8). Self-reported eating behavior was measured with the DEBQ. Health-related lifestyle was determined by physical activity, breakfasting, fruit consumption and snacking. High restrained, and low external eating were positively associated with being overweight, whereas no significant association between emotional eating and being overweight was found for girls, and a negative association for boys. Adolescents who ate breakfast on a daily basis were less likely to be overweight than those who ate breakfast irregularly or never. Being overweight was positively associated with fruit consumption for girls and negatively with physical activity for boys.

Key words: Overweight, obesity, adolescence, emotional eating, restrained eating, external eating.

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INTRODUCTION

The prevalence of childhood overweight and obesity is increasing worldwide (IOTF, 2002, 2003; Seidell, 1999), and has great impact on both immediate (in childhood) and long-term (in later life) health risks. Immediate risks include increased risk of diabetes type II, gallstones and sleep disorders but associated with being overweight in adolescents. Moreover, demographic and ethnic differences in eating behavior have been examined. The purpose of this study was to determine how emotional, external and restrained eating behavior and other health-related lifestyle factors were associated with being overweight in adolescents. Moreover, demographic and ethnic differences in eating behavior have been examined. The respondents were 10,087 Dutch adolescents aged 11–16 years (M = 13.0, SD = 0.8). Self-reported eating behavior was measured with the DEBQ. Health-related lifestyle was determined by physical activity, breakfasting, fruit consumption and snacking. High restrained, and low external eating were positively associated with being overweight, whereas no significant association between emotional eating and being overweight was found for girls, and a negative association for boys. Adolescents who ate breakfast on a daily basis were less likely to be overweight than those who ate breakfast irregularly or never. Being overweight was positively associated with fruit consumption for girls and negatively with physical activity for boys.

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Although obesity has a strong genetic component (Maﬀeis, 2000), the high increase in obesity in the past two decades shows that whatever the genetic liability, environmental influences play a key role in the development of obesity. The obesogenic environment, with restricted opportunities for physical activity, and high availability and active promotion (like advertising and marketing) of high fat, sugar and energy density foods, is often blamed for the high increase in obesity. Cultural changes in food patterns, such as shifts from meals to snacking, and higher outdoor food consumption (Zizza, Siega-Riz & Popkin, 2001) might also contribute to increasing weight (Ebbeling et al., 2002; IOTF, 2002; Swinburn, Caterson, Seidell & James, 2004). The question remains, however, why some individuals in this obesogenic environment are able to keep their weight in balance for years, while others become overweight even as a child. Physical activity has an important role in body weight and adiposity (DiPietro, 1995; Swinburn et al., 2004), but the main focus of this study was on the other scale of the energy balance: food intake and eating behavior. In an attempt to find out why some people eat more than others, three psychological theories on triggers of overeating have been developed over the past decades.

The psychosomatic theory focuses on “emotional eating”, which states that emotional eaters do not eat in response to internal signals, feelings of hunger and satiety but in response to their emotions. In case of emotional arousal or stress, emotional eaters respond by excessive eating, while normally emotional arousal and stress would result in loss of appetite (Bruch, 1973; Greeno & Wing, 1994; Kaplan & Kaplan, 1957; Schachter, Goldman & Gordon, 1968). A second theory, focusing on external eating, states that certain people are more sensitive to external food cues than others, and eat in response to those stimuli, regardless of their internal state of hunger and satiety (Schachter & Rodin, 1974). According to a third theory, the restrained eating theory, dieting can cause overweight through bingeing. People who diet suppress their feeling of hunger cognitively and eat less. However, when cognitions are undermined (disinhibition), restrained eaters are more likely to overeat than non-dieting individuals; this is called counter-regulation (Herman & Polivy, 1980; Polivy & Herman, 1985; Ruderman, 1986).
Based on these theories one should expect a positive relation between overweight and emotional, external, and restrained eating. However, the few studies that have investigated those relations in children and adolescents did not support the hypotheses in all aspects (Lluch, Herbeth, Mejean & Siest, 2000; Wardle, Marsland, Sheikh, Quinn, Fedoroff & Ogden, 1992). In a French family study, being overweight was positively related to restrained eating, but negatively related to external eating (only for girls) and non-related to emotional eating (Lluch et al., 2000). In a study by Wardle et al. (1992) average body mass index (BMI) was higher in restrained, and lower in external eaters, whereas no relationship was found between emotional eating and BMI (Wardle et al., 1992). The studies by Wardle et al. (1992) and Lluch et al. (2000) consisted of heterogeneous samples with relatively small numbers per age group, making it hardly possible to draw firm conclusions about the links between eating behavior and being overweight. Besides, these studies did not include physical (in)activity, which is an important determinant for being overweight. In the current study, we assessed the scores of emotional, external, and restrained eating in a large, nationwide sample of Dutch adolescents (11–16 years). This large sample allows us to estimate the relation between eating behavior and being overweight, and also to determine age, gender, socio-demographic, and ethnic differences with regard to being overweight and eating behaviors.

