The Relation Between Eating- and Weight-Related Disturbances and Depressive Symptoms Among Early and Late Adolescents

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Abstract

A substantial proportion of adolescents experience clinical and subclinical depression. It is particularly important to study novel risk factors that may broaden our understanding of depression during adolescence. There is growing literature on the relation between eating- and weight-related disturbances (e.g., body weight regulation strategies, body dissatisfaction) and depression during adolescence; however, age and gender differences in this relation remain unclear. Using data from the National Longitudinal Survey of Children and Youth, the current study examined the relation between eating-and weight-related disturbances and depressive symptoms among early and late adolescent girls and boys. Multiple regression analyses were conducted to investigate the relation between eating- and weight-related disturbances and depressive symptoms after accounting for self-esteem, pubertal status, and body mass index among early and late adolescent girls and boys. Several body weight regulation strategies, including binge eating, purging, and weight control behaviors were associated with depressive symptoms and varied by gender and age. The results are clinically meaningful and have the potential to inform youth mental health services. For example, depression prevention programs could increase their effectiveness by encouraging healthy body weight regulation strategies and nutritional eating, particularly among early adolescents.

Keywords: Body weight regulation strategies; Depressive symptoms; Adolescence; Gender differences

Introduction

Depression is a common mental health issue among adolescents and has numerous educational and interpersonal implications [1]. Studies suggest that between 20-50% of adolescents endorse symptoms of depression [2], and as many as 45% of depressed adolescents continue to experience symptoms in emerging adulthood [3]. By age 16, 9.5% of adolescents will have experienced a depressive disorder [4]. Gender differences in depression emerge around ages 13-15, and rates of depression are two to three times higher among women than men in both adolescent and adult populations [2]. However, a significant proportion of young men experience depression in adolescence (e.g., one study found an 11.6% lifetime prevalence rate for major depression in adolescent males [5]). Although much research has underscored gender differences in depression rates among adolescents, the factors that contribute to these differences remain understudied [6].

One set of novel risk factors that may improve our understanding of adolescent depression in general, as well as gender differences more specifically, is eating- and weight-related disturbances (EWRDs). EWRDs are defined as maladaptive eating- and weight-related cognitions (e.g., body and weight dissatisfaction) and body weight regulation strategies (e.g., dietary restraint, binge eating, purging, and trying to control one's weight [7]). EWRDs affect male and female youth. According to a 2004 study, at least 1 in 10 adolescent girls is at risk of disordered eating [8]. Findings in the literature also suggest that the prevalence of body dissatisfaction among males is increasing, and male body dissatisfaction differs qualitatively from the female experience of body dissatisfaction [9,10]. Despite considerable evidence underscoring the role that EWRDs play in the development of depression in adolescence, EWRDs are not typically thought of as risk factors for depression [7,11,12]. Furthermore, the specific nature of age and gender differences in this relation remains unclear. Previous research supports this relation in relatively smaller community samples of adolescent girls [11,13,14]. However, few studies have examined the relation between EWRDs and depressive symptoms in a population-based sample of adolescent girls and boys, which would increase the generalizability of the findings. Thus, the primary objective of the

current research was to investigate gender and age (i.e., early and late adolescence) differences with respect to the relation between depressive symptoms (i.e., subthreshold symptoms) and EWRDs after accounting for several salient risk factors for depression (i.e., pubertal status, body mass index (BMI), and self-esteem) using a national population-based sample.

The current study involved an examination of both cognitive EWRDs (e.g., body dissatisfaction) and maladaptive body weight regulation strategies (e.g., binge eating, purging, engaging in weight loss behaviors) in relation to depressive symptoms. Some research on the relation between EWRDs and depression has focused on cognitive measures of EWRDs, namely body image and body dissatisfaction [11,15-17]. Researchers have also expanded the measurement of EWRDs to include maladaptive body weight regulation strategies and have found support for the prospective relation between both types of EWRDs and depression in adolescence [14,18-21]. For example, some adolescent girls engage in cigarette smoking because of the belief that it helps to regulate body weight, and girls who smoke and have weight concerns are at increased risk for developing depression [22]. Similarly, girls who engage in weight regulation strategies, such as purging, are at risk for future increases in depressive symptoms [21].

