



Prevalence of dieting and fear of weight gain across ages: a community sample from adolescents to the elderly

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Abstract

Objectives The current study aimed to define the prevalence of dieting and fear of weight gain among men and women across the entire lifespan and identify factors associated with them.

Methods Data were available for 31,636 participants (60.2% women; age 13–98 years) from the Netherlands Twin Register. Dieting and fear of weight gain were described by age and sex. Associations with BMI, exercise behavior, urbanization and educational attainment were examined by regression analyses in 19,294 participants.

Results Dieting was most frequently reported by 35- to 65-year-old women (56.6–63%), and 45- to 65-year-old men (31.7–31.9%). Fear of weight gain was most prevalent in women between 16 and 25 (73.2–74.3%), and in 25- to 55-year-old men (43.2–46.1%). In addition to sex and BMI, dieting and fear of weight gain were associated with each other. Furthermore, fear was associated with the age×sex interaction and educational attainment.

Conclusions Dieting and fear of weight gain is common during the entire lifespan for women, but is also endorsed

by a substantial number of men. Given the low rate of overweight in young women, the high levels of fear of weight gain are striking.

Keywords Dieting · Fear of weight gain · Prevalence · Community study · Lifespan

Introduction

In Western society, dieting to lose weight is common practice, with the reported prevalence ranging from 21 to 56% in women and 6 to 25% in men (Kjelsas et al. 2004; Liechty and Lee 2013; Mangweth-Matzek et al. 2006; Neumark-Sztainer et al. 2007). Women in particular, as well as individuals with a higher BMI, are more likely to engage in dieting (Forrester-Knauss and Zemp 2012; Liechty and Lee 2013; Mendes et al. 2014). However, prevalence studies in samples that include broad age ranges and/or men are rare.

Contrary to expectation, dieting does not lead to weight loss: dieting efforts appear to predict weight gain and overweight status over time (Field et al. 2010; Neumark-Sztainer et al. 2007; Pietilainen et al. 2012; Stice et al. 1999). Furthermore, dieting behavior increases the risk of extreme weight loss behaviors and eating disorders (Liechty and Lee 2013; Neumark-Sztainer et al. 2006; Stice et al. 2011). A core characteristic of eating disorders is fear of weight gain. The few prevalence studies that have examined this feature demonstrate that over 60% of 13-year-old girls, and over 60% of women above 50 years, reported fear of weight gain (Gagne et al. 2012; Micali et al. 2014). Thirty-nine percent of 13-year-old boys were afraid of gaining weight and strong fear of weight gain was endorsed by 12–42% of girls and 5–10% of boys between ages 12 and 18 (Deschamps et al. 2015; Micali et al. 2014).

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Expanding upon findings from previous studies, the current study aimed to define the prevalence of dieting and fear of weight gain among men and women across the entire lifespan, in a large population-based sample ($N > 31,000$; age range 13–98 years). Recruitment was based on the presence of twins in the family. In a large subsample with data on BMI, exercise behavior, degree of urbanization, and educational attainment, the associations of these lifestyle and demographic variables with dieting and fear of weight gain were examined.

Methods

Sample

Participants were registered with either the Young or Adult Netherlands Twin Register (YNTR or ANTR; Vrije Universiteit Amsterdam). Both the YNTR and ANTR collect information on health, lifestyle, personality and/or behaviour problems in the twins and their family members on a 2- to 3-year basis (Van Beijsterveldt et al. 2013; Willemsen et al. 2013).

In the YNTR, twins and multiples (e.g. triplets) are registered at birth by their parents. Surveys are completed at fixed ages of the children (Van Beijsterveldt et al. 2013). At the ages of 14, 16, and 18 years, twins, triplets and additional siblings, complete self-report surveys with parental consent. Data from surveys collected between 2005 and 2013 were analyzed in the present study. The response rate was 47%. For participants who completed the survey on more than one occasion (e.g. at 14 and 16 years of age), the most recent assessment was taken.