Further, we determined health-related behaviors of overweight and non-overweight adolescents. A recent study showed that consumption of fruits and vegetables among Dutch young adults was inadequately meeting recommendation levels (Hulshof, Ocke, Van Rossum et al., 2004). Also, dietary fat intake and intake of saturated fats was too high (Hulshof et al., 2004). Snack foods generally have low nutritional value, and energy intake from snack foods has increased in the same time period as the prevalence of overweight has increased (Zizza et al., 2001), but a positive association between snacking and weight change during childhood and adolescence has not consistently been found in previous studies (Field, Austin, Gillman, Rosner, Rockett & Colditz, 2004; Phillips, Bandini, Naumova et al., 2004), although snacking was a risk factor in families that are at greater genetic and environmental risk of being overweight (Francis, Lee & Birch, 2003). An unhealthy lifestyle was therefore operationalized as low physical activity and unhealthy eating habits (i.e., breakfast skipping, high snacking and low fruit consumption). The association of these factors with being overweight was studied.

METHODS

Participants

The respondents were 10,087 adolescents aged 11–16 years (M = 13.0, SD = 0.8). We randomly selected 55 secondary schools from four regions in the Netherlands (North, South, East and West) to obtain a national sample. The majority of the school boards (34) agreed to participate. If schools joined the project, all 1st and 2nd grade students attending the school were asked to fill in questionnaires at school (in total 11,124 students). Data collection took place in January and February 2003. On the day of assessment, only 15 students explicitly refused to cooperate, 507 students were absent or had left school, 455 questionnaires where non-filled out for unknown reasons and 60 questionnaires where left out of the analysis due to incompleteness. The total response was 91.9%. The medical ethics committee CMO Arnhem-Nijmegen approved the study’s design.

Sample characteristics

The sample consisted of approximately equal numbers of boys (49%) and girls (51%). The average age of the participants was 13.0 years (range 11–16 years). Most of the adolescents (96.6%) were aged between 12 and 14 years. As only a few subjects were 11 or 16 years old, we combined the ages 11 and 12 and the ages 15 and 16 in further analysis. The native country of the parents decided ethnicity: If one or both parents were born outside the Netherlands, the respondent was included into that ethnic group. The sample consisted of all major ethnic groups in the Netherlands: 81% of the respondents were Dutch, 19% were from other ethnic groups. Students from all levels of secondary school education that are classified in the Netherlands took part in this study. The majority, 55% of the students, attended lower level education (preparatory college for technical and vocational training; in the Dutch school system: LWOO, VMBO), and 45% higher level education (preparatory school for college or university; in the Dutch school system: HAVO, VWO, atheneum, gymnasium).

Procedure and measurements

The questionnaires were filled out during normal school hours under supervision of a teacher, who had received a written explanation about the procedure. The questionnaire consisted of questions on demographic variables, height and weight, eating behavior and health-related lifestyle.

BMI, overweight and obesity. BMI was calculated based on self-reported height and weight. To determine whether a child was overweight or obese we used international cut-off scores (Cole, Bellizzi, Flegal & Dietz, 2000). The cut-off points are age and sex specific and based on curves that reach BMI scores of 25 and 30 at the age of 18. We computed whether respondents had a BMI above the overweight and obesity cut-off scores for their age. Scores higher than the first curve (BMI at age 18 = 25) were considered overweight; this also includes obesity. Scores higher than the second curve (BMI at age 18 = 30) were considered obese. No underweight group was specified, thus all scores under the BMI 25 curve were nominated “not overweight”.