Gender Additive Model of Adolescent Depression

The overarching theoretical framework of the present study is based on the gender additive model of adolescent depression [23]. Findings in the literature support the prospective relation between EWRDs and

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adolescent depression in girls. However, few studies have examined the relation between EWRDs and depression in adolescent boys [7,24]. The gender additive model proposed by Stice and Bearman [23] posits that adolescent boys and girls share certain risk factors for depression (e.g., low self-esteem, pubertal development). According to this model, some risk factors, particularly EWRDs, are specific to girls (e.g., pressure to be thin, thin-ideal internalization, body dissatisfaction), putting girls at increased risk for the development of depression. Recent findings suggest that some EWRDs may constitute shared risk factors rather than being specific to girls [13], and particular EWRDs may be differentially related to depressive symptoms in young girls versus young boys [25]. For example, Bearman and Stice [26] found that bulimic symptoms were associated with depression among adolescent boys and girls, but that dietary restraint and body dissatisfaction were uniquely associated with depression among adolescent girls relative to adolescent boys. Other studies support that while girls desire to lose weight and strive to be thin [27], boys may desire to gain weight and obtain a muscular physique [28-30]. Taken together, these studies indicate that the interrelation between EWRDs and depression may be found in both boys and girls, but specific patterns need to be further explored. Given the emerging evidence to support the idea that adolescent boys experience unique EWRDs that are prospectively associated with depression [9], further studies informed by the gender additive model are warranted [31]. The current study used a population-based data set that included girls and boys and afforded the opportunity to investigate the EWRD-depressive symptoms relation in boys, an important contribution to the field. Further, the use of a population-based data set increases the generalizability of study findings.

Developmental Differences

Since few studies examining EWRDs have focused on late adolescence, it is critical to explore the relation between EWRDs and depressive symptoms in this age group. Additionally, preliminary research suggests the relation between certain EWRDs and depression continues in emerging adulthood, underscoring the need to study developmental trends across adolescence [15,32]. Indeed, the majority of studies have used samples of early to mid-adolescents [14,16]. In addition to late adolescence, early adolescence is a critical time period to study given that depressive symptoms and EWRDs are known to emerge during this developmental period [2,8]. To target these salient developmental periods of adolescence, the current study used a cross-sectional design and sampled early (12-13 year old) and late (16-17 year old) adolescents from a population-based data set.

Self-esteem

Self-esteem and pubertal status are empirically supported risk factors for depression in adolescence [33,34]; indeed, EWRDs, self-esteem, and pubertal status are often studied as interrelated constructs in relation to depression [35]. Following the gender additive framework, low self-esteem is conceptualized as a shared risk factor for depression among adolescent girls and boys [17,23,34]. Previous studies have examined the relations among self-esteem, body image, and depression among adolescent girls and boys [16,36,37]. Marcotte and colleagues [35] found that self-esteem and body image were significantly associated with depression and mediated the relationship between gender and depression in adolescence. Similarly, Siegel [17] found that EWRDs, such as changes in body satisfaction, were significantly associated with depression and were independent of one's global assessment of the self, suggesting that EWRDs, though related to self-esteem, may also be a distinct construct. This finding supports

the need to further study the associations between body image and self-esteem and depression. In turn, one aim of the current study was to investigate the association between several cognitive EWRDs (e.g., body dissatisfaction, weight dissatisfaction) and body weight regulation strategies (e.g., binge eating, purging, weight gain behaviors) in relation to depressive symptoms, accounting for the relation between self-esteem and depressive symptoms.

Pubertal Development

Previous research has also examined the relation between pubertal status and depression [17]. Findings consistently suggest that there are age and gender differences in the relation between pubertal status and depressive symptoms. Using a cross-sectional sample drawn from a large national sample of adolescent girls and boys, MacPhee and Andrews [34] investigated pubertal status as a risk factor for depression along with several other possible risk factors including body image, peer and parental factors, socioeconomic status, and conduct problems. It was found that, compared to the other risk factors for depression, pubertal status was not significantly associated with depression scores. This finding suggests that the association between pubertal status and depression may be secondary relative to other established risk factors such as low self-esteem, which accounted for the majority of explained variance in depression scores [34]. Interestingly, some researchers have proposed that the link between puberty and depression may exist during a specific developmental period, for example, only during early adolescence [34]. Other researchers have proposed that this link is stronger for post-pubertal than pre-pubertal girls and does not vary across pre-pubertal and post-pubertal boys [38]. To better understand the relation between pubertal status and depression, the association between pubertal status and depressive symptoms was investigated in the current study.

Objectives and Hypotheses

There were two objectives of the current study. The first objective was to examine gender and age differences in the relation between depressive symptoms and cognitive EWRDs as well as body weight regulation strategies (i.e., behavioral EWRDs) and to determine the distinctiveness of EWRDs from well-established and related adolescent depressive risk factors. It was hypothesized that both cognitive and behavioral EWRDs would be significantly associated with depressive symptoms above and beyond pubertal status, BMI, and self-esteem in early and late adolescent boys and girls. For girls and boys, it was hypothesized that body dissatisfaction, weight dissatisfaction, binge eating, and purging would be significantly associated with depressive symptoms. For girls only, it was hypothesized that engaging in weight control behaviors would be significantly associated with depressive symptoms. For boys only, it was hypothesized that behavioral EWRDs related to weight gain would be significantly associated with depressive symptoms. It was hypothesized that the significant association between individual EWRDs and depressive symptoms would be seen in both early and late adolescents.

