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Examination of shared risk and protective factors for overweight and disordered eating among adolescents

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Abstract

Objective—To identify shared risk and protective factors for purging, binge eating, and overweight in a large sample of adolescents.

Design—Prospective cohort study.

Setting—Self-report questionnaires.

Participants—Females (n = 6022) and males (n = 4518), aged 11 to 17 years in 1998, in the ongoing Growing Up Today Study (GUTS). Main exposures were putative risk and protective factors within the psychological, behavioral, and socio-environmental domains.

Main outcome measures—Using laxatives or vomiting (purging), binge eating, and overweight. Due to the low prevalence of purging, we did not examine shared risk or protective factors for this behavior among males.

Results—In 1998, 219 (3.7%) females and 30 (0.7%) males reported purging behaviors, 426 (7.1%) females and 90 (2.0%) males reporting binge eating, and 1019 (17.4%) females and 1040 (24.6%) males were overweight. Over the 3-year follow-up period (1999-2001), 331 (7.8%) females initiated purging behaviors, 503 (11.8%) females and 132 (4.5%) males initiated binge eating behaviors, and 424 (10.0%) females and 382 (13.6%) males became overweight. Concern for weight was significantly directly associated with all three weight-related problems among both males and females. Among females, dieting, parental weight-related teasing, and family meal frequency had a shared effect on the weight-related problems examined.

Conclusions—Factors within the psychological, behavioral, and socio-environmental domains may have a shared effect on purging, binge eating, and overweight. Further research is needed to determine if an intervention designed to address these shared risk and protective factors is effective in simultaneously reducing these weight-related problems.

INTRODUCTION

Weight-related problems, including purging, binge eating, and overweight/obesity (hereafter overweight), are prevalent among adolescents¹⁻³ and have adverse consequences for health.⁴⁻⁸ Research suggesting that weight-related problems may co-occur in an individual and that individuals may transition from one problem to another has prompted researchers in the fields of eating disorders and obesity prevention to propose an integrated approach that addresses the spectrum of weight-related problems within a single intervention.⁹⁻¹³ However, limited knowledge about shared risk factors for these weight-related problems is a roadblock to developing interventions using this integrated approach.

Few studies have examined shared risk factors for weight-related problems. A study of over 1000 adult twins found that parental comments about weight, assessed retrospectively, was a shared risk factor for binge eating and purging.¹⁴ Possible differential recall of comments from parents is an important inferential limitation of this study. Additionally, overweight wasn't examined. Previous analyses with GUTS have examined risk factors for binge eating and purging, but these analyses did not examine shared factors for purging, binge eating, and overweight.¹⁵

Neumark-Sztainer et al.,¹⁶ examined shared risk factors for overweight, binge eating, and weight control behaviors, including purging, among 2500 adolescents and found that, among females, weight concern, weight-related teasing, and dieting predicted all three outcomes. Among males, weight concern and weight control behaviors were associated with all three outcomes. Neumark-Sztainer et al.¹⁶ examined the association between each risk factor and each weight-related problem in separate models. Thus, the relative contribution of these factors in relation to the others explored is unknown. Examining the relative contribution would help identify the most potent factors on which to intervene. Additionally, Neumark-Sztainer et al.'s analyses didn't account for the correlation between these outcomes,¹⁶ possibly causing the standard error estimates of the effects to be too small which can result in p-values that overstate the significance of observed associations. Our study addresses limitations of previous research by modeling these weight-related outcomes jointly allowing for appropriate estimation of p-values and for assessing whether risk factors are associated differentially with purging, binge eating, and overweight.

We aimed to identify shared risk factors for overweight and disordered eating behaviors that could serve as targets for integrated prevention interventions. To achieve this aim, we examined cross-sectional and prospective associations between a range of psychological, behavioral, and socio-environmental factors and purging, binge eating, and overweight among a large sample of adolescents. We hypothesized that factors within the psychological, socio-environmental, and behavioral domains will jointly predict purging, binge eating, and overweight.

