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Age at dieting onset, body mass index, and dieting practices: A twin study

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Abstract

Objective—Using a twin study design, we sought to determine whether an early age at dieting onset is a risk factor for higher adult body mass index (BMI) or use of risky dieting practices, independent of genetic and familial factors.

Method—Female twins ages 18–60 years (N = 950) from the University of Washington Twin Registry completed 2 surveys an average of 3 years apart. Analyses of individual twins and within-twin pairs tested associations of self-reported age at dieting onset with 1) adult BMI at baseline, 2) change in BMI between the two surveys and 3) risky dieting behaviors at baseline.

Results—In analyses mimicking studies of unrelated individuals, an earlier age at dieting onset was associated with greater adult BMI ($p = 0.003$), higher Restraint Scale scores ($p < 0.001$), greater use of risky dieting behaviors ($p = 0.04$) and more weight cycling episodes ($p < 0.001$). In within-pair models that control for genetic and familial factors, the only significant association was between an earlier age at dieting onset and more weight cycling episodes ($p = 0.006$).

Discussion—Underlying genetic and familial factors may influence associations of early dieting with higher adult BMIs and risky dieting practices in women.

As obesity rates have increased worldwide, so has the use of dieting as a way to promote weight loss. Unfortunately, dieting has not been shown to be successful for long-term weight loss maintenance.¹ In fact, most dieters gain back what they lost, if not more weight, over time.^{2,3} There is a large gender discrepancy in dieting as evidenced by a much greater prevalence of dieting in females as compared to males.⁴ Additionally, the prevalence of dieting in women rises with increasing body mass index (BMI).⁵ Moreover, it has been documented that women who diet are more likely to have lower body satisfaction independent of their weight status.⁶

Nationwide, 46% of adolescents reported they have attempted to lose weight.⁷ Additional studies have supported that dieting in adolescence is associated with unhealthy weight

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Disclosure of Conflicts.

The authors have no conflicts of interest to report.

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control behaviors and dieting as they progress into young adulthood.⁸ Longitudinal studies have found that weight control behaviors used in adolescence and pre-adolescence predict a higher BMI later in life.^{9–12} Female adolescents who reported dieting had significantly larger gains in BMI over time as compared to nondieters.⁴ Additionally, dieting adolescents are not only predisposed to greater weight gain and obesity in adulthood, but also to risky eating behaviors that may be the precursors of clinical eating disorders.¹³

Individuals who diet can engage in risky or healthful dieting behaviors. Risky dieting behaviors such as fasting and excessive exercising as well as use of diet pills, vomiting, or laxatives, are associated with less healthful dietary patterns and a greater tendency to remain or become overweight.^{9,12} Adolescents who engage in risky eating behaviors have greater BMIs to start with and a greater change in BMI over time.¹² Fortunately, the use of risky dieting behaviors in adolescent females has decreased in recent years.^{7,14}

All dieting practices occur in the setting of the considerable genetic influence on body weight.¹⁵ In addition, other familial factors, such as learned eating habits, likely also contribute to an individual's weight. Dietary behaviors learned as a child generally continue on into adulthood.¹⁶ In particular, the parent's behavior, especially that of the mother, can have a strong influence on a child's eating behavior including specific eating styles, food selection and preference, and the self-regulation of food and energy intake.¹⁶ Parental encouragement for their child to diet, especially on the part of mothers, was predictive of increased adolescent unhealthy weight control behaviors and added weight gain.^{17–19}

Although it is generally accepted that dieting is associated with greater weight gain over time and a greater BMI,^{4,20} the exact mechanism by which dieting influences weight gain is still unknown. For example, it is unclear if heavier people are more likely to diet and remain heavy, if dieting itself induces weight gain, or some interaction of the two whereby dieting induces excess weight gain in susceptible people. Some researchers have hypothesized that individuals predisposed to a greater weight are more likely to engage in unsuccessful dieting practices. Therefore, individuals predisposed to obesity may diet more often in order to control their affinity towards weight gain.²¹ On the other hand, dieting may actually induce weight gain.^{21,22}

Twin studies provide a unique opportunity to examine the questions related to body weight and weight loss practices, because they can control for the strong genetic influence on body weight as well as the familial influences on eating behaviors. This is because monozygotic (MZ) twins share 100% of their genetic background and dizygotic (DZ) twins share, on average 50%. If raised together in the same household, each member of the pair (MZ or DZ) shares the same familial environment. When twin characteristics are compared to the other twin within a pair, the shared family environment is controlled for. Similarly, genetic background is controlled for in MZ pairs and partially controlled for in DZ pairs.