The second objective of the study was to investigate the associations between depressive symptoms and both pubertal status and self-esteem. It was hypothesized that pubertal status would be significantly associated with depressive symptoms among early adolescent girls but not boys, and that pubertal status would not be significantly associated with depressive symptoms among late adolescent boys and girls. Among the early adolescent girls, it was expected that more advanced pubertal development would be related to higher levels of depressive

symptoms. It was also hypothesized that low self-esteem would be associated with higher levels of depressive symptoms in all four groups (i.e., early and late adolescent girls and boys).

Method

Data Source and Participants

Participants for this study were drawn from the National Longitudinal Survey of Children and Youth (NLSCY), a longitudinal study of a randomly selected representative sample of Canadian children that follows their development and well-being from birth to emerging adulthood. The NLSCY began in 1994 with data collection on a responding sample of 13,439 households (86.3% response rate). Within the responding households, 22,831 children aged newborn to 11 years of age were selected to participate in the survey. The NLSCY used a cohort-sequential design with assessments conducted biennially; thus, the survey is now in its eighth cycle of data collection. The data for the current study were obtained from Cycles 2 (1996-1997) and 4 (2000-2001) of the NLSCY [39,40]).

Participants included in the statistical analyses consisted of two cross-sectional age groups selected for the purpose of identifying developmental or age differences: Early (12 and 13 year olds; Cycle 2; n = 839; 53% female) and late adolescents (16 and 17 year olds; Cycle 4; n = 1,014; 56% female). Mid-adolescents were not included in the sampling because the dependent variable, depressive symptoms, was not asked of participants from the third cycle in which NLSCY participants would have been 14 and 15 years old.

Due to the fact that participants in the NLSCY were included at all possible cycles, the adolescents sampled in Cycle 4 potentially included those adolescents from Cycle 2 as well as other adolescents who had dropped out of the survey in a previous cycle and returned in Cycle 4. As is common practice with longitudinal surveys, Statistics Canada calculated longitudinal response rates based on Cycle 1 respondents only [40]. The Cycle 2 response rate for 12 and 13 year olds was 91.7% [40]. The Cycle 4 response rate for 16 and 17 year olds was 82.5% [40]. Therefore, there is a relatively high degree of overlap between the samples selected from Cycles 2 and 4.

For Cycle 2, the only available indicators for ethnicity were the responding parent or guardian's (i.e., the person most knowledgeable (PMK) about the child; usually the mother) country of origin, the spouse's country of origin, and whether or not the child was born in Canada. Over 80 percent (81.1%) of the PMKs were born in Canada. Of those PMKs who were born outside of Canada, 6.7% were born in Europe, 3.5% were born in Asia, 1.5% were born in the United States, and 7.2% were born in other countries. The breakdown of country of origin for spouses was similar; 80% of spouses were born in Canada, 6.0% were born in Europe, 5.5% were born in Asia, 1.6% were born in the United States, and 6.8% were born in other countries. 95.8% of the children were born in Canada (4.2% were born outside of Canada). With regard to annual household income, 13.1% earned up to $29,000, 43% fell in the $30,000-$59,999 range, 20.5% fell in the $60,000-$79,999 range, and 23.2% reported making $80,000 or more. A measure of socioeconomic status (SES) was also available (scores range from -2.000 to +1.750) that was derived from five sources: the level of education of the PMK, the level of education of the spouse/partner, the prestige of the PMK's occupation (as classified by the Standard Occupational Classification used by Statistics Canada [39]), the prestige of the occupation of the spouse/partner, and household income. Each of the

five variables was standardized to have a mean of zero and a standard deviation of one. The mean SES score for the sample was 0.034 (SD = 0.785). More information on the derivation of the SES indicator can be found in the Statistics Canada Cycle 2 User Guide [39].

Measures

Adolescents participating in the NLSCY were asked to respond to a self-report questionnaire that contained varying content depending on their age. Many of the questions included in the questionnaires were abbreviated from well-known and psychometrically sound instruments.

Depressive symptoms. Self-reported depressive symptoms were measured using an abbreviated 12-item version of the Center for Epidemiologic Studies Depression Scale (CES-D; [41]). Responses on each item ranged from 1 (rarely or none of the time; less than once a day) to 4 (most or all of the time; 5 to 7 days a week). Total scores ranged from 12 to 48 with higher scores reflective of greater depressive symptoms. The CES-D has been shown to have adequate internal consistency, test-retest reliability, and concurrent as well as discriminant validity in both adult and adolescent populations [41-43]. Previous studies have reported that shortened versions of the CES-D retain comparable reliability and validity to the original 20-item version [44]. In the current early adolescent sample, reliability of the depression scale was found to be moderate for both girls (Cronbach's α = .78) and boys (Cronbach's α = .73). In the current late adolescent sample, reliability of the depression scale was moderate for both girls (Cronbach's α = .83) and boys (Cronbach's α = .82).