METHODS

Theoretical Model

The putative risk factors of weight-related outcomes examined in this study are derived theoretically based on the Social Cognitive Theory (SCT; Figure 1).^{17, 18} Many have been examined previously in etiologic studies of overweight or disordered eating.^{16, 19}

Study Population

GUTS is a prospective cohort study of adolescents residing throughout the US. Participants are offspring of participants in the Nurses' Health Study II (NHS II). Participants in NHS II provided consent to invite their child to participate in GUTS. In 1996, we mailed GUTS

participants an explanatory letter and a questionnaire. Returning the questionnaire constituted assent. The Human Subjects Committee at Brigham and Women's Hospital approved this study.

Details of initial recruitment are available elsewhere.²⁰ The baseline 1996 sample included 8843 females and 7696 males, age 9-14 years. Participants were mailed follow-up questionnaires annually from 1997-2001 and biannually since 2003. For the current study, we explored cross-sectional associations among risk factors and purging, binge eating, and overweight in 1998 when participants were aged 11-17 years. We examined these associations in 1998 because all predictor variables of interest were assessed that year and because most of the participants would have entered puberty by that time. Puberty has been shown to be associated with the development of weight-related problems.²¹ In our prospective analyses, we explored the association between factors assessed in 1998 and cumulative incidence of overweight, binge eating, and purging behaviors in 1999, 2000 and 2001. We selected these 3 years, which are the most proximal to when the predictor variables were measured, to help reduce the noise from other factors that may influence these outcomes. In our cross-sectional (1998) analyses we excluded 107 females and 73 males with medical conditions possibly interfering with growth, 1128 females and 1417 males missing data on all 3 outcome variables and 1586 females and 1688 males missing any of the 1998 predictor variables of interest. Our final sample for our cross-sectional analyses was 6022 females and 4518 males. In order to identify development of weight-related problems subsequent to the predictors of interest, only participants who were not overweight and were not engaging in any of the relevant disordered eating behaviors in 1998 were eligible for the prospective analysis. Thus, we excluded 1597 females and 1389 males who reported purging, binge eating, or who were overweight in 1998. We also excluded 163 females and 219 males missing data on all 3 outcome variables across the follow-up years. Our final sample for prospective analyses was 4262 females and 2910 males.

Measures

Purging—We assessed purging with validated questions:^{22, 23, 24} “During the past year, how often did you make yourself throw up to keep from gaining weight?” and “How often did you take laxatives to keep from gaining weight?” Response options ranged from “never” to “daily.” We defined purging as reporting vomiting or laxative use in the past year.

Binge eating—We assessed binge eating with validated questions.^{22, 23} Participants first reported the frequency during the past year of eating “so much food in a short period of time that you would be embarrassed if others saw you (binge-eating).” Response options ranged from “never” to “more than once a week.” Respondents reporting any episodes of overeating were directed to a follow-up question asking whether “you felt out of control during these episodes, like you could not stop even if you wanted to.” We defined binge eating as having at least one episode of overeating in the past year and feeling out of control during the episode.

Overweight—Adolescents self-reported their height and weight. Previous studies report high validity for self-reported heights and weights in adolescents.^{25,26, 27} We classified children as overweight or obese based on the International Obesity Task Force cut-offs,²⁸ which are age- and sex-specific BMI values for ages <18 years that correspond with a BMI of 25 kg/m² at 18 years. Thus, the IOTF cut off points provide comparability in assessing overweight in adolescents and adults.

Psychological Factor

Weight concern—We assessed weight concern using items from the McKnight Risk Factor Survey.²⁹ Males are more likely than females to want to increase muscle tone, rather than be thin,³⁰ thus, to make the questions appropriate for males, we replaced the questions on thinness with questions about the importance of not being fat in the surveys sent to male participants.

Behavioral Factors

Dieting—We assessed dieting with the question: “During the past year, how often did you diet to lose weight or to keep from gaining weight?” Response options ranged from “never” to “always on a diet.” For these analyses, participants were considered dieters if they reported any dieting.