The primary aim of this study is to determine the associations of age at dieting onset with both BMI, in cross-sectional and longitudinal analyses, and dieting practices, among female twins. We hypothesized that an earlier age at dieting onset would be associated with a greater BMI at baseline and over time as well as with the use of various risky dieting practices, regardless of genetic predispositions. In other words, we proposed that initiation of dieting behaviors at an early age would be an individual environmental factor that promotes both weight gain and unhealthy dieting behaviors.

METHODS

Participants

Participants for this study were female twins, aged 18 to 60 years from the University of Washington Twin Registry. Both male and female twins from Washington State have been recruited from driver's license and ID applications since the 2002 mailed invitation letter and recruitment survey.²³ A more detailed survey that included questions about dieting practices and eating behavior, the University of Washington Twin Registry Health Survey, was mailed out to everyone in the Registry in 2006 and repeated in 2008; this survey achieved a 55% response rate. A subsequent follow-up survey, administered since 2010 with a response rate of 74%,²⁴ was used for the longitudinal assessment of BMI. The variable duration of time between these 2 survey administrations resulted in an average longitudinal follow-up period of approximately 3 years.

After excluding women over age 60, twins who did not live together prior to age 18, and twins with a history of weight loss surgery, 950 eligible women who had completed both the initial and the follow-up survey were used in analyses. Of these, 464 were individual twins and 486 were members of the 243 complete pairs (66% MZ, 30% DZ, 4% indeterminate).

Measures

Body Mass Index—Baseline BMI (kg/m^2) was calculated from self-reported weight and height provided in the 2006 survey, based on the questions “how tall are you without shoes?” and “how much do you weigh without clothes or shoes?” Time 2 BMI was calculated from self-reported height and weight from the 2010 follow-up survey. The question asked, “What is your current height (in feet and inches) and weight (in pounds)?” Change in BMI was the difference between BMI at Time 2 and baseline. We performed a reliability study among 78 Registry participants enrolled in a separate study to compare self-reported to measured BMI. Self-reported and measured BMI were strongly correlated with each other (regression slope coefficient = 0.96; 95% confidence interval: 0.92, 0.99). The mean absolute difference between self-reported BMI and measured BMI was $-0.22 \text{ kg}/\text{m}^2$ (95% confidence interval: $-0.51, 0.08$) reflecting a slight underestimation of BMI.

Zygosity—All twins completed a questionnaire about childhood similarity to assess zygosity.²⁴ Studies show that questions about childhood similarity in twin pairs can be used to correctly differentiate among monozygotic (MZ) and dizygotic (DZ) twin pairs with an accuracy that is ~95% of that achieved by using biological indicators.²⁵

Restrained Eating—The Restraint Scale is a 10-item self-report questionnaire used to assess restrained eating.²⁶ People who score high on the scale exhibit frequent dieting, disinhibited eating, and body dissatisfaction.²⁷ Questions focus on weight fluctuations and feelings about eating behaviors and current weight such as “Would a weight fluctuation of 5 pounds affect the way you live your life?”; “How conscious are you of what you are eating?”; “Do you have feelings of guilt after overeating?”; and “What is the maximum amount of weight you have ever lost in 4 weeks?” The validity of the Restraint Scale has been assessed, and while it was predictive of many behaviors, it may overestimate restraint in overweight individuals.²⁷ Specifically, normal-weight females score higher from their feelings of body dissatisfaction, whereas overweight and obese females achieve high scores due to the degree of weight loss or gained rather than excessive concern with weight or eating habits.

Dieting Practices—People may institute a “diet” for many reasons besides losing weight. We defined “dieting” for this study as the participants’ self-reported attempt to lose weight,

acknowledging that we do not have information about whether the participants conceived of this attempted weight loss as a “diet” or how successful the weight loss attempt was. “Age at dieting onset” was defined from the self-reported, retrospective question “How old were you when you first attempted to lose weight?” Use of risky dieting behavior methods over the past 12 months was also assessed by self-report.²⁸ The lead-in question asked, “During the past 12 months, how did you try to lose weight?” Of seven possible responses, the three deemed indicative of risky dieting behavior were: “Skipped meals/fasted”; “Took diet pills prescribed by a doctor”; and “Took laxatives or vomited”. These behaviors were selected because they have been associated with the development of eating disorders and high BMI and because they were previously used as indicators for unhealthy weight control behaviors.^{11,12,14} Positive responses (Yes) to these items were totaled to create a continuous variable accounting for the cumulative use of risky dieting behaviors.