Pubertal status composite. Consistent with previous research using the NLSCY, a pubertal status composite was created for adolescent boys and girls separately [34]. For boys, the pubertal status composite included questions asking about body hair growth, voice change, and facial hair growth (measured on a 4-point scale where *1 = has not yet started growing* and *4 = growth/change seems completed*). For girls, the pubertal status composite included questions regarding body hair growth, menstruation (*0 = no, 1 = yes*), and breast growth and was measured using the same 4-point scale as for boys. For late adolescents, the pubertal status composite excluded an item on menstruation, as this was not asked in Cycle 4. Total scores ranged from 3 to 12 for male adolescents and from 2 to 9 and 2 to 8 for early and late adolescent girls, respectively. Higher scores on the pubertal status composites indicate more advanced pubertal development.

Body mass index. Consistent with previous studies [13,45], BMI was entered as a covariate of depressive symptoms. BMI was derived from self-reported height (measured in meters) and weight (measured in kilograms) using the formula (kilograms/meter^2). Measured height and weight, which would lead to a more objective indicator of BMI, were not available in the data set. However, it is acceptable to use self-reported height and weight to calculate BMI when more objective measures are not available. Vaughan and Halpern [46] found that self-reported BMI was highly correlated with measured BMI (r = .92) in a national sample of American adolescents.

Self-esteem. The measure of self-esteem was created based on the sum of four items (e.g., "In general, I like the way I am.") that were part of the Self-Description Questionnaire (SDQ; [47]). Higher scores indicate higher levels of self-esteem. Reliability on the self-esteem measure in the current early adolescent sample was moderate for boys (Cronbach's α = .79) and girls (Cronbach's α = .83). The self-esteem measure in the current late adolescent sample was high for boys (Cronbach's α = .86) and girls (Cronbach's α = .87).

Body dissatisfaction. For early adolescents, the NLSCY employed a four-item shortened version of the Physical Appearance scale from the SDQ [47] that measures youths' body satisfaction including the self-perception of their physical appeal, the way others perceive their physical appearance, and how their physical appearance compares with that of their peers [48]. The utility of abbreviated versions of the SDQ has been shown to be acceptable [49]. The body dissatisfaction measure was created based on the sum of the four reverse-coded items (e.g., "I am good looking."). Total scores on the body dissatisfaction measure ranged from 4 to 20 with higher scores on the scale indicative of greater dissatisfaction with appearance. Reliability for the body dissatisfaction measure was high for both early adolescent boys (Cronbach's α = .91) and girls (Cronbach's α = .87). For late adolescents who were taken from Cycle 4, only one item was available to be used as an indicator of body dissatisfaction (i.e., "I like the way I look."). This item was reverse-coded to be consistent with interpretation of the comparable measure in younger adolescents.

Weight dissatisfaction. One item was available for use as an indicator of weight dissatisfaction across early and late adolescent girls and boys: "Would you say you are (a) trying to lose weight, (b) trying to gain weight, (c) trying to stay the same weight, or (d) not trying to do anything about your weight?" This variable, taken to be a cognitive indicator of weight dissatisfaction, was dummy-coded such that the categories were 0 (satisfied with weight; included only those who said that they were not actively trying to do anything about their weight) and 1 (dissatisfied with weight; all other response categories).

Weight control behaviors. For early adolescents, there was one question available that tapped into engaging in weight maintenance and weight loss behaviors: "During the past 7 days, which one of the following did you do to lose weight or to keep from gaining weight?" Possible responses included "I did not try to lose weight or keep from gaining weight," "I dieted," "I exercised," "I exercised and dieted," "I used some other method, but I did not exercise or diet." This variable (hereafter referred to as weight control item) was dichotomized such that the categories were 0 (did not engage in weight control behavior) or 1 (engaged in some form of weight control behavior).

For late adolescents, the question regarding weight dissatisfaction asked respondents to specify how they tried to maintain their weight, lose weight, or gain weight. Possible responses for trying to maintain or lose weight included "dieted" ("ate less or differently"), "exercised" ("to burn calories or fat"), "took diet pills" (e.g., Dexatrim), "smoked," or "other." Possible responses for trying to gain weight included "ate more food or took food supplements," "lifted weights or exercised to build muscle," "used steroids," or "other." The weight maintenance and weight loss variable was recoded into a weight control composite such that each participant had a score indicating the number of weight maintenance or weight loss behaviors he or she had engaged in (range = 0 to 5). Similarly, for the weight gain composite, a score representing number of weight gain behaviors engaged in was calculated for each late adolescent participant (range = 0 to 4).