Fast food intake—We assessed fast food intake with the question “How often do you eat fried foods away from home (like french fries)?” Response items range from “never/less than once per week” to “daily.” This item is moderately correlated with a question asking about frequency of eating at a fast food restaurant.³¹

Breakfast—We assessed frequency of breakfast with the question “How many times each week (including weekdays and weekends) do you eat breakfast?” Response options ranged from “never or almost never” to “5 or more times per week”

Physical activity—We assessed mean hours of physical activity per week using the 18-item Youth/Adolescent Activity Questionnaire, which is based on the validated assessment tool developed for the NHS II questionnaire.³²

TV viewing—We assessed TV viewing with the question: “How many hours per week do you spend watching TV?” Response options ranged from “never” to “31+ hours per week.” Separate questions were asked for weekends and weekdays and the values were summed and averaged to create the hours per day variable.

Socio-environmental Factors

Maternal dieting—We assessed adolescent perception of maternal dieting with the question “In the past year, how often has your mother tried to lose weight?” Response options ranged from “never” to “always.” For these analyses, mothers were considered dieters if their child reported any maternal dieting.³³

Parental weight-teasing—We assessed parental weight-teasing with the question “In the past year, how often has your mother made a comment about your weight or eating that made you feel bad?” (similar question for father). Response options ranged from “never” to “always.”

Peer concern with thinness—We assessed peer concern with the following questions: 1) “How often have your friends talked about wanting to lose weight?” 2) “How important has it been to your friends that they not be fat?” 3) “How important has it been to your friends that you not be fat?” We used the mean score of these questions to create the peer influence variable.

Desire to look like same-sex media figure—We assessed desire to look like media figures with the question: “In the past year, how often have you tried to look like the girls

or women you see on television, in movies, or in magazines?” (similar question for males). Response options ranged from “not at all” to “totally.”

Family meal frequency—We assessed family dinner with the question: “How often do you sit down with other members of your family to eat dinner or supper?” Response options ranged from “never” to “every day.”

Other covariates—We calculated child’s age from his or her birth date and the date each questionnaire was returned.

Statistical Analyses

We used generalized estimating equations^{34, 35} to jointly model the effects of the predictors on purging, binge eating, and overweight. These models assume that there is some correlation among the outcomes and adjusts standard errors to account for this correlation. We first assessed whether different effects for each predictor were necessary. To do this, we included each predictor as a main effect plus interaction terms between outcome type (i.e., purging, binge eating, overweight) and each predictor. Specifically, we included a row for each outcome for each participant. An indicator variable for outcome (purging, binge eating, overweight) is included in this row, as well as an interaction term between the indicator variable and each predictor. The test to examine whether different odds ratios are required for each outcome is a 2 df test of whether that interaction is significant. If the interaction terms were statistically significant ($p < .05$) then we retained them in the model and show the distinct odds ratios for each outcome associated with the predictor. If the interaction terms were not significant, we removed them from the model and we present the homogenous main effect of the predictor on the outcomes as a single odds ratio, which applies to all of the outcomes. All analyses were stratified by gender and conducted using SAS version 9.1.³⁶

We conducted sensitivity analyses for the cross-sectional and prospective analyses to examine how our decisions regarding inclusion and exclusion of participants may have influenced our results. We ran our models two different ways; 1) excluding any participants who had missing data on any outcome variable of interest; and 2) including all participants in the models regardless of how many outcomes of interest were missing. There were no substantive differences in results for the model options. We chose to use results from the second model, which kept all available data by including all participants in the models regardless of how many outcome variables of interest were missing.

RESULTS

Participant Characteristics

In 1998, 219 (3.7%) females and 30 (0.7%) males reported purging and 426 (7.1%) females and 90 (2.0%) males reported binge eating (Table 1). Additionally, 1019 (17.4%) females and 1040 (24.6%) males were overweight. Given the small number of males reporting purging, we did not include purging in our examination of shared factors for males. Over the 3-year follow-up period, 331 (7.8%) females initiated purging, while 503 (11.8 %) females and 132 (4.5%) males initiated binge eating. In addition, 424 (10.0 %) females and 382 (13.6 %) males became overweight.