The ANTR cohort consists of adult twins and multiples (born between 1909 and 1996), their parents, non-twin siblings, spouses and offspring (Willemsen et al. 2013). The present study was based on data from the 8th survey that was conducted between 2009 and 2011 (Geels et al. 2013). We approached 47,122 subjects and based on follow-up of participants over the past years, we estimate that 37,934 received the invitation and 45% returned the survey. The eighth survey was sent out in multiple waves, where participants in the later waves received a shorter survey. For individuals who participated in both the YNTR and ANTR, data from the ANTR were selected. Data collection was approved by the Medical Ethical Committee of the VU University Medical Center in Amsterdam.

Measures

Dieting and fear of weight gain

The surveys included two items on weight-related features. Dieting: 'Have you ever gone on a diet to lose weight or to

stop gaining weight?'. Responses were on a 5-point scale ('never', 'a couple of times', 'several times', 'often', and 'always on a diet'). Fear of weight gain: 'How afraid are you of gaining weight or becoming fat?'. Responses were on a 5-point scale ('not afraid', 'slightly afraid', 'somewhat afraid', 'very afraid', and 'extremely afraid').

Demographic and lifestyle variables

Degree of urbanization was based on address density in the residential area and measured on a scale of 1 to 5 (very high, high, moderate, low, very low). In accordance with a previous NTR study the degree of urbanization was collapsed into two categories (very low-moderate vs. high-very high; Geels et al. 2013).

Since most YNTR participants were still attending high school, educational attainment was assessed as the current or last attended level of secondary education in this cohort. Educational attainment was coded as 'low-middle' (technical school/lower general secondary education) or 'high' (higher general secondary education/pre-university education). In the ANTR cohort the highest degree of completed education was coded as 'low-middle' (primary school/lower or intermediate vocational schooling/upper secondary school) or 'high' (upper vocational/university; Geels et al. 2013; Statistics Netherlands 2012).

Based on self-reported or measured height and weight, body mass index (BMI) was calculated and categorized into 'underweight' [ANTR: $BMI < 18.5$; YNTR: BMI cut-off ranged between 15 (13 years) and 18.5 (≥ 18 years); Van Buuren 2004)], 'normal weight' (ANTR: $25 > BMI \geq 18.5$; YNTR: depending on age $20.6-25 > BMI \geq 15-18.5$), and 'overweight' (ANTR: $BMI \geq 25$; YNTR: depending on age $BMI \geq 20.6-25$; Hirasing et al. 2001).

Voluntary exercise behavior in leisure time was assessed by asking individuals what activities they participated in (including times a week and minutes each time). Each activity was subsequently recoded into its metabolic equivalent of task (MET) according to the compendium of physical activity for adults (Ainsworth et al. 2000) or for youth (Ridley et al. 2008) in the YNTR. One MET is the rate of energy expenditure of an individual sitting quietly (approximately 1 kcal/kg/h). The METs of the different activities were summed for each individual to calculate an exercise behavior score (METs score) per week. In the YNTR cohort, school sports and sports with an intensity level lower than 2.5 METs were excluded from the METs score. In the ANTR cohort, sports with an intensity level below 4.0 METs were excluded from the METs score. 83.2% of adult participants received survey 8.0 and 17.8% the shorter survey 8.1; for this last group data on educational attainment and exercise were missing.

Analyses

The sample was stratified by sex and age (age groups 13–16, 16–18, 18–20, 20–25, 25–35, 35–45, 45–55, 55–65 and ≥ 65 years). The frequency distribution of the demographic and lifestyle variables and dieting and fear of weight gain were computed for the different sex by age groups in SPSS version 22 (IBM Statistics). Using χ^2 statistics, we investigated whether men and women differed significantly from each other within each age category on dieting and fear of weight gain. Furthermore, age differences within the male and female sample were examined.