Weight cycling was assessed from the following question, “In your lifetime, how many times have you lost 10 or more pounds on purpose?” The response options were: 0, 1–2, 3–4, and 5+. This question was used in previous studies to gauge the severity of weight cycling.²⁹ This question was administered as part of the 2010 follow-up survey, after the participants already stated their age at dieting onset in the baseline questionnaire.

Statistical Analyses

Statistical analyses were performed using STATA 11C (StataCorp, College Station, TX). Descriptive statistics were computed including means and standard deviations for continuous variables and proportions for categorical variables.

We first examined the distribution of age at dieting onset and then created age groups based on quartiles of the distribution. Twins in the 25th (ages 15–17), 50th (ages 18–24), and 75th (ages 25+) percentiles were compared to those who began dieting prior to age 15. This analysis was done in order to compare the various groups to one another to see if dieting at a certain age range was associated with differences in BMI compared to the other groups. Generalized estimating equations (GEE) with robust standard errors³⁰ were used to account for twin relatedness and to determine the extent to which BMI varied based on the age of a first weight loss attempt.

We also tested relationships between age at dieting onset, used as a single continuous measure, and continuous outcomes of interest, namely BMI at baseline, change in BMI, and eating behaviors including Restraint Scale scores, number of risky dieting practices and weight cycling episodes. Adjusted models controlled for age, race/ethnicity, and income.

Finally, we conducted within-twin-pair difference analyses³¹ among all complete twin pairs and stratified by zygosity by using simple linear regression models to test the association of within-pair differences in age at dieting onset to within-pair differences in our outcomes of interest. Because the twins are compared to each other, these analyses controlled for age as well as genetic and numerous unmeasured familial factors.

RESULTS

Twin characteristics

Twin characteristics are provided in Table 1 for all participants and stratified by percentiles of age at dieting onset. The mean age of dieting onset was 20.8 ± 9 years, with a range of 8 to 59 years. Participating women had a mean baseline BMI range of 15.6 kg/m² to 50.63 kg/m². Women who recalled their first attempt to diet prior to age 25 were on average between the ages of 31–34 at the time of assessment. However, those who recalled their first attempt to diet older than 25 years of age were significantly older at the time of assessment, with a

mean age of 47 years old. There were minimal differences in racial demographics between the groups. Overall, the sample population was predominantly Caucasian (89.5%), followed by Hispanic/Latino (4.4%), Other (3.3%), Asian (3.0%), American-Indian/Alaskan Native (2.9%), African-American (1.5%), and American Hawaiian/Pacific Islander (0.7%).

Associations between age at dieting onset and BMI

Analyses adjusted for age at time of assessment demonstrated significant associations between age at dieting onset in quartiles and BMI for women such that women who began dieting at ages 18–24 ($p=0.010$) and those 25 years and older ($p=0.003$) had lower BMIs when compared to the youngest dieting group (Table 2). The results indicate that individuals who began dieting at age 18 or older tend to have lower BMI's than individuals who began dieting prior to age 15. There was no significant association for the group who began dieting from 15–17 years of age as compared to the youngest (reference) age group (Table 2). However, change in BMI between the two surveys was not associated with age at dieting onset ($p=0.91$).

The mean within-pair difference in BMI was 3.15 ± 3.65 kg/m² (range = 0, 23.2 kg/m²) and within-pair differences were less for MZ than for DZ pairs (MZ mean = 2.39 ± 2.74 kg/m²; DZ mean = 4.59 ± 4.68 kg/m²). The mean within-pair difference in age at dieting onset was 0.25 ± 8.64 y (MZ mean = 0.67 ± 6.29 y; DZ mean = 0.83 ± 12.4 y). Results of analyses comparing within-pair differences in age at dieting onset to within-pair differences in BMI are shown in Table 3. These analyses inherently control 100% for age and shared familial environment. When MZ pairs are considered alone, genetics are controlled for in addition. Within-pair analyses showed no significant associations of age at dieting onset with either BMI at time of baseline assessment ($p=0.57$) or change in BMI ($p=0.37$).

Analyses stratified by zygosity also showed no relationships between age at dieting onset and BMI (MZ=157 pairs, $\beta=0.340$, 95% confidence interval= $-0.061, 0.129$, $p=0.480$; DZ=70 pairs, $\beta=0.057$, 95% confidence interval= $-0.184, 0.070$, $p=0.337$). Age at dieting onset was also unrelated to change in BMI when stratified by zygosity (data not shown).