Cross-sectional Results

Tables 2 and 3 present the cross-sectional multivariable adjusted odds ratios (ORs) of purging (females only), binge eating, and overweight associated with psychological, behavioral and socio-environmental factors among females and males, respectively. If we

found that the effect estimates for a predictor were similar for all three outcomes, i.e. the interaction term of outcome type and the predictor variable of interest was not significant, we present the single homogeneous main effect of the predictor variable on the outcomes. If we found that the effect estimates for a predictor were significantly different for the three outcomes, i.e. the interaction term was significant, we present the individual effect of the predictor variable and each outcome.

Females

Among females, weight concern was directly associated with all three weight-related problems and the direction and magnitude of the effect was similar for all three outcomes (homogeneous effect OR = 2.45, 95% CI 2.26, 2.67). Of the five behavioral factors examined, only dieting was found to be significantly associated with all three weight-related problems. The magnitude of the effect differed across the three outcomes, with dieting being most strongly associated with purging. Physical activity was significantly associated with purging and overweight, however, the direction of the effect differed; physical activity was directly associated with purging and inversely associated with overweight. Fast food intake, breakfast, and television viewing did not have a shared effect on the weight-related problems examined.

None of the socio-environmental factors were significantly associated with all three weight-related problems. However, a number of socio-environmental factors were associated with two of the three weight-related problems, suggesting a shared effect. Parental weight-related teasing was directly associated with binge eating and overweight. Family meal frequency was inversely associated with purging and binge eating. Desire to look like same-sex media figures and importance of thinness to peers were also significantly associated with two of the weight-related problems; however, the direction of these associations differed across outcomes. Desire to look like same-sex media figures was directly associated with purging and inversely associated with overweight. Importance of thinness to peers was directly associated with binge eating and inversely associated with overweight. Maternal dieting did not have a shared effect on the weight-related problems examined.

Males

Among males, concern with weight was directly associated with binge eating and overweight; the magnitude of effect differed across the two outcomes, with weight concern being more strongly associated with overweight. Of the five behavioral factors examined, only TV viewing was significantly associated with both binge eating and overweight. TV viewing was directly associated with both outcomes (homogenous effect OR= 1.12, 95% CI 1.06, 1.18). Dieting, fast food intake, breakfast, and physical activity did not have a shared effect on binge eating and overweight among males.

Parental weight-related teasing was directly associated with binge eating and overweight (homogenous effect OR = 1.31, 95% CI 1.15, 1.50). Importance of thinness to peers was significantly associated with binge eating and overweight; however, the direction of these associations differed across outcomes. Importance of thinness to peers was directly associated with binge eating and inversely associated with overweight. Desire to look like same-sex media figures was also directly associated with binge eating and inversely associated with overweight. Maternal dieting and family meal frequency did not have a shared effect on binge eating and overweight.

Prospective Results

Tables 4 and 5 present the prospective multivariable adjusted odds ratios (ORs) of incident cases of purging (females only), binge eating, and overweight status associated with risk factors among females and males, respectively.

Females

As in our cross-sectional analyses, concern with weight was directly associated with all three weight-related problems in our prospective analyses and the direction and magnitude of the effect was similar for all three outcomes (homogeneous effect OR = 1.56, 95% CI 1.42, 1.71). Dieting was also directly associated with the three outcomes (homogeneous effect OR = 1.48, 95% CI 1.25, 1.74). Unlike our cross-sectional results which found that physical activity was directly associated with purging and inversely associated with overweight, our prospective analyses showed that physical activity did not have a shared effect on the weight-related outcomes. Prospectively, fast food intake, breakfast, and television viewing did not have a shared effect on the weight-related problems, similar to our cross-sectional findings.

