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## Overweight, Body Image, and Depression in Asian and Hispanic Adolescents

**Bin Xie, PhD [Associate Professor], Jennifer B. Unger, PhD [Professor], Peggy Gallaher, PhD [Associate Professor], and C. Anderson Johnson, PhD [Dean; University Professor]**  
School of Community and Global Health, Claremont Graduate University, San Dimas, CA

**Qiaobing Wu, PhD [Assistant Professor]** and  
Department of Social Work, Chinese University of Hong Kong, Hong Kong SAR, P.R. China

**Chih-Ping Chou, PhD [Professor of Research; Associate Professor of Research]**  
Institute for Health Promotion and Disease Prevention Research, Keck School of Medicine,  
University of Southern California, Alhambra, CA

### Abstract

**Objectives**—To prospectively investigate associations between overweight and depressive symptoms in Asian and Hispanic adolescents.

**Methods**—Data included 780 Hispanic and 375 Asian students. Structural equation model was used to prospectively explore moderation effects of gender, ethnicity, and acculturation on associations of overweight, body image dissatisfaction, and depressive symptoms.

**Results**—Significant mediation effect was found only in Asian girls (mediation effect=0.16,  $P<0.05$ ) and girls with high acculturation (mediation effect=0.17,  $P<0.05$ ). Overweight significantly predicted higher body image dissatisfaction, which in turn was significantly related to depressive symptoms.

**Conclusion**—Our findings help understanding the association of overweight and experience of depressive symptoms.

### Keywords

overweight; depressive symptoms; body image; acculturation

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Pediatric overweight has been associated with depression and anxiety;<sup>1</sup> peer isolation and discrimination;<sup>2,3</sup> low self-esteem,<sup>4</sup> self-concept,<sup>5</sup> and social cooperation skills;<sup>6</sup> family disharmony;<sup>7</sup> dislike of school or trouble with teachers;<sup>7</sup> and poor health-related quality of life.<sup>8</sup> The underlying mechanisms have been presumably related to the reflected self-appraisal hypothesis and social comparison theory,<sup>9-11</sup> which mainly involve cultural norms and social desirability of ideal weight and the process of self-appraisal and social comparison of body image and physical attractiveness. The reflected self-appraisal hypothesis is based on Cooley's concept of the "looking-glass self," which posits that an individual's *self-concept*, defined as the internalized view we have of ourselves, is socially constructed through the judgment of others and self-appraisal.<sup>10-12</sup> The Social Comparison Theory suggests that people engage in a process of self-evaluation, comparing themselves to others who they believe possess desirable social and cultural traits and, in turn, engage in

behaviors designed to achieve the desired characteristics.<sup>9</sup> Based on these mechanisms, the beliefs, feelings, and thoughts about our body (weight, size, shape, function, capacities, and appearance) are affected and refined by external social influences when we make external social comparisons with others and internalize the reflected appraisals. Given that overweight is viewed as a less desirable and more stigmatizing characteristic in the American culture, the process of self-appraisal or social comparison may explain why overweight individuals are at a heightened risk for negative psychological and behavioral outcomes, beyond the health risks of overweight.<sup>13,14</sup> These underlying mechanisms are especially assumed to be operative in adolescence,<sup>15,16</sup> when dramatic changes occur in cognitive functioning as well as physical and psychological development.

A mediation-moderation approach has been recommended to investigate this association between overweight and depressive symptoms with application of a prospective longitudinal design.<sup>3,17</sup> One potential mediator of this association is body image dissatisfaction. Compared with nonoverweight youth, overweight adolescents have been found to be more likely to report dissatisfied body image defined as one's attitudinal dispositions toward the physical self<sup>18</sup> and greater dissatisfaction quantified as the extent of discrepancy between self- and ideal-perception.<sup>18</sup> Body image dissatisfaction resulting from overweight status may ultimately lead to depressive symptoms.<sup>17</sup> In Rierdan and Koff's study of 175 sixth-grade girls<sup>19</sup> and Kaplan and associates' study of 344 junior and high school boys and girls,<sup>20</sup> it was weight-related body image concern and perception of body weight, not the objective BMI or actual weight categories, that significantly predicted depressive symptoms in adolescent girls. These inconsistent results on actual body weight, self-perceived weight, and body image concern suggest that body image or weight perception may have a mediating effect on the relationship between actual body weight and depressive psychological symptoms.