Binge eating. Among early adolescent girls and boys, binge eating was assessed using one question that was dichotomized from its original form such that the categories were 0 (never engaged in binge eating) and 1 (engaged in binge eating at least once). The original question asked "How often do you eat so much food in a short period of time that you feel out of control and would be embarrassed if others saw you?" The original response categories included "never," "less than once a month," "once a month," "2 to 3 times a month," and "2 or more times a week." Frequencies for each of the categories other than never were extremely low and therefore were collapsed into one group.

Purging. Similarly, among early adolescent boys and girls, a single purging item was dichotomized from its original form such that the categories were 0 (never engaged in purging) and 1 (engaged in purging at least once). The original question asked "If you have ever eaten so much food in a short period of time that you felt out of control and would have been embarrassed if others saw you, did you ever try to make yourself vomit or throw up?" The original response categories were "I have never eaten that much," "yes," and "no." Frequencies for each of the response categories "I have never eaten that much" and "no" were high and are operationally similar; therefore, these categories were combined into one group.

Missing Data

Missing data were imputed by Statistics Canada using a procedure available in SAS known as PRINQUAL. This procedure indicates, among valid item values, the value that seems most plausible for a given record [39]. The procedure takes into consideration the response profile of the case with the missing item, the response profile of other responding cases in the sample, and the number of factors in the analyses. Missing data were imputed according to the following rule: If less than 10% of the items had a missing value, the items with non-response codes were imputed before the score for the measure was computed [39]. This information is applicable to the measures in which scores were calculated by Statistics Canada and in the current study includes the measures of self-esteem, body dissatisfaction, and depressive symptoms.

Statistical Analysis

Multiple regression analyses were used to explore the associations among pubertal status, BMI, self-esteem, EWRDs, and depressive symptoms (i.e., the dependent variable) in each of the samples. Due to the fact that predictors in the analyses varied across gender (i.e., pubertal status) and age (e.g., weight control behaviors), regression models were run separately on early and late adolescent boys and girls. With respect to the rationale for ordering of the predictors, pubertal status and BMI were entered in the first step of analyses. Self-esteem was entered in the second step of the model because of its empirical support in the literature as a strong predictor of depression. Next, each cognitive EWRD (i.e., body dissatisfaction and weight dissatisfaction) was entered individually followed by each body weight regulation strategy individually (i.e., weight control behaviors, weight control and weight gain composites, binge eating, and purging).

Due to the statistical power garnered by the large sample size in the current study, only results that obtained significance levels of $p < .01$ or smaller were interpreted as statistically significant. Statistical analyses were conducted using weighted data to account for the unequal sampling probabilities. Additionally, in order to protect against the artificial inflation of sample sizes by the application of weights, a standard procedure to rescale weights was adopted in which each person's post-stratification weight was divided by the average weight of the samples [50]. Protecting against Type 1 error, rescaled weights maintain the robustness of the post-stratification weights provided by Statistics Canada, but are a more accurate reflection of the actual number of participants included in the analysis.

Results

Table 1 provides the means and standard deviations or percentages for categorical variables of the predictors by gender and age. Results for the regression analyses are presented in Table 2 and are summarized as follows. Model 1 includes regression results for early adolescent boys and girls; Model 2 includes regression results for late adolescent boys and girls.

Early Adolescent Boys and Girls

Self-esteem was significantly associated with depressive symptoms in both adolescent girls and boys (p's < .001), such that lower levels of self-esteem were related to higher levels of depressive symptoms. Among early adolescent boys, BMI (p < .01), self-esteem (p < .001), and binge eating behaviors (p < .001) were significantly associated with depressive symptoms. Of note, BMI was significantly associated with depressive symptoms only among early adolescent boys; higher levels of BMI were associated with higher levels of depressive symptoms. Among early adolescent girls, self-esteem (p < .001), binge eating (p < .01), and purging (p < .001) were significantly associated with depressive symptoms. More specifically, having engaged in binge eating or purging was related to higher levels of depression. Body and weight dissatisfaction and the weight control item were not significantly associated with depressive symptoms in early adolescent boys or girls after accounting for pubertal status, BMI, and self-esteem.

Late Adolescent Boys and Girls

Among late adolescent boys, only pubertal status and self-esteem were significantly associated with depressive symptoms (p's < .001). Pubertal status was significantly associated with depressive symptoms only among the late adolescent boys, such that more advanced pubertal status was related to higher levels of depressive symptoms. Finally, among late adolescent girls, self-esteem and the weight control composite were significantly associated with depressive symptoms (p's < .001). Higher scores on the weight control composite were related to higher levels of depressive symptoms. Body dissatisfaction was not significantly associated with depressive symptoms after accounting for pubertal status, BMI, and self-esteem among either late adolescent girls or boys.