As we found in our cross-sectional analyses, parental weight-related teasing was directly associated with binge eating and overweight, but not purging prospectively. Also similar to our cross-sectional analyses, desire to look like same-sex media figures was associated with more than one weight-related problem prospectively, but the direction of this effect differed across outcomes; it was directly associated with purging and inversely associated with overweight. Prospectively, family meal frequency was inversely associated with all three weight-related outcomes (homogenous effect OR = 0.90, 95% CI 0.83, 0.98). Maternal dieting and importance of thinness to peers did not have a shared effect on the weight-related problems.

Males

As we found in our cross-sectional analyses, concern with weight was directly associated with both binge eating and overweight prospectively; the effect's magnitude differed across the two outcomes, with weight concern being more strongly associated with overweight. Unlike our cross-sectional results, which found that television was directly associated with both binge eating and overweight, prospectively TV viewing did not have a shared effect on obesity and binge eating. Dieting, fast food, breakfast, and physical activity also did not have a shared effect on binge eating and overweight among males. Prospectively, none of the five socio-environmental factors had a shared effect on binge eating and overweight among males.

COMMENT

Using analytic methods that account for the correlation between the three weight-related outcomes, we examined shared risk factors of purging, binge eating, and overweight in a large cohort of adolescents. Identification of shared risk factors for these weight-related problems can inform development of interventions to promote maintenance of healthful weight and decrease risk of disordered eating.

We found that weight concern was the most robust shared risk factor for purging (females only), binge eating and overweight among both male and female adolescents. Among females, dieting was a shared risk factor for purging, binge eating, and overweight. Two socio-environmental factors, weight-related teasing by parents and family meal frequency, had a shared effect on weight-related problems. Weight-related teasing was a risk factor for binge eating and overweight and family meal frequency was a protective factor for all three

weight-related outcomes. These findings are consistent with previous research showing that dieting^{37, 38} and weight-related teasing^{39, 40} are associated with increased risk of disordered eating and obesity and that family meals⁴¹⁻⁴⁴ may reduce adolescents' risk of engaging in disordered eating behaviors.

Our finding that female adolescents who reported wanting to look like same-sex media figures were less likely to become overweight, but were more likely to initiate purging behaviors underscores the importance of examining the influence of risk factors on a range of weight-related problems. By looking only at the influence of wanting to look like media figures on obesity risk, researchers and public health practitioners may inadvertently promote an obesity prevention strategy, i.e., emulating media figures, that could increase disordered eating risk among adolescents.⁴⁵

Among males, none of the behavioral or socio-environmental factors were consistently associated with binge eating and overweight. Our results are consistent with the finding by Neumark-Sztainer et al.¹⁶ that, compared to females, substantially fewer risk factors had a shared effect on weight-related problems among males. It is possible that our relatively null findings among males may be due to the fact that our measures of the behavioral or socio-environmental factors do not adequately capture the experiences of males. For example, we did not assess performance (vs. appearance) related pressures to achieve an ideal body weight, which may have a strong influence on weight-related problems among males.⁴⁶ Further research is needed to elucidate shared factors of weight-related problems among males.

This study's strengths include prospective data collection, the breadth of theoretically-driven risk factors examined, and the use of analytic methods that account for the correlation among the weight-related outcomes examined. This study also had limitations. Although study participants reside throughout the US, our cohort is not a representative sample of US adolescents. Participants are children of registered nurses and the cohort is >90% white, which may reduce the generalizability of our findings. However, our findings are similar to those found by Neumark-Sztainer,¹⁶ who examined shared risk factors in a racially and socio-economically diverse population. Another limitation was the necessity of collecting data from youth by self-report questionnaires. All three self-report outcome measures have been previously validated^{22, 23, 47} and the resulting measurement error should be random.

CONCLUSION

We found that weight concern was the most robust shared risk factor for overweight and disordered eating among adolescents. Among females, we found that dieting, weight-related teasing, and family meal frequency had a shared effect on these weight-related problems. Interventions that aim to prevent multiple weight-related problems should test strategies that address these factors to determine if such efforts can reduce the high prevalence of overweight and disordered eating behaviors among youth.