Dieting and fear of weight gain were regressed on the demographic and lifestyle variables. Ordinal regression analyses were carried out in Mplus version 7.3. The Weighted Least Square with mean adjusted Chi-square test statistics (WLSM) in combination with the ‘Complex’ option was used to correct for the effect of dependency due to familial clustering (Rebollo et al. 2006). A split-sample validation method was used. First, regression analyses were performed with all demographic and lifestyle variables of 75% of the sample. This group was randomly selected from the total sample, for which data on all independent variables were available. The remaining 25% of the sample was used in the second step, to validate the results of the initial regression and estimate model performance. In this step, only the variables significantly associated with dieting or fear of weight gain in the initial analyses were entered into the regression. Age, sex (male=0, female=1) and an age \times sex interaction term were also entered into the regression. To examine the association between the two weight-related features, fear of weight gain (at least slightly=1, not=0) was entered into the regression analyses of dieting and vice versa (dieting: at least a couple of times=1, never=0). Cohort (YNTR=0, ANTR=1) was included to correct for differences in measures assessing educational attainment and exercise behavior. The significance level was set at $\alpha = 0.01$.

To examine whether missing data affected the results of the regression analyses, initial and ordinal regression analyses were also performed after applying multiple imputation in Mplus. Ten imputed datasets were generated. Results from the imputed datasets were pooled according to Rubin’s rules to account for the uncertainty associated with the imputations (Rubin 1987).

The proportional odds assumption in the ordinal regression analyses was not fulfilled, therefore, additional binary logistic regression analyses were performed (Bender and Grouven 1998). Using cumulative probabilities dieting and fear of weight gain were rescaled into four binary variables (diet1 ‘at least a couple of times’, diet2 ‘at least several times’, diet3 ‘at least often’, diet4 ‘at least always’; fear1 ‘at least slightly’, fear2 ‘at least somewhat’, fear3 ‘at least

very’, fear4 ‘at least extremely’). Because of the increase in parameters the significance level was set at $\alpha = 0.00016$.

Finally, to investigate whether the results between the sex and age categories from the first part of our study remained after controlling for covariates, age was entered as a categorical variable in the ordinal regression analyses of dieting and fear of weight gain in the initial sample. Eight dummy-coded age variables were entered (age 16–18, age 18–20, age 20–25, age 25–35, age 35–45, age 45–55, age 55–65, age >65).

Results

Data on dieting or fear of weight gain were available for 31,636 participants (see Table 1). The majority of the respondents was women (60.2%) and twins (61.9%). Their mean age was 31.6 years (SD 17.6, range 13.0–97.8). YNTR participants were on average 16.0 years old (SD 1.8, range 13–22), and ANTR participants were on average 40.4 years old (SD 16.3, range 13.7–97.8).

Demographic and lifestyle variables

Table 2 shows the distribution of the demographic and lifestyle variables, stratified by age and sex. More than one third of the participants lived in densely populated areas. Adult men and women (25–35 years old) were most likely to live in an urban residential area. Over half of the participants reported a high level of education. High educational attainment was most prevalent in 25- to 35-year-old men and 20- to 25-year-old women, and least prevalent in participants over 65.

Underweight and normal weight was most common in 13- to 16-year olds. Overweight was most prevalent in men between 55 and 65 years and in women over 65. The same trend was observed with BMI. The level of exercise

Table 1 Overview of the number of Netherlands Twin Register participants, stratified by age and sex (Netherlands, 2005–2013)

	Male	Female	Total
13–16 years	2529	2978	5507
16–18 years	2035	2438	4473
18–20 years	1546	2713	4259
20–25 years	935	1789	2724
25–35 years	859	1864	2723
35–45 years	1061	2002	3063
45–55 years	1595	2984	4579
55–65 years	1454	1658	3112
>65 years	568	628	1196
Total	12,582	19,054	31,636

Table 2 Distribution or prevalence of demographic and lifestyle variables, stratified by age and sex (Netherlands, 2005–2013)