Eating behavior. Eating behavior was assessed using the Dutch Eating Behaviour Questionnaire (Van Strien, Frijters, Bergers & Defares, 1986b) (originally published in Dutch (Van Strien, Frijters, Bergers & Defares, 1986a)). This questionnaire consists of 33 items, which measured emotional (13 items), external, and restrained eating (both 10 items). All items had to be rated on a five-point scale from 1 (never) to 5 (very often). Examples of items were: “Do you have a desire to eat when you are irritated?” (emotional eating), “If foods smells and looks good, do you eat more than usual?” (external eating) and “Do you try to eat less at mealtimes than you would like to eat?” (restrained eating). The DEBQ scales have high internal consistency, high validity for food consumption, and high convergent and discriminative validity (Van Strien, 2002).
Emotional and external eating have been found to be good predictors for actual food intake in a laboratory setting (Ouwens, 2005). In a real life setting negative life events were associated with relative weight loss in low emotional eaters and with relative weight gain in high emotional eaters (Van Strien, Rookus, Bergers, Frijters & Defares, 1986c). Other studies found associations of DEBQ scores with a biological substrate (Volkow, Wang, Maynard et al., 2003) and with food intake measured with food frequency questionnaires, 24-hour recall, 24-hour food records or 7-day records in adults (Greene, Rogers, Elliman & Gatenby, 1994; Laesle, Tuschl, Rotthaus & Prike, 1989; Wardle et al., 1992), children (Hill & Robinson, 1991) and adolescents (Lluch et al., 2000; Wardle et al., 1992). The DEBQ is easy to fill out by adolescents and has been used in other adolescent studies (Lluch et al., 2000; Van Strien, 1996).

Cronbach's alphas in our study were: 0.92 (emotional eating), 0.84 (external eating) and 0.92 (restrained eating). Support for factor integrity was provided after subjecting DEBQ scores to factor analysis (principal component, varimax rotation) using a 3-factor solution. For both girls and boys, almost all of the 33 items loaded exclusively on the appropriate factor. One emotional eating item and, only for boys, one external eating item loaded on both the first (emotional eating) and third factor (external eating). Factor 1 (Emotional Eating) accounted for 25% and 27% of the variance, factor 2 (Restrained Eating) 19% and 17%, and factor 3 (External Eating) 7% and 6% for girls and boys respectively.

The intra-scale correlation was high between emotional and external eating: 0.57 for boys and 0.55 for girls. Correlations between emotional and restrained eating were 0.16 and 0.08, and between external and restrained eating −0.08 and −0.13 for boys and girls respectively (all correlations were significant at p < 0.01). The high correlation between emotional and external eating is similar to those found in previous studies. One study found that both emotional and external eating were grounded in the personality constructs neuroticism and conscientiousness (Heaven, Mulligan, Merrilees, Woods & Fairoz, 2001) indicating a single personality construct. However, the presupposition that subscales measure theoretically different aspects of overeating was supported by the findings that emotional eating, but not external eating, was related to levels of dopamine D2 receptors in the brain (Volkow et al., 2003), emotional distress and problems with relationships (Van Strien, Schippers & Cox, 1995). Moreover, in line with the psychosomatic theory, emotional eating was related to impulsivity (Fischer, Smith & Anderson, 2003) and to alexithymia in overweight women (Larsen, Van Strien, Eisinga & Engels, 2006).

Health-related lifestyle. The Godin-Shephard questionnaire (Godin & Shephard, 1985) was used to measure physical activity. This questionnaire measures the habitual number of activities per week at various levels of intensity: Light (e.g., walking), moderate (e.g., badminton) and strenuous (e.g., basketball). A total physical activities score was calculated using the following formula: (9 × strenuous) + (6 × moderate) + (3 × light). The scale had been validated for adolescents and children (Godin & Shephard, 1985; Sallis, Buono, Roby, Micale & Nelson, 1993). Health-related lifestyle was further determined by measuring eating habits: how many times per week adolescents consumed fruit and snacks, and how much, and how often they ate breakfast. Fruit consumption was measured by the number of fruits respondents usually ate in a day and snacking by the number of sweet and/or savoury snacks respondents usually ate in a day. Two items were derived from a larger questionnaire measuring total and saturated fat intake (Van Assema, Brug, Ronda & Steenhuis, 2001). These items assess “how many days a week students and parents consumed sweets and savoury snacks” and “the number of servings of sweets and savoury snacks they consumed on such days”, and have been used in an adolescent sample before. The distribution of ratings on the “days per week” items was highly skewed (i.e., 90% of the children consumed snacks daily), therefore we only used the “snacks per day” item.

Physical activity scores were divided in three groups: low (lower quartile), high (upper quartile) and moderate (middle group). Fruit and snack consumptions were divided into two groups with two pieces of fruit (minimum advised fruit consumption according to national guidelines) and three snacks per day (which corresponded roughly with the upper third) as cut-off points. Breakfasting was also divided in three groups: those who ate daily breakfast, those who never ate breakfast and those who ate 1–6 times breakfast per week (irregular breakfasters). The healthiest lifestyle is defined by moderate to high levels of physical activity consuming at least two pieces of fruit per day, limited amount of snacks, and daily breakfast.