Potential moderators of the association between overweight and depressive symptoms include gender, ethnicity, and acculturation. Gender differences in the overweight-depressive symptoms relationship have been reported in several studies with girls showing stronger associations than boys.<sup>3,5</sup> Norms of muscularity for boys and slimness for girls and the possibility that girls may be more likely to be concerned about their body image may account for this substantial difference.<sup>21</sup> Greater acceptance of heavier body weight and higher levels of satisfaction with size and appearance have been reported among Blacks than Whites,<sup>22</sup> so overweight may be less likely to cause depressive symptom experience among Blacks. The observed ethnic differences may be related to different cultural background effects on norms and attitudes towards body ideal and beauty standards among Blacks and Whites.<sup>22</sup> Hispanic, Asian, and Native American girls in Project EAT were found to report similar or more weight-related concerns and behaviors than those reported by white girls, whereas African American and Asian American boys were at greater risk for potentially harmful weight-related concerns and behaviors than were White boys.<sup>23</sup> In another study among third-grade multiethnic children, Hispanic and African American girls reported significantly more overweight concerns than did Asians, and White and Hispanic girls reported greater body dissatisfaction than Asian American girls.<sup>24</sup> According to recent figures released by the US Census Bureau, Asians and Hispanics are the fastest-growing minority populations in the United States (<http://cnnstudentnews.cnn.com/2000/US/08/30/minority.population>). The Asian American and Hispanic American populations represent a broad range of acculturation levels and adhere to a variety of traditional and American values, practices, and behaviors that reflect a broad range of acculturation levels.<sup>25</sup> Acculturation, reflected as levels of involvement in mainstream American culture, has been associated with an increased risk of overweight.<sup>26</sup> As Hispanic and Asian adolescents are exposed to the mass media and environment conveying weight norms and body ideals from the mainstream American culture,<sup>27</sup>

acculturation may strengthen the association between overweight and depressive symptoms.<sup>28</sup> However, recent cross-cultural studies also reported greater overall body image dissatisfaction and maladaptive attitudes among Asian women and Hispanic youth who were identified with a stronger adherence and affiliation with traditional Asian or Mexican cultural values than their highly acculturated counterparts.<sup>25,29</sup> More research efforts are needed to clarify the role of acculturation in modifying the overweight-depressive symptoms relationship.

In this study, we conducted a secondary analysis using 2 waves of existing data. Overweight status and experience of depressive symptoms were measured in seventh and eighth grade among Hispanic and Asian middle school students living in the greater Los Angeles area in 2001 and 2002. The objectives of this study (as shown in Figure 1) were to (a) prospectively explore the association between overweight and depressive symptoms; (b) explore the mediating role of body image dissatisfaction in bridging the overweight-depressive symptoms relationship; (c) examine moderation effects of gender, ethnicity, and acculturation levels on associations among overweight, body image dissatisfaction, and depressive symptoms. We hypothesized that subject's overweight status would be significantly related to level of body image dissatisfaction, which would in turn lead to depressive symptoms; moreover, this association was hypothesized to be more pronounced in girls. We also intend to explore the potential moderation effects of ethnicity and acculturation on this hypothesized association of overweight, body image dissatisfaction, and depressive symptoms.

## METHODS

### Data Source and Sample

Data were obtained from a National Cancer Institute (NCI)-funded smoking prevention trial in a representative sample of multiethnic middle school students living in the greater Los Angeles area.<sup>30</sup> The original cohort consisted of 3157 sixth-graders from 24 public or parochial middle schools who provided active consent and completed the baseline survey in 2000. The cohort was followed up in grades 7 and 8 with N=2412 (76.4%) at eighth grade. At grades 7 and 8, weight and height were measured by trained staff, and depressive symptoms experience was assessed by structured questionnaires. Parental consent was obtained for each student during the study recruitment, which was described in our previous paper.<sup>30</sup> Body image was measured only at eighth grade. Analysis data for this study included 780 Hispanic and 375 Asian students (total N=1155 with 43.9% boys and 56.1% girls) with complete demographic, smoking, and weight and height measures taken at grades 7 and 8 in 2001 and 2002. Both the original study and the secondary analysis were approved by the Institutional Review Board committee at University of Southern California.