Discussion

The current study is one of only a few population-based studies that have examined the EWRD-depressive symptoms relation in adolescence. Further, the present study addressed a limitation in the literature by including a representative sample of adolescent boys, which is an important direction for the field given mounting evidence to suggest that adolescent boys experience EWRDs qualitatively differently than girls. The primary aim of the current study was to use a population-based sample of adolescents to understand gender and age differences in the relation between EWRDs (both cognitive EWRDs and body weight regulation strategies) and depressive symptoms. Another objective of the study was to investigate the relation between EWRDs and depression alongside two well-studied risk factors for depression, namely, pubertal status and self-esteem. Overall, the results support previous findings in the literature suggesting a link between maladaptive body weight regulation strategies and depression and important gender and age differences [11,14-22,26]. Maladaptive body weight regulation strategies were significantly associated with depressive symptoms among early adolescent boys and girls and among late adolescent girls after accounting for pubertal status, BMI, and self-

| | | Early adolescents | | | Late adolescents | |
| | | Boys | Girls | | Boys | Girls |
Variable	Range	Mean (*SD*) or percent	Mean (*SD*) or percent	Range	Mean (*SD*) or percent	Mean (*SD*) or percent
Depressive symptoms	12 - 48	17.92 (4.57)	18.55 (5.22)	12 - 48	19.99 (5.71)	22.28 (6.40)
Pubertal status	3 - 12 (2 - 9)	6.53 (1.97)	6.37 (1.42)	3 - 12 (2 - 8[a])	9.98 (1.36)	7.54 (0.67)
BMI		20.52 (3.66)	20.04 (3.61)		23.43 (4.26)	22.32 (4.34)
Self-esteem	4 - 20	13.40 (2.30)	12.77 (2.72)	4 - 20	12.70 (3.01)	12.00 (3.08)
Body dissatisfaction	4 - 20	8.88 (3.86)	9.48 (3.72)	1 - 5	1.64 (1.09)	2.07 (1.33)
Weight dissatisfaction						
No		38.6%	34.8%		29.8%	17.3%
Yes		47.5%	56.2%		41.2%	59.0%
Weight control item[b] or composite[c]						
No		54.4%	44.8%		-	-
Yes		30.1%	44.1%		-	-
Composite	-	-	-	0 - 5	0.27 (0.64)	1.05 (1.04)
Weight gain composite	-	-	-	0 - 4	0.30 (0.68)	0.03 (0.21)
Binge eating						
No		57.7%	60.3%		-	
Yes		24.9%	28.2%		-	
Purging						
No		59.8%	61.9%		-	
Yes		2.7%	4.5%		-	

Note. Percentages do not add to 100 because of missing data. Ranges on the pubertal status composite differ between boys (3-12) and girls (early: 2-9; late: 2-8). Therefore, scores cannot be compared across genders.
[a]Pubertal status score for late adolescent girls excludes menstruation item as this question not asked of late adolescent girls. [b]Measure used in early adolescent sample. [c]Measure used in late adolescent sample.

Table 1: Selected Sample Characteristics by Gender and Age (Weighted).

Predictor	Model 1: Early adolescents				Model 2: Late adolescents			
	Boys		Girls		Boys		Girls	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Pubertal status		-.07		.04		.14***		-.07
BMI	.03***	.12†	.01	-.07	.01	-.10	.01	.00
Self-esteem	.38***	-.53***	.35***	-.49***	.39***	-.55***	.36***	-.56***
Body dissatisfaction	.01	.07	.00	.01	.01	.11	.00	.04
Weight dissatisfaction	.00	-.08	.02***	.01	.00	.05	.00	-.06
Weight control item[a] or composite[b]	.01	.05	.01**	.11	.00	.01	.02***	.19***
Weight gain composite	-	-	-	-	.00	-.02	.00	.04
Binge eating	.04***	.20***	.03***	.12†	-	-	-	-
Purging	.01	.08	.03***	.20***	-	-	-	-
Total R^2	.47***		.45***		.40***		.40***	
n	394		445		446		568	

Note. Pubertal status and BMI were entered simultaneously in Step 1. Self-esteem was entered in Step 2. Each subsequent predictor was entered individually according to the order in the Table. – indicates that variable was unavailable for the particular regression model.
[a]Measure used in early adolescent sample. [b]Measure used in late adolescent sample.
p < .01. †p = .001.*p < .001.

Table 2: Regression Models: Effects of Pubertal Status, BMI, Self-Esteem, and EWRDs on Depressive Symptoms.

esteem. Binge eating was significantly related to depressive symptoms in both early adolescent girls and boys. Purging was also significantly related to depressive symptoms among early adolescent girls. Among late adolescent girls, engaging in a greater number of weight control behaviors was associated with higher levels of depressive symptoms. Contrary to expectation, cognitive EWRDs were not significantly associated with depressive symptoms. BMI was significantly associated with depressive symptoms among early adolescent males only, while pubertal status was significantly associated with depressive symptoms only among the late adolescent males. Self-esteem was significantly associated with depressive symptoms in each group of adolescents. Findings on EWRDs and self-esteem are discussed first, followed by results related to pubertal status and BMI.

