

## Short Communication

# Past dieting is related to rigid control and disinhibition in adolescents from the Québec Family Study

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### Abstract

Eating behaviour traits of rigid control and disinhibition have been associated with body weight in both adults and adolescents. Moreover, adults reporting a dieting history have increased levels of unhealthy eating behaviours. Against this background, the present study aimed to examine the relationship between dieting history and eating behaviour traits in adolescents. For the purpose of this research, a total of sixty adolescents (aged 15 (SEM 2.4) years) from the Québec Family Study completed the Three-Factor Eating Questionnaire (TFEQ) and a questionnaire regarding eating habits. Self-reported current and past dieting were analysed against eating behaviour traits measured by the TFEQ, including all subscales. As the results revealed, few adolescents reported currently dieting ( $n$  3). Adolescents who reported a dieting history (23.3%) were older (16.9 *v.* 14.4 years,  $P < 0.001$ ), were more likely to be female (78.6 *v.* 41.3%,  $P < 0.05$ ) but did not have a significantly higher BMI *z*-score (1.5 *v.* 0.9,  $P = 0.10$ ), although they were more likely to be either overweight or obese ( $P < 0.01$ ). After correcting for sex, BMI and age, adolescents who reported a dieting history had higher levels of rigid control and disinhibition ( $P < 0.05$ – $0.0001$ ) than those reporting no dieting history. A greater proportion of adolescents characterised by high rigid control and high disinhibition were past dieters, compared to those characterised by low levels of both behaviour traits (53 *v.* 4%). The study arrived at the following conclusions: as observed in adults, adolescents with a history of dieting present unfavourable eating behaviour traits. These behavioural traits may represent an additional challenge to the long-term regulation of body weight.

**Key words:** Eating behaviour: Dieting: Adolescents: Three-Factor Eating Questionnaire

Obesity rates among youth are high and factors implicated in their aetiology need to be identified. Eating behaviour traits have been related to body weight<sup>(1,2)</sup>, weight gain over time<sup>(3)</sup>, reduced weight loss in a weight loss intervention<sup>(4)</sup> and reduced weight loss maintenance<sup>(5)</sup>. Recently, we reported that the eating behaviour traits of rigid control and disinhibition, as measured by the Three-Factor Eating Questionnaire (TFEQ)<sup>(6)</sup>, were positively associated with body weight in adolescents from the Québec Family Study (QFS)<sup>(2)</sup>. Dieting to lose weight is also prevalent among youth, with proportions reaching up to 57% and 25.3% for girls and boys, respectively (mean age 12.8 (SEM 0.8) years)<sup>(7)</sup>. Additionally, dieting in this age

group has been shown to be related to weight gain<sup>(7,8)</sup> and binge eating<sup>(8,9)</sup> and is important in the prevention of obesity, particularly since dieting and disordered eating are known to persist from adolescence into adulthood<sup>(10)</sup>. In adults of the QFS, past dieters had greater cognitive restraint, rigid control and disinhibition compared to non-dieters<sup>(11)</sup>. On the contrary, Turkish adolescents who were chronic dieters (dieting  $\geq$  5 times/year) had lower cognitive restraint, disinhibition and hunger scores compared to adolescents with no past dieting<sup>(12)</sup>. Thus, the relationship between dieting or past dieting and eating behaviour traits is not clear. Moreover, to our knowledge, no study has looked at dieting history and the specific TFEQ

**Abbreviations:** TFEQ, Three-Factor Eating Questionnaire; QFS, Québec Family Study.

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subscales among adolescents. The aim of the present study is to examine the relationship between past dieting and eating behaviour traits among adolescents from the QFS.

## Methods

Participants for this study belonged to Phase 2 of the QFS. Details of the QFS are described elsewhere<sup>(13)</sup>. At the end of Phase 2 (1989–95), sixty adolescents completed the TFEQ<sup>(6)</sup> which measures cognitive restraint, disinhibition and hunger as well as their respective subscales<sup>(14,15)</sup>. They also completed a questionnaire pertaining to their eating habits. Participants who responded positively to the question ‘do you remember following a diet in the past 5 years?’ were categorised as past dieters. Participants who responded positively to the question ‘are you currently following a diet?’ were categorised as current dieters. Body weight and height were measured using standardised laboratory methods. BMI *z*-scores were calculated from the Centers for Disease Control and Prevention (CDC) growth charts to create an age-normalised body weight variable<sup>(16)</sup>. In addition, body weight categories, e.g. normal weight, overweight and obese, were determined by cut-offs suggested by Cole *et al.*<sup>(17)</sup>. Median split was used to categorise high and low eating behaviour traits, creating groups of equal sizes. Statistical analyses were performed using JMP 7.0 statistical software (SAS Institute). Descriptive statistics consist of means with their standard errors and medians with inter-quartile ranges (TFEQ scores). ANOVA and Fisher’s exact test were used to test for significant differences between groups, i.e. past dieters and non-dieters. The  $\chi^2$  test was used to test for independence between high and low eating behaviour trait categories and past dieting status. Bivariate analyses were adjusted for age, sex and BMI. Relative risk was used to quantify the risk of dieting between eating behaviour trait categories. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the ethics committee of Laval University. Written informed consent was obtained from all subjects/patients.