### Measures

**Body Mass Index (BMI)**—Measurements of height and weight were collected using a standard calibrated scale and stadiometer, with subjects wearing light clothes with either thin socks or barefoot. Body weight was measured to the nearest 0.1 pounds and subsequently converted to kilograms. Height was recorded to the nearest 0.1 centimeters. Body mass index was calculated as weight in kilograms divided by height in meters squared. Adolescents were classified as overweight based on BMI at or greater than 95<sup>th</sup> age- and gender-specific percentile cutoffs established by the US National Center for Health Statistics (NCHS) according to the 2000 Centers for Disease Control and Prevention growth charts of children and adolescents in the United States.<sup>31</sup>

**Depressive symptoms**—The 5-item measure of depressive symptoms was adopted from the Center for Epidemiological Studies Depression Scale, CES-D, which is a 20-item self-report measure that uses 4-point scales to tap depressed mood over the past week.<sup>32</sup> Numerous studies have indicated that it is a valid and reliable measure in assessing depressive symptoms rather than the broader construct of negative affectivity among adolescents.<sup>33,34</sup> We used factor analysis to determine which items to use in the abridged version of the survey. Consistent with suggestions from previous research using shorter forms of the CES-D scale, we chose the 5 items that loaded the highest on the first factor, called “depression.” The factor loadings for these items ranged from 0.72 to 0.81. The alpha for these 5 items was 0.87. These items include “During the past 7 days, think about how often you had trouble shaking off sad feelings, felt depressed, thought your life had been a failure, felt lonely, and felt sad,” with Likert-scale responses ranging from 1 day or less to 6 to 7 days scoring 1-4. This 5-item measure of depressive symptoms was used in our previous papers.<sup>35,36</sup>

**USA acculturation**—The 8-item scale of acculturation for adolescents in a multicultural society (AHISMA) was used to assess acculturation.<sup>26</sup> Items included “I like TV shows from the United States”; “The way I do things is the way things are done in the United States,” with Likert-scaled responses ranging from not true at all to very true scoring 1-4 (Cronbach’s alpha=0.86). High and low-acculturated groups were classified based on median-split of the composition score of USA acculturation scale.

**Body image**—The instrument was adapted from the body figure perception scale established by Collins.<sup>37</sup> The cornerstone is to use silhouette drawings to measure body size, shape, weight, and satisfaction with appearance. This figure rating body-image instrument has been used in a number of studies and has demonstrated certain degree of validity and reliability for assessing cognitive body image in children and adolescent population.<sup>38-40</sup> Subjects were asked to select their perceived and ideal body size from 7 drawings of silhouettes representing body sizes from very thin to very overweight. Body dissatisfaction was obtained by subtracting the ratings of subjects’ ideal body size from their perceived current body size.

Other variables include gender, ethnicity (Asian/Hispanic), pubertal status, socioeconomic status (SES), smoking status, and intervention group assignment. Pubertal status, SES, and smoking status were considered for covariates in the SEM analysis given data that these variables have important links with body image and weight-related behavior. Early maturation in both boys and girls has been suggested to enhance the risk of being overweight and further influence the severity of obesity in adulthood.<sup>41,42</sup> For boys, in addition to the increase in fat mass accumulation, most of the weight gain is explained by an increase in muscle tissue, whereas for girls the physical changes of puberty involve significant deposition of fat mass on abdomen, buttocks, and thighs.<sup>43</sup> Because of this additional weight and body fat, puberty is associated with a rise in body dissatisfaction.<sup>44</sup> Significant relationships between early onset of menarche and lower ratings of body image were observed in large-scale studies.<sup>45</sup> SES, especially social class, was also reported to have a consistent relationship with weight concern. To be specific, higher-class female subjects were more likely to place greater importance on physical appearance and thin ideal body size, and they reported higher levels of body dissatisfaction than did lower-class subjects.<sup>46</sup> Results from several cross-sectional and prospective studies showed a significant association between cigarette smoking and dieting.<sup>47-51</sup> Elevated body dissatisfaction, eating disturbance showed significant relations to subsequent onset of smoking in Stice et al’s sample of adolescent girls.<sup>47</sup> In this paper, SES was reflected by a standardized average of several indicators.<sup>30</sup> These included parents’ education, the number of rooms per resident in the home (a measure of overcrowding, which is correlated with poverty<sup>52</sup>), the median

annual household income in the student's zip code (from 2000 US Census data), and dichotomous indicators of having a computer and Internet access at home. The Cronbach's alpha of this scale was 0.82. The SES score was further trichotomized into low, medium, and high levels. Pubertal status was measured by asking girls to report the age of their first menses and boys to report the age when they first noticed changes in their Adam's apple, voice, or the growth of a beard as a proxy for measurement of pubertal status. The original questions were "How old were you when you had your first menstruation?" and "How old were you the first time you found that your Adam's apple got bigger, or that your voice changed, or that you had started to grow a beard (for boys)?" for girls and boys, respectively. Subjects who reported "has not happened yet" were defined as prepubertal status, whereas subjects giving specific age were defined as peri-/postpubertal status.<sup>53</sup> Smoking status was assessed by one item asking adolescents to report if they ever smoked a whole cigarette in their lifetime.