EWRDs and Self-Esteem

There were gender and age differences in the relation between the unhealthy body weight regulation strategies and depressive symptoms. In particular, at least one type of body weight regulation strategy was significantly associated with depressive symptoms over and above self-esteem in all groups except older adolescent boys. A salient finding was that binge eating (a variable only available for early adolescents) was significantly related to depressive symptoms in both early adolescent girls and boys. This finding is consistent with Bearman and Stice's study [26], in which they found that binge eating behavior predicted depression onset among adolescent girls and boys. This finding is also consistent with previous research suggesting that boys who experience EWRDs may be vulnerable to developing depression [16,25], providing a rationale to modify the gender additive model. One possible modification of the gender additive model could be the delineation of specific EWRDs that are similar and different across adolescent boys and girls. For example, future research could investigate whether behavioral EWRDs, which may be indicative of more severe underlying problems, are shared by boys and girls, and whether cognitive EWRDs may be a more salient risk factor for depression specific to girls. Interestingly, purging (a variable only available for early adolescents) was significantly related to depressive symptoms only for girls. This finding is consistent with previous research showing that adolescent girls who engaged in a greater number of weight control behaviors were more likely to have higher levels of depressive symptoms [14]. Future research could examine more severe forms of body weight regulation

strategies in adolescent boys using more comprehensive measures than were available in the current study.

The hypothesis pertaining to the cognitive EWRDs (i.e., body dissatisfaction and weight dissatisfaction) was not supported; cognitive EWRDs were not significantly associated with depressive symptoms at the conservative level of significance used in the current study, which is inconsistent with previous research [16]. In the current study, the strength of the relation between self-esteem and depressive symptoms may have affected the statistical relation between the cognitive EWRDs and depressive symptoms, although much of the previous research in this area has also included self-esteem as a covariate and has still found evidence of a significant association between cognitive EWRDs and depressive symptoms [13,17]. Consistent with previous research [13,34], low self-esteem was significantly associated with depressive symptoms amongst the four groups, suggesting that self-esteem is an important factor in adolescent depression. Future research could investigate whether self-esteem mediates the relation between EWRDs and depressive symptoms.

Pubertal Status and BMI

The current study found that more advanced pubertal status was related to increased depressive symptoms in older adolescent boys. This finding is in contrast with previous research that has found that late maturing boys are more at risk than early maturing boys for mental health problems such as depression, at least in part as a result of the discrepancy in body changes associated with puberty between themselves and their "on-time" peers [51]. Therefore, further investigation of the effects of pubertal development and pubertal timing on the emergence and maintenance of depressive symptoms within normative and clinical samples is warranted. One explanation for this gender and age difference in the current study may be that adolescent boys who are more physically developed by late adolescence become concerned with their bodies in a qualitatively different way than those boys who are late maturers. For example, boys who are more physically developed by late adolescence may have internalized a muscular ideal and may strive to achieve this ideal by using weight gain strategies such as eating more food or taking food supplements, lifting weights to build muscle, or using steroids. While the weight gain composite was not predictive of depressive symptoms in the current study's sample

of late adolescent boys which would have provided some support for this explanation, this nevertheless may be a plausible explanation given the limitations associated with using a composite measure in which the behaviors of interest were infrequently reported (i.e., the mean on the weight gain composite was 0.30 for late adolescent boys).

Interestingly, contrary to expectation, pubertal status was not significantly related to depressive symptoms among early adolescent girls. Previous research has suggested that, similar to late-maturing adolescent boys, early-maturing adolescent girls are also at risk for mental health issues as a result of the physical changes they are experiencing that are not occurring at the same time in their peers [51]. This finding is, however, consistent with another study that used the NLSCY that found pubertal status was not significantly associated with depressive symptoms for adolescent girls [34]. Marcotte and colleagues found that body image, self-esteem, and negative stressful life events mediated the relationship between pubertal status and depressive symptoms in a sample of adolescents [35]. Therefore, the null finding in the current study supports the need for additional research into the interrelations among pubertal status, BMI, body image, and depressive symptoms. While the current study did not investigate the issue of off- versus on-time pubertal development in relation to depressive symptoms, the findings related to late adolescent boys and the null findings related to early adolescent girls certainly support future research in this regard which could take a mediational approach to examining the role of pubertal status in depression. BMI was significantly associated with depressive symptoms only for early adolescent boys. This finding is consistent with Santos and colleagues' study [13] in which they found that adding BMI to the structural equation model, where depressive symptoms was the outcome, improved model fit. It is noteworthy that this finding was specific to early adolescent boys. It is possible that for late adolescents and female adolescents, one's subjective weight perception overrides one's BMI, which would account for the lack of a significant relationship between BMI and depressive symptoms in the other groups of adolescents within the current study.