	Age 13–16		Age 16–18		Age 18–20		Age 20–25		Age 25–35		Age 35–45		Age 45–55		Age 55–65		Age >65		
	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)	Women (%)	
Urbanization level (N = 30,846)																			
Urban residential area	26.5	28.3	27.7	26.7	31.3	35.0	37.9	42.4	48.2	43.7	38.2	33.6	30.5	30.1	34.9	35.4	37.1	40.0	
Educational attainment (N = 24,853)																			
High	56.9	58.5	60.1	59.7	56.9	56.8	66.3	71.6	66.9	63.8	56.2	44.4	50.8	36.6	49.7	32.0	44.1	24.1	
Weight class (N = 30,674)																			
Underweight	13.6	16.2	10.3	13.4	8.9	10.6	4.7	8.0	2.0	4.0	0.2	1.8	0.3	1.2	0.1	1.1	0.2	1.0	
Normal weight	78.1	75.8	81.7	78.0	83.1	78.4	79.2	77.8	65.0	70.0	51.1	63.3	41.5	54.4	38.3	50.0	45.6	47.9	
Overweight	8.3	8.0	8.0	8.6	8.0	11.0	16.1	14.2	32.9	26.0	48.7	34.9	58.2	44.5	61.5	48.9	54.2	51.1	
Body mass index (N = 30,674)																			
Mean (SD)	18.9 (2.6)	19.4 (2.7)	20.6 (2.5)	20.8 (2.8)	21.5 (2.7)	21.6 (3.2)	22.4 (3.0)	22.3 (3.5)	24.1 (3.2)	23.4 (3.8)	25.3 (3.2)	24.5 (4.6)	26.0 (3.4)	25.3 (4.4)	26.3 (3.3)	25.5 (4.2)	25.8 (3.2)	25.9 (4.2)	
Weekly METs score (N = 27,857)																			
Mean (SD)	31.8 (31.7)	22.4 (26.2)	32.6 (34.1)	21.6 (28.6)	24.4 (29.4)	15.9 (23.4)	21.2 (28.3)	13.0 (20.6)	13.7 (21.4)	8.8 (14.8)	11.3 (17.8)	7.3 (11.3)	11.9 (20.7)	7.5 (12.3)	9.7 (18.3)	6.8 (13.8)	6.5 (14.6)	4.3 (9.2)	

MET metabolic equivalent task

(weekly METs score) was highest in 13- to 16-year-old females and 16- to 18-year-old males. The lowest METs score was found in participants over 65.

Dieting and fear of weight gain

In Fig. 1 the distributions of dieting and fear of weight gain stratified by sex and age are depicted. Most men and women were 'never on a diet' (Fig. 1a, b; 68.1–94.5% in men, 37.0–82.1% in women). More women than men reported dieting in each of the age categories ($\chi^2(4)$ range 71.6–477.2, $p < 0.0001$). The distribution of dieting differed significantly between the age categories in men ($\chi^2(32) = 993.0$, $p < 0.0001$) and women ($\chi^2(32) = 1818.3$, $p < 0.0001$). 45- to 65-year-old men (31.7–31.9%) and 35- to 65-year-old women (56.6–63%) reported the highest rates of dieting. In the total sample, 7.4% of women [range 2.8% (13–16 years) to 12.8% (45–55 years)] and 1.2% of men [range 0.2% (25–35 years) to 3% (55–65 years)] were 'often' or 'always' on a diet.

Across all ages the distribution of fear of weight gain was significantly different between men and women ($\chi^2(4)$ range 55.9–985, $p < 0.0001$; Fig. 1c, d). The majority of men (53.9–74.5%) were 'not afraid' of gaining weight or becoming fat, compared to 25.7–46.2% of women. Among

women, being 'slightly afraid' was endorsed most often (38.9–43.9%), except in those over 65. Fear of weight gain differed significantly between the age categories in men ($\chi^2(32) = 357.6$, $p < 0.0001$) and women ($\chi^2(32) = 478.5$, $p < 0.0001$). Men reported being 'slightly afraid' of gaining weight (36.1–37.4%) more between ages 25–55. Fear of weight gain was most frequently endorsed in females between 16 and 25 years ['slightly' 41.6% (39.7–43.9%); 'somewhat' 19.4% (18.3–20.0%); 'very' 10.1% (9.7–10.5%); 'extremely' 2.5% (2.0–3.5%)]. In the total group, 8.9% of women [range 2.3% (>65 years) to 14% (16–18 years)] and 1.5% of men [range 0.5% (>65 years) to 1.9% (16–18 and 20–25 years)] were 'very' or 'extremely' afraid of gaining weight.