## Results

Mean age and BMI of the participants were 15.0 (SEM 2.4) years and 25.9 (SEM 8.0) kg/m<sup>2</sup>, respectively. Overall, 55% of the sample was categorised as either overweight or obese. Few adolescents were currently following a diet (*n* 3 or 5.0%). More adolescents reported a past dieting experience (*n* 14 or 23.3%). Analyses were not performed on current dieters due to the low number of participants expressing this behaviour. Past dieters were older (16.9 *v.* 14.4 years,  $P < 0.001$ ) and constituted a greater proportion of females (78.6% *v.* 41.3%,  $P < 0.05$ ), compared to those who had no past dieting experience. There was a trend for past dieters to have a higher BMI *z*-score ( $P = 0.10$ ), higher waist circumference ( $P = 0.06$ ) and greater percentage body fat ( $P = 0.09$ ). Significantly more overweight/obese adolescents reported past dieting than normal-weight adolescents (36.4 *v.* 7.4%,  $P = 0.008$ ). Most TFEQ scores were higher among past dieters than non-past dieters

(Table 1). After correcting for sex, age and BMI, a past dieting experience predicted rigid control ( $P = 0.05$ ), attitude to self-regulation ( $P = 0.03$ ) and disinhibition and its subscales ( $P < 0.05$ – $0.001$ ). A greater proportion of past dieters was found among those with high rigid control and high disinhibition compared to those with low rigid control and low disinhibition ( $P < 0.01$ ; Fig. 1). In addition, relative to adolescents reporting both low rigid control and low disinhibition, adolescents reporting both high rigid control and high disinhibition had an increased relative risk of being a past dieter of 15.6 (95% CI 2.13, 113.8). Overall, 10% of the sample (*n* 6) was considered past dieters with high rigid control and high disinhibition and all six were either overweight (*n* 3) or obese (*n* 3).

## Discussion

The main finding of the present study was that past dieting is related to rigid control and disinhibition in adolescents. More specifically, the highest prevalence of past dieters was found among those characterised as having both high rigid control and high disinhibition. Similar findings have been recorded among adults of the QFS<sup>(11)</sup>. The eating behaviour profile of the dieter is informative as it may suggest the types of dieting behaviour adopted by the individual.

Past adolescent dieters of the QFS reported high levels of rigid control and attitude to self-regulation. Rigid control is an extreme form of dietary restraint<sup>(14)</sup>, which has been related to dieting<sup>(11,18)</sup>, disinhibition, binge eating and increased body weight in adults<sup>(14)</sup>. For these reasons, rigid control is considered an unhealthy form of dietary restraint. Moreover, attitude to self-regulation, which is associated with an all-encompassing perspective on eating and weight control<sup>(15)</sup>, is another form of strict control. It is not surprising that these behaviour traits were prevalent among adolescent dieters, as unhealthy dieting methods, e.g. laxative use, fasting, diet pills, eating little food, are prevalent among this age group<sup>(19)</sup>. In addition, flexible control, which is considered a more healthful approach to dietary restriction and inversely related to BMI in adults<sup>(14)</sup>, was not different between past dieters and those without a dieting history, after correcting for sex, age and BMI. Therefore, past dieters in this sample are not characterised by healthy solutions to restrict their dietary intake. Overall, this finding indicates that the dieting approach adopted by these adolescents is unlikely to lead to successful long-term body weight control.