### Statistical Data Analysis

The conceptual model was to test the unidirectional pathways of depressive symptoms, overweight, and body image, in which overweight status in seventh grade was set to predict depressive symptoms in eighth grade, controlling for seventh-grade depressive symptoms and other covariates and to be mediated by body image dissatisfaction. The mediation effect was evaluated according to 4 standard criteria.<sup>54,55</sup> Criterion 1: the independent variable (IV) must predict the mediator (M). Criterion 2: M must predict the dependent variable (DV) when IV is controlled. The mediation effect is calculated as the product of the 2 regression coefficients from IV to M in criterion 1 and from M to DV adjusting for IV in criterion 2. Criterion 3: IV must have a significant effect on DV that is expressed as the total effect. Criterion 4: the mediation effect must be significant using the procedure outlined by MacKinnon.<sup>55</sup> A suppression effect may be indicated in a situation when the direct effect is larger than the total effect.<sup>55</sup> In this situation, the direct and indirect effects often have fairly similar magnitudes and opposite signs that may entirely or partially cancel each other out and result in zero or a nonzero but nonsignificant total effect.<sup>55</sup> In addition, the mediation effect was hypothesized to be moderated by gender, ethnicity, and levels of acculturation. Multiple-group structural equation models (SEM) with controlling of measurement errors of latent constructs of depressive symptoms implemented with MPlus (version 4.1) were used to prospectively explore the hypothesized moderated mediation effects. Preliminary analysis revealed no significant moderation effects of smoking intervention group assignment on the relationships of overweight and depressive symptoms. Therefore, intervention group assignment and smoking status in seventh grade as well as other covariates (listed in Table 1) were controlled in all SEM analyses.

Prior to the SEM, results of analyses revealed significant gender difference in depressive symptom experience, body image dissatisfaction, and overweight prevalence (in Table 1 and detailed description in Results section). Therefore, the first multiple-group SEM was constructed to compare associations of overweight, body image dissatisfaction, and depressive symptoms between males and females. As significant gender difference was observed in the final model of multiple-group SEM (in Table 2 and detailed description in Results section), subsequent models of SEM focusing on interplays of gender with either ethnicity or acculturation were constructed to compare hypothesized associations between Asian and Hispanic, low and high acculturation levels within male and female adolescents separately. We were unable to further explore the joint interactions of all 3 moderators together (ie, the third-order interaction) due to the subsequent small subgroup sample size and low frequencies within each cross-tabulation cell of moderators.

Several fit indices were used in this study to evaluate the fit of a model. (a)  $\chi^2$  statistic needs to be nonsignificant ( $P > 0.05$ ); however, as the  $\chi^2$  is sensitive to sample size, it can be a

difficult index to satisfy. (b) Comparative Fit Index (CFI) should be greater than .90. (c) Root mean Square Error of Approximation (RMSEA), a population-based index of badness of fit, measures the amount error in the model. The RMSEA for a model with good fit should ideally be  $<0.05$ , though a fit of  $<0.08$  is considered acceptable.<sup>56</sup> In this study, the percentage of missing data across all overweight status, psychological outcome, and mediator ranged from 7% to 22% in seventh grade and from 13% to 22% in eighth grade. About 15% of subjects had missing responses on acculturation, and 19% of subjects had missing responses on puberty. There were no missing cases for other moderators and covariates. Full information maximum likelihood (FIML) built in Mplus software was applied to compute maximum likelihood parameter estimates and standard errors from data with missing values.<sup>56</sup>

## RESULTS

General characteristics of the study sample are summarized in Table 1. Girls reported significantly higher levels of body image dissatisfaction and depressive symptoms over 2 years than boys did although the overweight prevalence was significantly lower in females than in boys ( $P<0.01$ ). In addition, these characteristics were also compared between ethnic groups. SES levels were significantly higher in Asian adolescents than in Hispanics ( $P<0.01$ ), whereas the prevalence of overweight was consistently higher in Hispanics than in Asians over the 2 years ( $P<0.01$ ). There were no ethnic differences in scores of depressive symptom experience and acculturation. However, Hispanic adolescents reported slightly but significantly higher mean level of body image dissatisfaction than did Asians (0.67 vs. 0.4,  $P<0.01$ ).