Associations between age at dieting onset and dieting strategies

In both adjusted and unadjusted overall analyses, an earlier age at dieting onset was associated with greater Restraint Scale scores ($p<0.001$; Table 3). For every year increase in age at dieting onset, the Restraint Scale score decreased by 0.13. However, when familial and genetic factors were controlled for by use of within-pair analyses, the associations were not present ($p=0.186$; Table 3). There was also a significant association between earlier age of dieting onset and a greater use of risky dieting behaviors among women who reported dieting, but again, the association did not persist once genetic and familial factors were accounted for in within-pair analyses (Table 3).

Finally, unadjusted and adjusted analyses showed a significant relationship between an earlier age at dieting onset and episodes of weight cycling (Table 3). Additionally, within-pair analyses were also significant, indicating that twins who began dieting at an earlier age report more weight cycling episodes in their lifetime than their twin who began dieting at a later age (Table 3). When analyzed separately, trends were present between both MZ ($\beta=-0.023$, $p=0.060$) and DZ twins ($\beta=-0.021$, $p=0.054$).

DISCUSSION

Among a large group of female twins, we found that an earlier age at dieting onset was associated with a greater BMI. Early dieting was also associated with higher Restraint Scale

scores, greater use of risky dieting behaviors and a greater number of weight cycling episodes. Subsequent within-pair analyses, which controlled for the twins' shared genetic and family environment factors found no significant associations between age at dieting onset and our outcome measures of interest except for weight cycling episodes. These findings suggest that women who begin dieting at earlier ages, regardless of their genetic or family background, experience more episodes of weight cycling in their lifetime. Apart from weight cycling, our findings support the hypothesis that genetic and family environmental factors may be mediating or confounding the relationship of age at dieting onset to BMI and dieting behaviors.

There is an ongoing debate regarding findings that link dieting with weight gain.^{5,11,12,32} The two predominant hypotheses supported in the literature are 1) that those who diet are genetically predisposed to weight gain regardless of their attempts to diet for weight loss and 2) that dieting itself leads to an increased BMI. A number of studies indicate that a heavier weight precedes dieting. Girls who were already considered overweight at age 5 had higher levels of disinhibited eating, dietary restraint, overweight concern, and body dissatisfaction by age 9.³³ Additionally, a survey of binge-eating adults concluded that the majority reported being overweight prior to dieting and binge eating.³⁴ On the other hand, a recent twin study discovered that in MZ pairs discordant for intentional weight losses, the twin with more intentional weight loss episodes was heavier at follow-up compared to their non-dieting twin although there was no significant difference between the twins BMI at baseline.²¹ Other studies have found the use of specific dieting methods including restrained eating to be associated with weight gain.^{35,36}

Our findings demonstrate that an earlier self-reported age at dieting onset is associated with a greater BMI. Because of the cross-sectional nature of the analysis, we do not know how or if the dieting itself contributed to excess weight gain. However, our twin analyses suggest that genetics and the family environment may influence an individual's age at dieting onset and also their BMI. Although not conclusive, these data are most consistent with the hypothesis that twins who are genetically predisposed to a greater BMI may begin to diet early. Put another way, the impact of early dieting was not independent of genetic and familial influences: women who started dieting earlier than their twin did not have a significantly higher BMI than their twin at the time the survey was undertaken.

An important aim of this study was to determine if specific ages at dieting onset placed one at a particularly high risk for weight gain and use of risky eating behaviors. The exact ages at which risk is conferred cannot be reliably estimated from these data given the high probability of inaccuracy in the retrospective, self-reported measure. The data do suggest however, that women who report dieting onset prior to age 18 also report higher BMIs and greater use of unhealthy weight control behaviors as compared to women who retrospectively reported dieting at the onset of adulthood or later. One possible interpretation of these data is that delaying weight loss attempts until later ages protects against an unknown but deleterious effect of dieting on a developing body. An alternative interpretation is that women who began dieting at young ages had different motivations to lose weight and dieting strategies that persist into adulthood. This is supported by our data showing more risky dieting behaviors among early dieters as well as higher Restraint Scale scores, indicating a higher degree of concern with weight and dieting.²⁸ However, our within-pair analyses support an interpretation that women who diet as pre-teens or teenagers may already be overweight. If they suffer from body dissatisfaction as a result, then dissatisfaction itself is a predictor of dieting and use of unhealthy dieting behaviors.³⁷ In contrast, dieting in adulthood may be an attempt to offset the natural age-related decline in resting metabolic rate (approximately 1–2% per decade after 20 years of age)³⁸ reflecting a different motivation to diet and healthier weight control practices. Given the cross-sectional

and retrospective nature of these data, we cannot determine what factors motivated the initiation of weight loss attempts, but show that having a higher BMI and using unhealthy weight control behaviors in adulthood is associated with retrospective report of a first weight loss attempt prior to age 18.