Statistics

Average BMI, percentage overweight and obesity, and mean scores on emotional, external and restrained eating were calculated per sex, age, educational level and ethnic group. Differences between demographic groups in prevalence of obesity and being overweight had been computed by Chi square analyses. Differences in BMI and DEBQ scores were analysed using t-tests (sex, education level) or one-way ANOVA (age, ethnicity) with Scheffé post hoc tests. We conducted logistic regression analyses to further investigate the relation of being overweight with eating behaviors, and health-related lifestyle factors (eating habits and physical activity). The classification “being overweight or not” served as the dependent variable, and eating behaviors and health-related lifestyle factors as explanatory variables. The first analyses were univariate with separate regressions per explanatory variable (eating behaviors and health-related lifestyle factors). In the second phase of analysis, we also conducted separate regression analysis for the separate eating behaviors and health-related lifestyle factors, but these variables were entered into the second step of analysis. In the first step we corrected for age, educational level and ethnicity. The third phase of analysis was multivariate with background variables in the first step and all eating behavior and health-related lifestyle factors in the second step of the regression analysis. Boys and girls were analysed separately. The level used to establish significance in all tests was p < 0.05. All analyses were performed using SPSS (version 11.5).

RESULTS

Table 1 shows average BMI, percentage overweight and obesity, and average scores on emotional, external and restrained eating per sex, age, ethnicity and educational level of the adolescents.

Prevalence of overweight and scores on eating behavior

The cut-off scores to determine overweight and obesity differ per sex and between age groups (Cole et al., 2000). Although boys and girls did not differ significantly in reported BMI, the prevalence of overweight was higher in boys than in girls. No gender differences were found in the prevalence of obesity. Average BMI was higher in older age groups for both girls and boys, whereas no differences were found in percentages for overweight and obesity between the age groups. In total, the average reported BMI was 18.7 for boys and 18.6 for girls, 11.0% of the boys and 7.1% of
Table 1. BMI, percentages overweight and obesity and mean scores on emotional, external and restrained eating per sex, age, ethnicity and educational level of Dutch adolescents (means (M) standard deviations (SD)).

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>BMI</th>
<th>Overweight</th>
<th>Obesity</th>
<th>Emotional eating</th>
<th>External eating</th>
<th>Restrained eating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M (SD)</td>
<td>%</td>
<td>%</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
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<tr>
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<td></td>
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<tr>
<td>Boys</td>
<td>4,430</td>
<td>18.7 (2.7)</td>
<td>11.0</td>
<td>0.9</td>
<td>1.85 (0.74)</td>
<td>2.75 (0.72)</td>
<td>1.87 (0.78)</td>
</tr>
<tr>
<td>Girls</td>
<td>4,581</td>
<td>18.6 (2.6)</td>
<td>7.1</td>
<td>0.8</td>
<td>1.97 (0.71)</td>
<td>2.66 (0.67)</td>
<td>2.25 (0.92)</td>
</tr>
<tr>
<td>Boys</td>
<td>4,430</td>
<td>18.0 (2.6)</td>
<td>11.0</td>
<td>0.9</td>
<td>1.85 (0.73)</td>
<td>2.73 (0.73)</td>
<td>1.93 (0.77)</td>
</tr>
<tr>
<td>Girls</td>
<td>4,581</td>
<td>18.5 (2.5)</td>
<td>7.1</td>
<td>0.8</td>
<td>1.97 (0.71)</td>
<td>2.66 (0.67)</td>
<td>2.25 (0.92)</td>
</tr>
<tr>
<td>Boys</td>
<td>2,618</td>
<td>18.0 (2.6)</td>
<td>18.0 (2.5)</td>
<td>11.0</td>
<td>1.85 (0.73)</td>
<td>2.73 (0.73)</td>
<td>1.93 (0.77)</td>
</tr>
<tr>
<td>Girls</td>
<td>4,581</td>
<td>18.0 (2.5)</td>
<td>7.1</td>
<td>0.8</td>
<td>1.97 (0.71)</td>
<td>2.66 (0.67)</td>
<td>2.25 (0.92)</td>
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<tr>
<td>Ethnicity</td>
<td></td>
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</tr>
<tr>
<td>Dutch</td>
<td>7,239</td>
<td>18.5 (2.6)</td>
<td>18.5 (2.5)</td>
<td>11.0</td>
<td>1.86 (0.74)</td>
<td>2.75 (0.71)</td>
<td>1.85 (0.76)</td>
</tr>
<tr>
<td>Surinam/Antillean</td>
<td>319</td>
<td>18.6 (2.8)</td>
<td>19.6 (3.3)</td>
<td>9.5</td>
<td>1.67 (0.58)</td>
<td>2.70 (0.74)</td>
<td>1.90 (0.79)</td>
</tr>
<tr>
<td>Moroccan</td>
<td>90</td>
<td>18.8 (2.2)</td>
<td>19.7 (2.8)</td>
<td>9.1</td>
<td>1.90 (0.78)</td>
<td>2.70 (0.77)</td>
<td>2.65 (0.77)</td>
</tr>
<tr>
<td>Turkish</td>
<td>298</td>
<td>20.1 (2.6)</td>
<td>20.2 (3.0)</td>
<td>18.7</td>
<td>1.94 (0.81)</td>
<td>2.89 (0.77)</td>
<td>2.61 (0.71)</td>
</tr>
<tr>
<td>Other</td>
<td>883</td>
<td>19.2 (2.8)</td>
<td>18.8 (2.6)</td>
<td>15.1</td>
<td>1.84 (0.72)</td>
<td>2.78 (0.74)</td>
<td>1.94 (0.78)</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Lower level</td>
<td>4,504</td>
<td>18.9 (2.8)</td>
<td>18.9 (2.8)</td>
<td>12.6</td>
<td>1.89 (0.74)</td>
<td>2.76 (0.72)</td>
<td>1.92 (0.78)</td>
</tr>
<tr>
<td>Higher level</td>
<td>4,254</td>
<td>18.4 (2.5)</td>
<td>18.3 (2.4)</td>
<td>8.8</td>
<td>1.80 (0.72)</td>
<td>2.75 (0.71)</td>
<td>2.26 (0.92)</td>
</tr>
</tbody>
</table>