Not only did past dieters have higher scores of rigid control, but they also had higher scores of disinhibition. Due to the cross-sectional nature of the data, the direction of the past dieting–disinhibition relationship, i.e. whether disinhibited eating was a result of previous dieting, cannot be determined. In other studies, dieting has previously been shown to lead to binge eating among adolescents<sup>(8,20)</sup>. Therefore, it is possible that dieting could lead to disinhibited eating through mechanisms described by the restraint theory<sup>(21)</sup>, i.e. the chronic restriction of food alters the ability to self-monitor satiety signals and may lead to overeating once the restriction is removed. It would be interesting to know if increased disinhibition scores were also found among current dieters or if this is a behaviour found among restrained eaters not currently on a

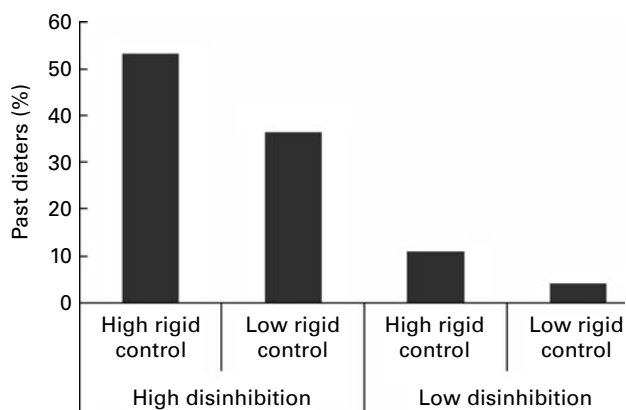
**Table 1.** Eating behaviour traits separated by dieting status among adolescents (Median values and interquartile ranges (IQR); mean values with their standard errors, *n* 60)

	Past dieter				<i>P</i> *
	Yes ( <i>n</i> 14)		No ( <i>n</i> 46)		
	Median	IQR	Median	IQR	
Cognitive restraint	6.5	6.9	3.6	4.0	0.06
Flexible control	2.0	3.2	1.6	2.0	0.23
Rigid control	2.0	2.3	0.5	1.0	0.03
Strategic dieting behaviour	1.0	1.5	0.0	1.0	0.31
Attitude to self-regulation	2.3	3.0	1.0	1.0	0.02
Avoidance of fattening foods	2.0	1.7	1.0	1.5	0.45
Disinhibition	9.0	3.5	4.5	5.0	0.0002
Habitual susceptibility	2.0	2.3	0.0	1.0	0.0002
Emotional susceptibility	3.0	1.2	0.0	2.0	0.0006
Situational susceptibility	3.0	1.5	1.0	3.0	0.02
Hunger	7.0	5.5	6.0	5.0	0.38
Internal locus	3.0	3.5	3.0	4.0	0.45
External locus	3.0	3.3	2.0	2.7	0.15
BMI z-score					0.1
Mean	1.5		0.9		
SEM	0.2		0.2		
Waist circumference (cm)					0.06
Mean	90.3		79.6		
SEM	5.5		2.7		
Percentage body fat (%)					0.09
Mean	31.6		24.8		
SEM	2.6		2.3		
Age (years)					0.0003
Mean	16.9		14.4		
SEM	0.4		0.3		
Sex (% female)	78.6		41.3		0.03

\* *P* value for Three-Factor Eating Questionnaire scores corrected for possible confounding factors (sex, age, BMI).

diet. Unfortunately, this could not be examined because of the few adolescents reporting currently dieting.

The lack of a significant difference in body weight measures between past dieters and non-dieters is perplexing because past dieting has been shown to lead to weight gain in adolescents<sup>(8,20)</sup> and high rigid control and high disinhibition have previously characterised the heaviest adolescents in this sample<sup>(2)</sup>. However, the trends for higher measures in the present study suggest a possible sample size issue, a clear



**Fig. 1.** Proportion of adolescents with a past dieting history in each eating behaviour trait category (high–low categories determined by median split);  $\chi^2$ , *P* < 0.002.

limitation of our study. Furthermore, the types of dieting strategies were not documented in our study. Past dieters could have adopted healthy means of weight control. Indeed, one participant had a history of dieting, and yet presented low levels of both disinhibition and rigid control. Other factors could also play a part in weight gain among dieters, such as reduced physical activity and reduced breakfast and fruit/vegetable consumption<sup>(9)</sup>.

Besides sample size, one main limitation of this study is the cross-sectional nature of the data. Thus, the direction of the eating behaviour–dieting relationship cannot be addressed by our analyses. As such, we can only speculate on the nature of this relationship. With so few adolescents reporting currently dieting, we cannot determine which eating behaviours characterise the former as opposed to past dieters. In addition, the present results may not be generalisable to all adolescent populations due to the high percentage of overweight/obese participants. For example, a recent Canadian Survey reported adolescent overweight and obesity rates to be 27%<sup>(22)</sup>, which is less than that reported in this study. Nevertheless, this observational study suggests that dieting and unhealthy eating behaviour co-exist among adolescents.