Although dieting has been associated with weight gain, not all women who diet are overweight, and many women of normal weight diet. Based on the personal characteristics, there were many individuals of a normal weight-status who reported dieting and use of dieting behaviors in our sample. Results from the National Health and Nutrition Examination Survey demonstrated that dieting was related to an individual's perceived weight rather than their actual weight.³⁹ Similarly, teenage dieters were not overweight as compared to non-dieters, although they perceived themselves to be.⁴⁰ Therefore, many normal weight individuals may diet because of body dissatisfaction rather than a genetic predisposition for a larger BMI. Findings such as these, that connect early dieting to higher BMIs, emphasize how critical it is to understand whether dieting behaviors among normal weight individuals constitute a risk factor for excess weight gain even beyond genetic predisposition.

We also found that the association between early dieting onset and greater use of risky dieting behaviors was not independent of genetic and familial factors. Exposure within the family to dieting behavior could drive early initiation of dieting as well as use of unhealthy dieting behaviors.¹⁸ This finding has implications for prevention of eating disorders because the use of unhealthy weight control behaviors¹² or severe dieting⁴¹ has been shown to increase risk of eating disorders. An important future direction is to further parse genetic and familial contributions to this relationship through bivariate structural equation modeling and through additional studies into specific factors that may contribute to early dieting onset and risky dieting behavior.

In the current work, an early age of dieting onset was related to a greater number of episodes of weight cycling even in our within-pair analyses and analyses stratified by zygosity demonstrated consistent trends. These findings suggest that, independent of their family environment or genetic propensity toward weight gain (100% controlled among MZ twins) individuals who diet at an earlier age also appear to experience more weight cycling. This could be because dieting from an early age interacts with physiological systems to make permanent weight loss more difficult.⁴² Or, by initiating dieting early, the individual has more opportunities to gain and lose weight, or vice versa. Conversely, the women who reported more weight cycling episodes may be able to recall their age of dieting onset more accurately than women who reported less episodes.

These analyses are not without limitations. The sample population was demographically homogenous and cannot be extrapolated to other populations. The mean BMI of participating individuals was barely considered overweight and may not reflect the involvement in dieting or use of dieting behaviors in populations with higher obesity prevalence. Weight, in particular, is subject to underreporting by overweight participants,⁴³ a factor that could have caused us to underestimate the true effect an earlier age at dieting onset on adult body weight. Our own reliability study suggested that actual BMIs were likely higher. The primary variable of interest, age at dieting onset, required the individual to recall when they first engaged in dieting behavior in order to lose weight and is therefore subject to recall bias and inaccuracy. In fact, many of the women responded to the survey in mid-life, decades later than their reported age at dieting onset and may be inaccurate. For example, those who recalled their first attempt to diet >25 years were on average 47 years old, while those who recalled their first attempt to diet <25 years of age were on average 31–34 years old. This could reflect either recall bias or a cultural shift toward increased pressure

on young women to lose weight over time. Because the question only asked “How old were you when you first attempted to lose weight?” there is no information regarding how successful their dieting attempt was. We had no measure of the individual’s BMI leading up to their reported age at dieting onset. Therefore, we cannot extrapolate these results to show how weight status influenced the age at dieting onset. Finally, risky behaviors were self-reported as was weight cycling.

In sum, among female twins, we found that a younger age at dieting onset is associated with increased BMI as well as higher Restraint Scale scores, risky dieting behaviors, and episodes of weight cycling. The within-pair analyses showed that genetic and familial factors likely influence the relationship between age at dieting onset and both BMI and dieting behaviors. However, weight cycling episodes were associated with an earlier age at dieting onset independent of genetic and family factors. Additionally, these results illustrate that the delay of dieting onset until adulthood is associated with lower BMIs, possibly because those who begin to diet later do so for different reasons than those who diet earlier. Future studies should investigate the specific genetic and familial factors that might explain both an early onset of dieting as well as higher BMI and use of risky dieting behaviors.