Notes: For main effects of gender, age, ethnicity or educational level in the ANOVAs, significant differences effects are marked: * p < 0.05; ** p < 0.01; *** p < 0.001 (n = 4,430 boys and 4,581 girls). Differences between age and ethnic groups have been tested with post hoc tests (Scheffe) and significant differences (p < 0.05) are marked with a, b, c.

1 Based on self-reported height and weight.
2 Average scores on five-point scale from 1 (never) to 5 (very often).
the girls were overweight, and obesity percentages were 0.9% and 0.8% respectively.

In general, average scores on eating behaviors per gender group ranged between 1.85 (emotional eating for boys) and 2.75 (external eating for boys) on five-point scales (see Table 1).

The scores differed between boys and girls, implying that boys scored higher on external eating, while girls had higher scores on emotional and restrained eating. For girls, higher mean score on all three eating behavior scales were found for older compared to younger participants. Girls’ emotional eating scores showed significant higher scores in the group aged 14 compared to 11–12 years. External eating scores were lower for 11–12 than for 13-year-old girls, and restrained eating scores were lower for girls aged 11–12 compared to those aged 13, 14 and 15–16. For boys only the difference in external eating between 12 and 14-year-olds was significant, with higher scores in older boys. No significant differences in emotional and restrained eating were found for boys of different age groups (Table 1).

Socio-demographic and ethnic differences

There was a clear association between educational level and BMI. Boys and girls with lower levels of education had a higher average BMI, and a higher prevalence of overweight and obesity than those with higher levels of education. Boys with lower levels of education scored higher on emotional and restrained eating than boys with higher levels of education. No dissimilarities were found for scores on emotional, external, and restrained eating for girls of different educational levels.

Ethnic differences were found in scores on BMI, overweight, obesity for girls, restrained eating, emotional eating for boys, and external eating for girls. Dutch adolescents had the lowest BMI scores, and lowest percentages of overweight and obesity. Turkish adolescents had the highest BMI scores as well as the highest prevalence of overweight and obesity, followed by Moroccans and Surinamese/Antilleans. Girls and boys showed the same pattern. Turkish boys scored higher on restrained eating than other ethnic groups (except Moroccan boys). For girls, highest scores were found for Turkish girls and significant lower scores for Moroccan and Dutch girls. No clear ethnic differences were found for emotional and external eating; the only significant difference was a lower score on emotional eating for Surinamese/Antillean boys compared to Dutch and Turkish boys.

In an ANOVA analysis with age group, ethnicity, and educational level in one model, demographic differences in BMI and eating behaviors were replicated.

**Being overweight in relation to eating behaviors and health-related lifestyle**

Table 2 shows the findings of logistic regressions on the relationship between being overweight and eating behaviors, and health-related lifestyle. Separate regressions (univariate analysis) were conducted on the relations between the scores on eating behaviors and being overweight. High restrained boys and girls were more likely to be overweight (odds ratios 2.43 and 1.92 respectively) than adolescents with lower restraint scores. For emotional and external eating, the result was the opposite, as adolescents with higher levels of emotional and external eating were less likely to be overweight compared to less emotional and external eaters.