Regression analyses

Data on all demographic and lifestyle variables were present for 19,294 participants [7874 men, 11,420 women; mean age 33.4 (range 13.0–97.8)]. For the initial regression analyses 74.8% of this sample ($N = 14,434$) was randomly selected. Dieting regressed significantly ($p \leq 0.01$) on sex, BMI, METs score and fear of weight gain (Table 3). Being female, higher BMI, higher level of exercise and fear of weight gain were associated with an increased rate

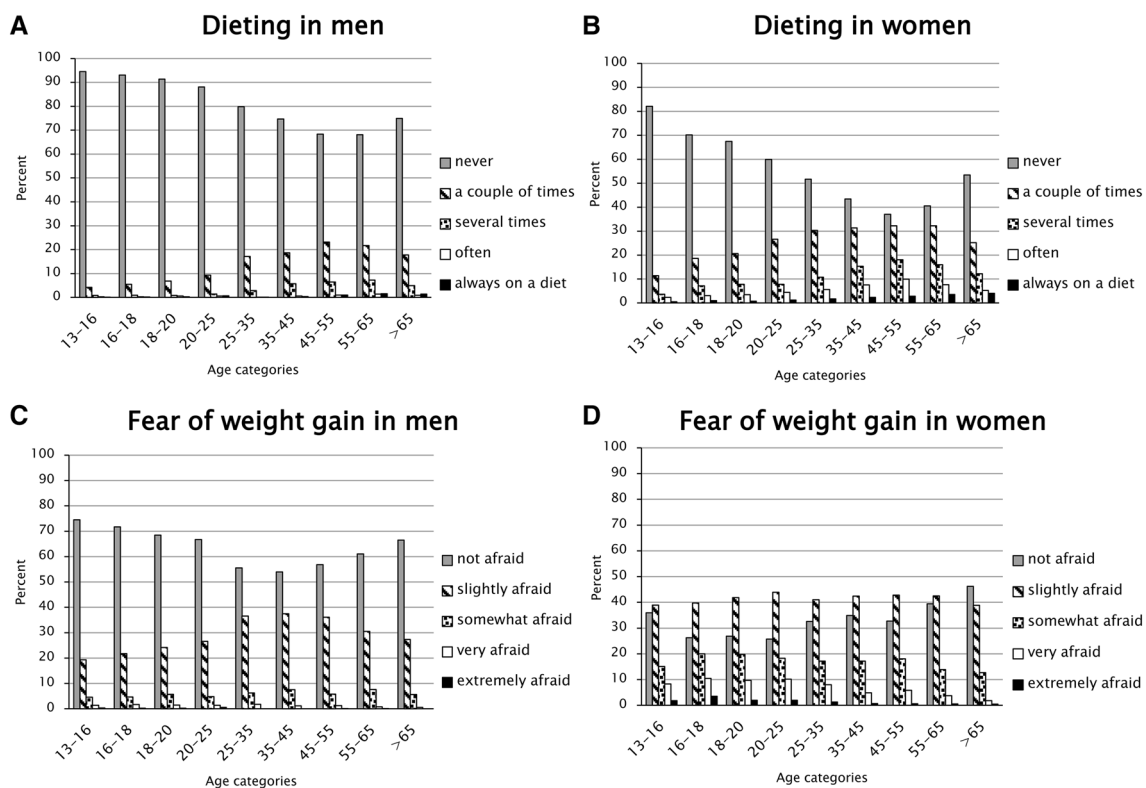


Fig. 1 Distribution of dieting ($N = 29,139$) and fear of weight gain ($N = 31,515$) in men (a, c) and women (b, d) per age category (Netherlands, 2005–2013)

of dieting. Fear of weight gain regressed significantly ($p \leq 0.01$) on all variables with the exception of degree of urbanization. Greater fear of weight gain was associated with being female, being younger and their interaction, higher BMI, higher level of exercise, higher educational attainment and dieting.