In conclusion, past dieting adolescents from the QFS report high scores of disinhibition and rigid control. This profile suggests that these adolescents may not be adopting a healthy weight control behaviour which may create a challenge for

successful weight control in the future. In the context of the obesity epidemic, acknowledging these behaviours, specifically among dieters, should be incorporated into obesity interventions.

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### References

1. Provencher V, Drapeau V, Tremblay A, *et al.* (2003) Eating behaviors and indexes of body composition in men and women from the Quebec Family Study. *Obes Res* **11**, 783–792.
2. Gallant AR, Tremblay A, Pérusse L, *et al.* (2010) The Three-Factor Eating Questionnaire and BMI in adolescents: results from the Québec family study. *Br J Nutr* **104**, 1074–1079.
3. Drapeau V, Provencher V, Lemieux S, *et al.* (2003) Do 6-y changes in eating behaviors predict changes in body weight? Results from the Quebec Family Study. *Int J Obes Relat Metab Disord* **27**, 808–814.
4. Dalle Grave R, Calugi S, Corica F, *et al.* (2009) Psychological variables associated with weight loss in obese patients seeking treatment at medical centers. *J Am Diet Assoc* **109**, 2010–2016.
5. Wing RR & Phelan S (2005) Long-term weight loss maintenance. *Am J Clin Nutr* **82**, 222S–225S.
6. Stunkard AJ & Messick S (1985) The three-factor eating questionnaire to measure dietary restraint, disinhibition and hunger. *J Psychosom Res* **29**, 71–83.
7. Neumark-Sztainer D, Wall M, Guo J, *et al.* (2006) Obesity, disordered eating, and eating disorders in a longitudinal study of adolescents: how do dieters fare 5 years later? *J Am Diet Assoc* **106**, 559–568.
8. Field AE, Austin SB, Taylor CB, *et al.* (2003) Relation between dieting and weight change among preadolescents and adolescents. *Pediatrics* **112**, 900–906.
9. Neumark-Sztainer D, Wall M, Haines J, *et al.* (2007) Why does dieting predict weight gain in adolescents? Findings from project EAT-II: a 5-year longitudinal study. *J Am Diet Assoc* **107**, 448–455.
10. Neumark-Sztainer D, Wall M, Larson NI, *et al.* (2011) Dieting and disordered eating behaviors from adolescence to young adulthood: findings from a 10-year longitudinal study. *J Am Diet Assoc* **111**, 1004–1011.
11. Provencher V, Drapeau V, Tremblay A, *et al.* (2004) Eating behaviours, dietary profile and body composition according to dieting history in men and women of the Quebec Family Study. *Br J Nutr* **91**, 997–1004.
12. Bas M, Bozan N & Cigerim N (2008) Dieting, dietary restraint, and binge eating disorder among overweight adolescents in Turkey. *Adolescence* **43**, 635–648.
13. Bouchard C (1996) *Genetic Epidemiology, Association and Sib-Pair Linkage: Results from the Quebec Family Study*. Baton Rouge, LA: Louisiana State University Press.
14. Westenhoefer J, Stunkard AJ & Pudel V (1999) Validation of the flexible and rigid control dimensions of dietary restraint. *Int J Eat Disord* **26**, 53–64.
15. Bond MJ, McDowell AJ & Wilkinson JY (2001) The measurement of dietary restraint, disinhibition and hunger: an examination of the factor structure of the Three Factor Eating Questionnaire (TFEQ). *Int J Obes Relat Metab Disord* **25**, 900–906.
16. Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, *et al.* (2000) CDC growth charts: United States. *Adv Data* 1–27.
17. Cole TJ, Bellizzi MC, Flegal KM, *et al.* (2000) Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* **320**, 1240–1243.
18. Timko CA & Perone J (2006) Rigid and flexible control of eating behavior and their relationship to dieting status. *Eat Weight Disord* **11**, e90–e95.
19. Neumark-Sztainer D, Wall MM, Story M, *et al.* (2003) Correlates of unhealthy weight-control behaviors among adolescents: implications for prevention programs. *Health Psychol* **22**, 88–98.
20. Neumark-Sztainer D, Paxton SJ, Hannan PJ, *et al.* (2006) Does body satisfaction matter? Five-year longitudinal associations between body satisfaction and health behaviors in adolescent females and males. *J Adolesc Health* **39**, 244–251.
21. Polivy J & Herman CP (1985) Dieting and bingeing. A causal analysis. *Am Psychol* **40**, 193–201.
22. Statistics Canada (2010) Canadian Health Measures Survey: Cycle 1 Data Tables. *Catalogue* no. 82-623X.