With regard to health-related lifestyle univariate analyses showed that adolescents with moderate or high levels of physical activity were less likely to be overweight than those with low levels of activity (significant only for boys). Eating breakfast every day was negatively associated with being overweight. Adolescents who ate breakfast on a daily basis were less likely to be overweight than those who ate breakfast irregularly and (for boys) twice less likely than those who never ate breakfast. Unexpectedly, girls who ate two or more pieces of fruit per day were more likely to be overweight compared to those who ate less fruit. High snacking (three or more snacks per day) was associated with a lower chance of being overweight compared to lower snacking.

After correcting for background variables, inserting age, ethnicity, and educational level in the first step of the regression analyses, we found the same relations between eating and health-related behavior and being overweight. However, the significant lower chance of being overweight for boys with high physical activity scores compared to those with low and moderate scores disappeared after this correction for background variables.

When we conducted multivariate analyses, with background variables in the first step and all eating behavior and lifestyle factors in the second step of the analyses, almost all univariate relations with overweight remained, however, the significant negative association with overweight for high snack consumption and for high emotional eating (for girls) disappeared.

**DISCUSSION**

This study showed that being overweight was positively associated with restrained eating, and negatively associated with external and (only for boys) emotional eating, whereas no significant association with emotional eating was found for girls. Being overweight was associated with low physical activity and irregular or no breakfasting for boys, and with irregular breakfasting and eating more than two pieces of fruit per day for girls. No associations between snacking and overweight were found in multivariate analyses.

**Prevalence of overweight and obesity**

BMI scores in our study have been based on self-reported height and weight. A number of studies found that overweight children, and especially girls, were more likely to under-report their weight (Shannon, Smiciklas-Wright & Wang, 1991).
Table 2. Univariate and multivariate analyses on overweight\(^a\); effect of eating behavior and health-related lifestyle in Dutch adolescents (odds ratios (OR) and 95% interval)

<table>
<thead>
<tr>
<th></th>
<th>Univariate</th>
<th>Univariate with background variables(^b)</th>
<th>Multivariate with background variables(^b, c, d)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys OR</td>
<td>Girls OR</td>
<td>Boys OR</td>
</tr>
<tr>
<td></td>
<td>(95%)</td>
<td>(95%)</td>
<td>(95%)</td>
</tr>
<tr>
<td>Emotional eating</td>
<td>0.84**</td>
<td>0.81*</td>
<td>0.81**</td>
</tr>
<tr>
<td></td>
<td>(0.73–0.97)</td>
<td>(0.68–0.95)</td>
<td>(0.70–0.93)</td>
</tr>
<tr>
<td>External eating</td>
<td>0.65***</td>
<td>0.60***</td>
<td>0.63***</td>
</tr>
<tr>
<td></td>
<td>(0.57–0.75)</td>
<td>(0.50–0.71)</td>
<td>(0.55–0.73)</td>
</tr>
<tr>
<td>Restrained eating</td>
<td>2.43***</td>
<td>1.92***</td>
<td>2.43***</td>
</tr>
<tr>
<td></td>
<td>(2.17–2.73)</td>
<td>(1.70–2.15)</td>
<td>(2.15–2.73)</td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Moderate</td>
<td>0.72**</td>
<td>0.93</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>(0.56–0.92)</td>
<td>(0.69–1.25)</td>
<td>(0.60–1.00)</td>
</tr>
<tr>
<td>High</td>
<td>0.72*</td>
<td>0.73</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>(0.54–0.96)</td>
<td>(0.51–1.05)</td>
<td>(0.60–1.09)</td>
</tr>
<tr>
<td>Breakfast</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Every day</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1–6 days/week</td>
<td>1.58***</td>
<td>1.73***</td>
<td>1.46**</td>
</tr>
<tr>
<td></td>
<td>(1.26–2.00)</td>
<td>(1.35–2.23)</td>
<td>(1.15–1.85)</td>
</tr>
<tr>
<td>Never</td>
<td>2.01***</td>
<td>1.49</td>
<td>1.90**</td>
</tr>
<tr>
<td></td>
<td>(1.41–2.87)</td>
<td>(0.99–2.25)</td>
<td>(1.31–2.76)</td>
</tr>
<tr>
<td>Snacks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 3 snacks/day</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>≥ 3 snacks/day</td>
<td>0.66***</td>
<td>0.75*</td>
<td>0.60***</td>
</tr>
<tr>
<td></td>
<td>(0.53–0.81)</td>
<td>(0.57–0.97)</td>
<td>(0.48–0.75)</td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 2 pieces/day</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>≥ 2 pieces/day</td>
<td>1.06</td>
<td>1.41***</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>(0.87–1.28)</td>
<td>(1.12–1.76)</td>
<td>(0.81–1.22)</td>
</tr>
</tbody>
</table>

Notes: Significant differences effects are marked: * \(p < 0.05\); ** \(p < 0.01\); *** \(p < 0.001\) (\(n = 10,087\)).