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Highlights

- 950 adult female twins retrospectively reported age at first weight loss attempt
- Outcomes were self-reported adult BMI and dieting behaviors
- Early dieting was associated with higher adult BMI and more risky dieting behaviors
- These associations were not present in within-pair analyses
- Genetic/familial factors influence associations of early dieting with poor outcomes

Table 1

Participant characteristics by age of dieting onset*

	Overall (n = 938)	<15 (n = 184)	15-17 (n = 234)	18-24 (n = 305)	25+ (n = 215)
Age (years)	36.3 (14.5)	32.2 (12.6)	31.3 (12.8)	34.5 (14.2)	47.5 (12.3)
BMI [†] (kg/m ²)	25.8 (5.5)	26.4 (6.0)	26.1 (5.9)	25.3 (5.4)	25.7 (4.7)
BMI Change (kg/m ²)	0.8 (2.5)	0.8 (2.8)	0.9 (2.6)	0.7 (2.4)	0.6 (2.2)
Restraint Scale Score	15.7 (4.8)	17.8 (4.9)	15.9 (5.2)	14.9 (4.4)	14.8 (4.4)
Weight Cycling** (%)					
0	21.0	13.9	21.3	26.6	18.9
1-2	44.2	41.9	42.7	43.5	49
3-4	20.8	22	20.5	18.5	23.6
5+	13.7	22	15.3	11.3	8.3
Risky Dieting Behaviors [‡] (%)	41.6	50.5	43.1	38.6	36.6
Zygosity (%)					
MZ ¹	54.6	57.5	56.9	52.4	52.7
DZ ²	42.1	39.2	41.7	43.0	43.5
IZ ³	3.2	3.2	1.2	4.5	3.6

Continuous variables presented as mean (standard deviation) and categorical variables as percentages.

* Age groups defined by quartiles of the age distribution.

[†] BMI; Body Mass Index (body weight [kg] divided by height [m²])

** Weight cycling; # of times lost 10 or more pounds

[‡] Risky Dieting Behaviors; In response to the question "During the past year, how did you try to lose weight?", the percentage of respondents who reported doing any of the following: "skipped meals/fasted", "took diet pills prescribed by a doctor", or "took laxatives or vomited".

¹ MZ; Monozygotic Twins

² DZ; Dizygotic Twins

³ IZ; Indeterminate zygosity

Table 2Adjusted overall associations between age at dieting onset and body mass index, by age quartiles¹ (N=938)

	<15	15–17	18–24	25+
Adjusted Mean BMI	23.90	23.72	22.45	22.10
95% CI	(22.62, 25.18)	(21.28, 26.16)	(20.08, 24.83)	(19.63, 24.56)
Z	Ref.	−0.30	−2.58	−2.98
p> z 	Ref.	0.76	0.01 [*]	0.003 [*]

* Significantly different from group who dieted younger than 15 years of age

¹ P-values were derived from GEE with robust standard errors and are adjusted for age at time of assessment.

CI=confidence interval.

Table 3Overall and within-pair analyses for age at dieting onset to dieting behaviors¹

	N	Coefficient	Test statistic	P value	95% confidence interval
Restraint Scale Scores:					
Overall	913	-0.082	-4.62	<0.001	(-0.116, -0.047)
Adjusted ²	913	-0.130	-6.41	<0.001	(-0.170, -0.090)
<i>Within-Pair</i> ³	224	-0.054	-1.33	0.186	(-0.135, 0.026)
Risky Behaviors:					
Overall	771	-0.006	-3.12	0.002	(-0.011, -0.002)
Adjusted ²	771	-0.005	-2.02	0.043	(-0.009, -0.000)
<i>Within-Pair</i> ³	171	-0.001	-0.15	0.879	(-0.013, 0.011)
Weight Cycling:					
Overall	944	-0.009	-2.74	0.006	(-0.015, -0.002)
Adjusted ²	944	-0.027	-7.13	<0.001	(-0.034, -0.019)
<i>Within-Pair</i> ³	240	-0.021	-2.80	0.006	(-0.036, -0.006)

¹ For overall and adjusted analyses test statistics (z) and P-values were derived by using generalized estimating equations with robust standard errors. For within-pair analyses, test statistics (t) and P-values were derived by using simple linear regression models of within-pair differences.

² Adjusted for age at time of assessment

³ For within-pair analyses (italics) N is the total number of twin pairs included in analyses.