Most of these results could be replicated in the validation regression analyses in the remaining sample of 4860 participants. As shown in Table 3, sex, BMI and fear of weight gain were significantly associated with dieting. Fear of weight gain significantly regressed on sex, the sex \times age interaction, BMI, educational attainment and dieting. When combining the results of the initial and validation analyses, increased dieting appeared to be associated with being female, higher BMI and fear of weight gain. Increased fear of weight gain was associated with being a (young) woman, higher BMI, higher educational attainment and dieting. The ordinal regression analyses after applying multiple imputation (Online Resource 1) and the binary logistic regression analyses (Online Resource 2 and 3) yielded comparable results.

When investigating age categories instead of a continuous age variable in the initial sample, dieting regressed significantly on all the age categories (β 's 0.04–0.19,

$R^2=0.48$). Compared to the 13- to 16-year olds older participants had a higher chance of reporting dieting. Being afraid of gaining weight regressed significantly on the age categories 25–35, 35–45, 45–55, 55–65 and >65 years (β 's -0.10 to -0.20 , $R^2=0.31$). Participants in these age categories had less of a chance of reporting fear of weight gain. Both these findings were in line with the results from the first part of our study.

Discussion

This is the first study to examine the prevalence of dieting and fear of weight gain across the adolescent and adult lifespan in both genders. Significant differences between gender and age were demonstrated. More women had been on a diet, and the prevalence of dieting was highest in the 35–65 age range in women and the 45–65 age range in men. Across the lifespan the majority of women were afraid of gaining weight or becoming fat, with a peak prevalence in 16- to 25-year-olds. The majority of men, on the other hand, were not afraid of gaining weight (the highest prevalence was found in 25- to 55-year-olds). Fear of weight gain, higher BMI and being female were associated

Table 3 Regression (ordinal) of dieting and fear of weight gain on demographic and lifestyle variables (Netherlands, 2005–2013)

	Initial regression ($N=14,434$)				Validation regression ($N=4,860$)			
	β	SE	99% CI	R^2	β	SE	99% CI	R^2
Dieting								
Sex	0.27*	0.02	0.22, 0.33	0.40	0.26*	0.02	0.22;0.30	0.46
Age	0.04	0.02	-0.01, 0.09		-	-	-	
Sex \times age	0.01	0.02	-0.04, 0.07		-	-	-	
BMI	0.40*	0.01	0.38, 0.42		0.38*	0.02	0.35, 0.42	
Weekly METs score	0.05*	0.01	0.03, 0.08		0.04	0.02	-0.002, 0.08	
Educational attainment	0.02	0.01	-0.01, 0.04		-	-	-	
Degree of urbanization	0.01	0.01	-0.01, 0.03		-	-	-	
Fear of weight gain (at least slightly)	0.27*	0.01	0.25, 0.29		0.28*	0.02	0.24, 0.31	
Fear of weight gain								
Sex	0.51*	0.02	0.47, 0.55	0.32	0.51*	0.03	0.44, 0.59	0.31
Age	-0.07*	0.02	-0.12, -0.03		-0.01	0.03	-0.08, 0.07	
Sex \times age	-0.26*	0.02	-0.31, -0.21		-0.29*	0.04	-0.38, -0.20	
BMI	0.25*	0.01	0.22, 0.27		0.26*	0.01	0.23, 0.30	
Weekly METs score	0.04*	0.01	0.01, 0.06		0.02	0.01	-0.02, 0.05	
Educational attainment	0.06*	0.01	0.04, 0.09		0.06*	0.01	0.03, 0.10	
Degree of urbanization	0.01	0.01	-0.01, 0.03		-	-	-	
Dieting (at least a couple of times)	0.30*	0.01	0.28, 0.33		0.30*	0.02	0.26, 0.33	

Sex: male = 0, female = 1. Educational attainment: low-middle = 0, high = 1. Degree of urbanization: low-moderate = 0, high-very high = 1. Cohort (Young Netherlands Twin Register = 0, Adult Netherlands Twin Register = 1) was entered into the regression analyses to correct for differences in assessments of exercise behavior and educational attainment

β (beta) standardized regression coefficients, SE standard errors beta, MET metabolic equivalent of task

*Betas were significant at $\alpha=0.01$

with increased dieting. Greater fear of weight gain, was associated with dieting, being a (young) woman, higher BMI and high educational attainment.