\(^a\) BMI based on self-reported height and weight, overweight was determined by international BMI cut-off points based on age and gender and corresponding with BMI above 25 at the age of 18 (Cole \textit{et al.}, 2002).

\(^b\) Background variables included are: age, ethnicity and educational level.

\(^c\) Different analyses were performed with BMI or age standardized BMI scores as outcome variable, these showed identical results except from physical activity, which was significant for girls but not for boys.

\(^d\) No significant interaction effects were found between background variables (age, ethnicity, educational level) and other model variables on overweight.
However, the results on the validity of self-reported weight are mixed, in a number of studies self-reported measurements have been found to differ relatively little and correlate highly with measured height and weight (Brener, McManus, Galuska, Lowry & Wechsler, 2003; Strauss, 1999; Stunkard & Albam, 1981). Self-reported height and weight have been found highly reliable for predicting obesity related morbidities and behaviors (Strauss, 1999). Although not as accurate as measured weight and height it remains the most cost-efficient way to assess weight in large-scale epidemiological studies.

The ethnic differences in anthropometrics in our study are consistent with previous Dutch studies, which show higher ratings on BMI and higher percentages of overweight for Turkish and Moroccan children (Fredriks et al., 2003; Spee-van der Weke, Radder, Verloove-Vanhorick & Schalk-van der Weide, 1994). Because cut-off scores for BMI are age and gender specific, differences in age and gender cannot explain ethnic differences in prevalence of overweight. It has been argued, however, that the relationship between body fat percentage and BMI differs for ethnic groups and that cut-off points for overweight and obesity based on BMI will therefore have to be ethnicity specific (Deurenberg, Yap & Van Staveren, 1998). We cannot exclude that ethnic differences in body composition influenced our results, therefore in the multivariate analyses we corrected for ethnicity.

Eating behavior

Boys reported higher levels of external eating, while girls scored higher on emotional and restrained eating. Most eating behavior scores increased with age. These gender and age differences have also been found in previous studies (Brugman, Meulmeester, Spee-van der Weke, Radder, Verloove-Vanhorick & Schalk-van der Weide, 1994). Because cut-off scores for BMI are age and gender specific, differences in age and gender cannot explain ethnic differences in prevalence of overweight. It has been argued, however, that the relationship between body fat percentage and BMI differs for ethnic groups and that cut-off points for overweight and obesity based on BMI will therefore have to be ethnicity specific (Deurenberg, Yap & Van Staveren, 1998). We cannot exclude that ethnic differences in body composition influenced our results, therefore in the multivariate analyses we corrected for ethnicity.

Restrained eating

Previous studies showed that dieting is common practice among Dutch adolescents (Brugman et al., 1997) and starts at a young age (Hill & Robinson, 1991). Restrained girls are motivated to diet, limit their daily intake of food, skip meals (particularly breakfast) and experience high levels of hunger and low control over their eating. Obese adolescents have been found to score higher on dieting and concern for diet (Sanchez-Carracedo et al., 1996), and to have higher degrees of restraint than normal weight adolescents (Lluch et al., 2000; Wardle et al., 1992). In our study, we found a positive relation between restrained eating and being overweight, replicating those earlier results (Lluch et al., 2000; Wardle et al., 1992), and consistent with the restrained eating theory.

Previous publications showed that although restrained eating is associated with higher BMI it also associated with lower intake of energy, carbohydrate and protein (only significant for boys) (Lluch et al., 2000; Wardle et al., 1992). It seems contradictory that restrained eating is associated with restriction of food intake as well as with being overweight. The restraint theory explains this by declaring that skipping meals lead to irregular eating patterns and to counter-regulation at moments of disinhibition, thus binging, and eventually higher weight. Therefore dieting is not always successful for long-term weight control of adolescents (Polivy & Herman, 1985). In our study restrained eating was negatively correlated to breakfasting; the higher adolescents scored on restrained eating the less often they breakfast (r(4430) = −0.06 for boys and r(4581) = −0.17 for girls (p < 0.01)). This suggests an irregular and restrictive eating pattern in restrained adolescents. However, the association between being overweight and restrained eating could also be the other way round: overweight adolescents are more likely to start dieting. Due to the cross-sectional nature of our and other studies among adolescents it is not

Eating behavior

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possible to draw conclusions about the direction of the relation. Longitudinal data should reveal whether restrained eating and skipping meals, are a cause of or a response to being overweight.