Limitations

One limitation of the current study is its cross-sectional design. For the purpose of the current study, it was decided *a priori* to maximize utility of the relevant variables available in Cycles 2 (i.e., binge eating and purging) and 4 (i.e., engagement in behavioral methods of weight control) of the NLSCY. The cross-sectional design of the study limits the conclusions that can be made regarding the causal connection between EWRDs and depressive symptoms. Another limitation of the present study is the constraints associated with using secondary data analyses. Challenges inherent in using secondary data include the use of shortened measures and single items to assess various psychological constructs. Hypotheses regarding the relation between cognitive EWRDs and depressive symptoms were not supported, which may have been an artefact of the single item measures, for example, the single item measure of weight dissatisfaction. One specific limitation regarding the purging variable should be noted. The purging variable was predicated on the adolescent having responded affirmatively to the question regarding whether he or she had ever engaged in binge eating. Asking about purging in this manner would fail to capture those individuals who may have purged in the absence of binge eating. Finally, since the current study involved a normative sample, the frequencies of the behavioral EWRDs were low. For example, early adolescent boys had extremely low rates of purging behavior (i.e., only 2.7% of early adolescent boys endorsed purging behavior). Similarly, the response rates for the questions asking about binge eating and purging were rather low which may have been because participants were hesitant to disclose this information. Taken together, these issues may have led to some of the nonsignificant results that were contrary to hypotheses and findings in the literature. Future research could examine the relation between specific behavioral EWRDs and depression in clinical samples in which the constructs of interest are more prevalent, allowing for more in-depth analyses to be conducted.

Theoretical Implications

With respect to the gender additive model, the results suggest that boys and girls may share a greater number of risk factors than originally proposed. In particular, in line with Bearman and Stice's study [26], early adolescent boys in the current study who engaged in binge eating had higher levels of depressive symptoms as did the early adolescent girls. Furthermore, BMI was significantly associated with depressive symptoms among early adolescent boys. Vaughan and Halpern [46] found that a mediational version of the gender additive model fit better than a moderational model, suggesting that female adolescents' greater vulnerability to depressive symptoms is at least partly accounted for by their increased levels of weight-related concerns and dieting relative to male adolescents as opposed to greater susceptibility to depressive symptoms as a result of experiencing EWRDs. An extension of Vaughan and Halpern's finding is that boys who experience increased EWRDs may be at similar risk for depressive symptoms. It is evident that further research is needed to clarify the role that EWRDs play in depressive symptoms in boys in both nondepressed and depressed populations. The gender additive model may need to be extended once the relation between EWRDs and depressive symptoms in boys becomes clearer.

Clinical Implications

Prospective studies providing evidence for a causal relation between EWRDs and depression in adolescence are warranted in order to begin developing evidence-based prevention and intervention efforts. However, the current results can provide preliminary information to inform assessment, intervention, and prevention practices. Within clinical practice, in addition to standard assessment of broad internalizing symptoms, it may be useful to assess EWRDs, especially maladaptive body weight regulation strategies, given their reported link to mental health outcomes. Further, following from an approach in which intake sessions include assessment of EWRDs, it could be beneficial to address any presenting EWRDs with cognitive-behavioral interventions (e.g., Fairburn and colleagues' transdiagnostic model of CBT for disordered eating [52]). With respect to prevention, the relation between depression and EWRDs is particularly salient given the importance of body image during adolescence. By contextualizing EWRDs as potential risk factors for depression, findings from the current study begin to advance the utility of addressing EWRDs in preventive efforts targeting mental health in children and adolescents. Prevention programs should be tailored in such a way to include nutritional strategies that can address EWRDs typically experienced by boys and girls. Finally, given the findings on the relation between low self-esteem and depressive symptoms, prevention programs that encourage the development of healthy self-esteem are essential to the prevention of depression in adolescence. Further research into the clinical utility of addressing EWRDs in the context of preventing and treating depression is necessary, and the current study provides initial evidence to support such research.

Conclusion

The present study investigated a novel set of risk factors for depression (i.e., EWRDs) in a population-based sample of adolescent girls and boys. Adolescent girls and boys who engage in maladaptive body weight regulation strategies (e.g., binge eating, weight control behaviors) may be at risk for developing depression. The findings support the utility of the gender additive model for understanding adolescent depression and provide the impetus for further investigation of the model. Additional research investigating adolescent boys' unique experience with EWRDs is warranted. Results from the current study have important clinical and nutritional applications and contribute to the literature on adolescent depression.

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