The prevalence of dieting was previously investigated in population-based samples of adolescents (Deschamps et al. 2015; Field et al. 2010; Groleau et al. 2014; Kjelsas et al. 2004; Liechty and Lee 2013; Neumark-Sztainer et al. 2007), adults (Eik-Nes et al. 2015; Forrester-Knauss and Zemp 2012; Liechty and Lee 2013) and elderly (Mangweth-Matzek et al. 2006). In comparison to our sample, overweight was more common in most of these studies (Deschamps et al. 2015; Eik-Nes et al. 2015; Field et al. 2010; Liechty and Lee 2013; Mendes et al. 2014; Neumark-Sztainer et al. 2007). Despite differences in the assessment our findings were comparable to the reported prevalence for current dieting (Deschamps et al. 2015; Kjelsas et al. 2004; Liechty and Lee 2013; Mangweth-Matzek et al. 2006), dieting in the past year (Mendes et al. 2014) and dieting in the past 10 years (Eik-Nes et al. 2015). However, dieting in the past year was more prevalent in 12- to 20-year-old American females and males (56.4 and 24.8% respectively; Neumark-Sztainer et al. 2007) and in 14- to 22-year-old American females (50.1%; Field et al. 2010) compared to our results (17.9–40.1% in 13- to 25-year-old females, 5.5–8.6% in 13- to 20-year-old males). In a community-based sample of Swiss adults (Forrester-Knauss and Zemp 2012) dieting in the past year was less prevalent (11.2% in women and 6.9% in men compared to 35.2–63.0% in NTR women and 8.6–31.9% in NTR men). All studies that included both genders demonstrated a higher prevalence for dieting in women compared to men, comparable to the results from our regression analyses. Furthermore, having a higher BMI or being overweight as an adolescent prospectively predicted dieting later in life (Liechty and Lee 2013; Mendes et al. 2014). The studies in adults are less consistent, being overweight was associated with dieting in Swiss men (Forrester-Knauss and Zemp 2012), while no association between BMI and dieting was found in Norwegian women (Eik-Nes et al. 2015). Contrary to the findings from our validation analyses, a higher exercise level was previously associated with dieting (Forrester-Knauss and Zemp 2012), whereas exercising 2–3 times a week prospectively predicted occasional dieting at age 17 in females (Mendes et al. 2014). In Liechty and Lee's (2013) sample, older adolescents had a higher chance of dieting 6–8 years later. In the Swiss adult sample, older age (men above 45, women above 35) was associated with a lower rate of dieting (Forrester-Knauss and Zemp 2012). Similar to our study, no association between age and dieting was found in the Norwegian women (Eik-Nes et al. 2015). In our regression analyses fear of weight gain was strongly associated with dieting, no other study has investigated the relationship between these features before. Although dieting was

associated with other weight-related features like body image distortion (Liechty and Lee 2013), body dissatisfaction (Mendes et al. 2014), overestimating body weight (Deschamps et al. 2015) and inversely with weight satisfaction (Eik-Nes et al. 2015).