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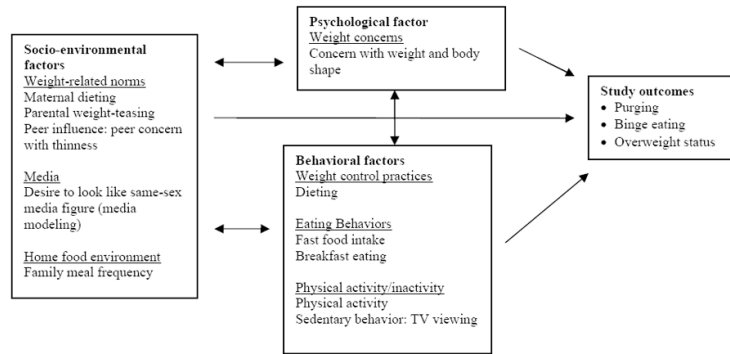


Figure 1. Putative socio-environmental, behavioral, and psychological risk and protective factors for purging, binge eating, and overweight status among adolescents

Table 1

1998 outcomes, predictors and covariates of Growing Up Today Study participants (4518 males and 6022 females)

Outcomes	Females		Males	
	N	%	N	%
Purging	219	3.7	30	0.7
Binge eating	426	7.1	90	2.0
Obese/Overweight	1019	17.4	1040	24.6
Predictors	Mean	SD	Mean	SD
<i>Psychological</i>				
Weight concern	2.4	1.1	1.6	0.8
<i>Behavioral</i>				
Dieting (N, % yes)	2316	38.5	719	15.9
Fast food (svg/wk)	1.2	1.3	1.5	1.5
Breakfast (times/wk)	4.8	2.0	5.2	1.7
Physical activity (hr/day)	1.8	1.1	2.1	1.2
TV viewing (hr/day)	1.4	1.1	1.8	1.3
<i>Socio-environmental</i>				
Maternal dieting (N, % yes)	4104	68.2	2746	60.8
Weight-teasing parents	1.3	0.6	1.2	0.6
Importance of thinness to peers	1.9	0.7	1.3	0.5
Look like media figure	1.7	1.0	1.4	0.7
Family meal frequency	3.1	0.8	3.2	0.8
<i>Other variables</i>				
Race/ethnicity (N, %)				
Non-white	375	6.3	306	6.8
White	5625	93.8	4201	93.2
Age (in years)	13.9	1.6	13.8	1.5

1998 Cross-sectional associations between psychological, behavioral, and socio-environmental factors and weight-related outcomes: Females^{a,b,c}

Table 2

	Homogeneous Main Effect		Different Effect by Outcome						
	OR	95%CI	Purging	Binge Eating	Obese/Overweight	OR	95%CI	OR	95%CI
<u>Psychological</u>									
Weight concern	2.45	2.26, 2.67							
<u>Behavioral</u>									
Dieting			3.37	2.03, 5.57	1.41	1.08, 1.85	1.58	1.31, 1.91	
Fast food	0.99	0.95, 1.04							
Breakfast	0.99	0.96, 1.01							
Physical activity			1.27	1.13, 1.43	1.00	0.92, 1.10	0.81	0.75, 0.88	
TV viewing			0.96	0.84, 1.10	1.00	0.92, 1.09	1.16	1.09, 1.23	
<u>Socio-environmental</u>									
Maternal dieting	0.97	0.85, 1.11							
Parental weight-teasing			0.96	0.81, 1.14	1.23	1.08, 1.41	2.05	1.82, 2.31	
Importance of thinness peers			1.28	1.03, 1.58	1.03	0.86, 1.23	0.74	0.64, 0.84	
Look like media figure			1.26	1.12, 1.42	1.10	0.99, 1.21	0.66	0.60, 0.72	
Family meal frequency			0.76	0.63, 0.91	0.87	0.77, 1.00	1.01	0.92, 1.11	

^aMultivariable model includes all psychological, behavioral, and socio-environmental factors