**External eating** External eating was negatively associated with being overweight. This is contrary to the theory of external eating and empirical findings in adult studies, but again in line with previous studies in adolescents (Lluch et al., 2000; Wardle et al., 1992). Interestingly, the findings of Wardle et al. (1992) and Lluch et al. (2000) showed that although external eating is negatively associated with weight, it is positively related to food intake. The influence of parents could explain this contradiction. In early adolescence much of the food intake is controlled by parents. For example, parental presence at the evening meal was found to be positively associated with adolescents' higher consumption of healthy food items (Videon & Manning, 2003). Heavier children are subject to more food control (Tiggemann & Lowes, 2002) and food restrictions (Fisher & Birch, 1999a). This could explain our findings that overweight adolescents scored lower on external eating than normal weight adolescents, and possibly also why overweight girls ate more fruit. Parents of overweight children are probably less likely to permit their children to give in to unhealthy external cues, or to expose them to these cues.

On the other hand, parental food restrictions can also have unintended effects. A series of experiments by Birch and Fisher (Birch & Fisher, 2000; Fisher & Birch, 1999a, 1999b, 2000) showed that restriction of palatable food was associated with higher intake of these restricted foods and more negative self-evaluation afterwards. Parental restriction of palatable snack food was associated with higher desire to eat, and the actual intake of these foods in an unrestricted setting, even without hunger. The authors therefore suggested that imposed restriction of palatable food can sensitize children to external eating cues, and may interfere with their ability to self-regulate intake (Fisher & Birch, 1999b; Johnson & Birch, 1994). Adolescents’ self-restraint, however, appeared to counteract the tendencies towards excessive external eating in the study by Wardle et al. (1992). The present study showed a negative correlation between restraint and external eating. It should be noted, however, that this correlation was low and that our study design does not allow conclusions about the mechanisms by which restraint, restriction, externality and food intake interact.

**Limitations**

A limitation of our study is that the data are cross-sectional. Longitudinal data on weight changes and weight outcomes at an older age are necessary to be able to make sound conclusions about the direction of our cross-sectional associations. As mentioned previously, restrained eating was positively associated with being overweight, but whether restrained eating actually preceded weight gain or whether being overweight causes dieting and thus higher restrained eating scores cannot be concluded from our data. The same can be discussed regarding our results on the negative association between external eating and being overweight. Is external eating indeed a protective factor for being overweight or do overweight adolescents adapt their eating behavior?

In this study snacking was not measured with a validated questionnaire, although it was derived from a validated scale. Common food-intake measurements (e.g. food records, dietary histories, and repeated 24-hour recalls) are costly and time consuming and therefore not suitable for large-scale studies. Moreover, measuring intake of nutrients was beyond the purpose of this study, in which we focused on snacking behavior irrespective of energy intake.

Also, physical activity was measured through self-reports, whereas other methods like the double labeled water method or heart rate monitoring are more accurate. Questionnaires, however, are more cost efficient and less of a burden for the subjects and therefore more suitable for large-scale studies like ours.

Another limitation of our study is that questionnaires are vulnerable in respect to socially desirable answers. Being overweight is highly stigmatized in our society, therefore it could be socially desirable for overweight subjects to endorse questions about being on a diet and not to endorse those about emotional and external eating (Van Strien & Ouwens, 2003). It is, however, also socially desirable to report high physical activity; this was not the case for obese subjects in our study. Therefore we think social desirability did not play a large role in this study.

Finally, this study used a community sample. Students from different regions, ethnicity and educational levels in the Netherlands were included. The results on eating behaviors, weight and health-related behaviours, however, cannot be generalized to specific high risk groups. For eating disorder patients, for example, different pathways could apply.

**Conclusions**

In this study, findings of previous small-scale studies have been replicated in a large nationwide sample. Three different measurements of eating behaviors (emotional, external and restrained eating) as well as other health-related behaviors (physical activity, fruit consumption, snacking and skipping breakfast) were studied in young adolescents. Results indicate that the theories developed in adult studies do not all seem to explain adolescents’ weight status. In adolescents, only restrained eating was positively associated with being overweight. Emotional eating was not associated with being overweight for girls and negatively associated for boys. External eating was negatively associated with being overweight. In addition, in this study we tried to get a better picture of the health-related behavior of overweight adolescents. Social-cultural pressure to be thin (Stice, 1994), higher food
restrictions and control by parents of overweight children could explain our results that being overweight is associated with more healthy fruit and snack consumption and low external eating. With regard to fruit and snack consumption and external eating it seems that overweight adolescents practice a healthier lifestyle than non-overweight adolescents. However, our data revealed that their lifestyle was not healthier in all aspects as being overweight was also associated with low physical activity, skipping breakfast and high restrained eating.

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