Few community studies have examined fear of weight gain; two adolescent samples (Deschamps et al. 2015; Micali et al. 2014) and two middle-aged samples of women (Gagne et al. 2012; Marcus et al. 2007). They all reported a higher frequency of overweight or mean BMI compared to the NTR sample. The previously reported prevalence for women were similar to our results; respectively, 63.2 and 11.5% of 13-year-old girls were afraid or very afraid of gaining weight (Micali et al. 2014), 9.2% of 42- to 52-year old women were frequently tormented by the idea of being fat (Marcus et al. 2007), and 58–66% of women over 50 were upset to gain five pounds (Gagne et al. 2012). In a French community study, 41.9% of the 12- to 18-year-old girls were (very) often afraid of putting on weight (Deschamps et al. 2015) compared to a much lower 10.1–14% in 13- to 18-year-old NTR girls that were very/extremely afraid of gaining weight. Furthermore, 10.4% of 12- to 18-year-old French boys were (very) often afraid of putting on weight. Respectively, 34.5% and 4.7% of 13-year-old English boys were afraid or strongly afraid of gaining weight (Micali et al. 2014), which is high in comparison to our findings that 25.4 and 1.7–1.9% of 13- to 18-year-old boys were afraid or very/extremely afraid of gaining weight. Deschamps et al. (2015) showed that over- or underestimating body weight was associated with, respectively, more or less fear of weight gain. Other studies have reported higher levels of weight concerns, including fear of weight gain, in individuals with a higher BMI (Gagne et al. 2012; McLean et al. 2010; Ro et al. 2012). The finding that older women report less fear of weight gain, was comparable to other weight-related features, such as weight dissatisfaction (Forrester-Knauss and Zemp 2012), importance of body image (Peat et al. 2008; Tiggemann 2004), drive for thinness and societal influence on body image (Pruis and Janowsky 2010). Finally, previous studies demonstrated an association between high educational level or social class and higher body or weight dissatisfaction (Forrester-Knauss and Zemp 2012; McLaren and Kuh 2004).

Some limitations of this study should be noted. First, 62% of the participants were twins. Because twins are born in all population groups, recruiting families with a twin is a good starting point for collecting a population-based sample (Martin et al. 1997). However, birth weight is generally lower in twins than in singletons, and the BMI difference remains in adulthood (Andrew et al. 2001; Schousboe et al. 2003). The comparison of twins to their non-twin siblings at the age of 18 years also showed that twins were as tall as their siblings but were significantly

leaner (Estourgie-van Burk et al. 2010). Indeed, the rate of overweight was between 1 and 10% lower (depending on age and sex) in our sample compared to the general Dutch population (Statistics Netherlands 2011). However, performing the analyses with sample weights (based on the distribution of the weight classes in the Dutch population) did not yield different results for the prevalence or regression models. Furthermore, 30% of our sample had missing data for one or more of the lifestyle and demographic variables and were, therefore, excluded from the regression analyses. These were partly missing by design (for 17.8% of adult participants educational attainment and exercise were not part of the survey). Minimal differences were found after applying multiple imputation, suggesting that this did not bias the results in an appreciable manner. Third, the analyses were performed with cross-sectional data. Hence, our findings, that the levels of dieting and fear of weight gain differed between ages, do not elucidate the developmental course of these traits. Longitudinal studies are necessary to understand how dieting and fear of weight gain change during the life span. Most YNTR participants were still attending high school. Therefore, the educational attainment variable in our study was comprised of different items for the YNTR and ANTR cohorts. Finally, exercise behavior was computed differently in the two cohorts (an intensity level of, respectively, 4.0 and 2.5 METs was used as a threshold for sports in the ANTR and YNTR participants). It is likely that this difference in calculation has magnified the difference in exercise behavior between young and older participants, and this may have hindered the possibility of finding an association with the weekly METs score.

In summary, this study confirmed the previously reported prevalence of dieting and fear of weight gain for several sex and age groups. Furthermore, it extended previous community-based studies by estimating the prevalence of dieting in adult men (>25 years) and fear of weight gain in 18- to 50-year-old women and men over 18. Dieting and fear of weight gain was more common in women, but a substantial number of men engaged in dieting (range 5–32%) and reported fear of weight gain (range 25–47%), particularly in middle-age. For women, on the other hand, dieting (range 17–63%) and fear of weight gain (range 53–75%) were common during the entire lifetime. More specifically, 16- to 25-year-old females seemed to be particularly afraid of gaining weight. Given the low rates of overweight, the finding that between 12 and 14% of these young women was 'very' or 'extremely' afraid of gaining weight is disturbing. Besides body weight and dieting other features may also influence the onset or maintenance of fear of weight gain. Future, longitudinal studies are necessary to identify these features and investigate the consequences of these findings.

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Compliance with ethical standards

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Ethical approval All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments.

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