^bMultivariable model adjusted for age when questionnaire was returned

^cBold represents statistically significant results (p ≤ 0.05)

1998 Cross-sectional associations between psychological, behavioral, and socio-environmental factors and weight-related outcomes: Males ^{a,b,c}

Table 3

	Homogeneous Main Effect		Different Effect by Outcome			
	OR	95%CI	Binge Eating OR	95%CI	Obese/Overweight OR	95%CI
<u>Psychological</u>						
Weight concern			2.10	1.64, 2.70	3.52	3.04, 4.07
<u>Behavioral</u>						
Dieting			1.09	0.60, 1.98	2.61	2.07, 3.30
Fast food	1.01	0.96, 1.06				
Breakfast	0.97	0.93, 1.01				
Physical activity	0.96	0.90, 1.02				
TV viewing	1.12	1.06, 1.18				
<u>Socio-environmental</u>						
Maternal dieting	1.08	0.92, 1.27				
Parental weight-teasing	1.31	1.15, 1.50				
Importance of thinness peers			1.26	0.93, 1.72	0.69	0.55, 0.85
Look like media figure			1.32	1.06, 1.63	0.67	0.57, 0.78
Family meal frequency	1.00	0.90, 1.11				

^aMultivariable model includes all psychological, behavioral, and socio-environmental factors

^bMultivariable model adjusted for age when questionnaire was returned

^cBold represents statistically significant results ($p \leq 0.05$)

Prospective associations between psychological, behavioral, and socio-environmental factors assessed in 1998 and incident weight-related outcomes in 1999-2001: Females^{a,b,c}

Table 4

	Homogeneous Main Effect		Different Effect by Outcome			
	OR	95%CI	Purging	Binge Eating	Obese/Overweight	95%CI
<u>Psychological</u>						
Weight concern	1.56	1.42, 1.71				
<u>Behavioral</u>						
Dieting	1.48	1.25, 1.74				
Fast food	1.02	0.97, 1.07				
Breakfast			0.97	0.92, 1.03	0.92	0.88, 0.97
Physical activity	1.05	1.00, 1.11				
TV viewing	1.01	0.95, 1.08				
<u>Socio-environmental</u>						
Maternal dieting	0.89	0.77, 1.02				
Parental weight-teasing			1.10	0.89, 1.37	1.29	1.08, 1.55
Importance of thinness peers			1.17	0.96, 1.44	1.08	0.92, 1.27
Look like media figure			1.14	1.01, 1.29	1.04	0.93, 1.16
Family meal frequency	0.90	0.83, 0.98				

^aMultivariable model includes all psychological, behavioral, and socio-environmental factors

^bMultivariable model adjusted for age when questionnaire was returned

^cBold represents statistically significant results (p ≤ 0.05)

Table 5

Prospective associations between psychological, behavioral, and socio-environmental factors assessed in 1998 and incident weight-related outcomes in 1999-2001: Males ^{a,b,c}

	Homogeneous Main Effect			Different Effect by Outcome			
	OR	95%CI		Binge Eating OR	95%CI	Obese/Overweight OR	95%CI
<u>Psychological</u>							
Weight concern			1.65	1.27, 2.13	2.41	2.00, 2.91	
<u>Behavioral</u>							
Dieting	0.94	0.65, 1.34					
Fast food			1.12	1.00, 1.24	0.93	0.87, 1.00	
Breakfast			1.06	0.94, 1.19	0.94	0.87, 1.00	
Physical activity	1.06	0.99, 1.15					
TV viewing	1.01	0.94, 1.09					
<u>Socio-environmental</u>							
Maternal dieting	1.14	0.94, 1.40					
Parental weight-teasing	1.07	0.88, 1.29					
Importance thinness peers	0.92	0.72, 1.17					
Look like media figure	0.95	0.82, 1.11					
Family meal frequency	0.89	0.78, 1.01					

^aMultivariable model includes all psychological, behavioral, and socio-environmental factors

^bMultivariable model adjusted for age when questionnaire was returned

^cBold represents statistically significant results (p ≤0.05)