The relationships among overweight, body image dissatisfaction, and depressive symptoms were first compared between males and females. The final model of multiple-group SEM revealed a good fit with data (CFI=0.956 and RMSEA=0.042). Detailed unstandardized and standardized parameter estimates of mediation test from the final model are presented in Table 2. Four criteria for establishing mediation effect were evaluated. A significant mediation effect was observed among girls. That is, overweight significantly led to higher body image dissatisfaction, which was in turn significantly and positively associated with depressive symptoms. When the mediator was included in the model, the sign of the direct effect of overweight on the depressive symptoms became negative. The direct and mediation effects had almost similar magnitudes (direct effect= $-0.12$ ; mediation effect= $0.11$ ) but in opposite signs, which cancelled each other out and contributed to a close-to-zero, nonsignificant total effect (total effect= $-0.02$ ). This suppression effect was also reflected by a relatively higher magnitude of direct or mediation effect than total effect. In boys, the total effect of overweight on depressive symptoms was significant (total effect= $0.16$ ,  $P<0.05$ ) and was reflected by the significant direct effect from overweight on depressive symptoms (direct effect= $0.18$ ,  $P<0.05$ ; mediation effect= $-0.02$ ,  $P>0.05$ ).

We then moved on to explore moderation effects of ethnicity and acculturation within girls and boys. Detailed unstandardized and standardized parameter estimates from the final multiple-group SEM models are summarized in Table 3. In Asian girls, overweight was significantly related to more depressive symptoms via significantly enhanced body-image dissatisfaction (mediation effect= $0.16$ ,  $P<0.05$ ). However, with the mediator included in the model, overweight was negatively associated with depressive symptoms (direct effect= $-0.43$ ,  $P<0.05$ ). Similar mediation and direct effects were also observed in highly acculturated girls (mediation effect= $0.17$ ,  $P<0.05$  and direct effect= $-0.31$ ,  $P<0.05$ ). There was no such observation in Hispanic girls or low-acculturated girls, or in the models within males comparing low and high acculturation levels or comparing Asians and Hispanics. We further explored joint interactions of all 3 moderators together (ie, the third-order

interaction). However, the subsequent small subgroup sample size and low frequencies within each cross-tabulation cell of moderators limited this analysis attempt.

## DISCUSSION

The present study attempted to enhance the understanding of associations among overweight status, body image dissatisfaction, and depressive symptoms in Asian and Hispanic adolescents. We examined the mediation pathway from overweight status in seventh grade to the subsequent experience of depressive symptoms in eighth grade through body image dissatisfaction across subgroups of adolescents with varied ethnicity (Asian and Hispanic), gender (boy and girl) and acculturation levels (low and high acculturation levels). Our results showed significant gender difference in the hypothesized mediation effect. When gender further interacted with either ethnicity or acculturation, the mediation was significant among Asian girls and boys with high acculturation. In addition, several previous prospective studies suggested early depression predicted subsequent risk of overweight.<sup>57, 58</sup> We have run alternative models in this direction and did not observe any significant results.

The gender differences observed in our study are consistent with previous findings in the literature. The relationship between body dissatisfaction and self-esteem has often been found to be significant and stronger in girls than in boys.<sup>4</sup> In Stice's study, for instance, body image dissatisfaction was a significant factor in predicting whether adolescent girls developed depression later.<sup>59</sup> The observed moderation effect of gender may be correlated with sociocultural norms and attitudes towards physical appearance in boys and girls,<sup>60</sup> in which sociocultural standards of beauty for boys emphasize strength and muscularity whereas thinness body ideal is advocated for girls.<sup>61</sup> Sociocultural factors including pressures from peers, relatives, parents, media, and other social environment may affect the ways in which adolescents set their own weight standards, no matter if these standards are healthy or unrealistic.<sup>21</sup> Given the fact that muscle is valued more in boys, we also ran additional analysis with the focus on underweight, depressive symptoms in boys and did not find any significant results. In addition, the gender difference may also be related to the fact that girls may be more likely to use social comparisons, a practice that has been shown to increase body dissatisfaction and unhealthy weight-control behaviors in adolescent girls.<sup>60</sup>

The effect of acculturation on the mediation pathway in our study was related to gender difference as we observed and discussed above. When the role of gender was considered, the mediation effect was only significant in female adolescents with high acculturation levels. The underlying mechanism of how gender interacted with acculturation on the mediation pathway in this study should be related to gender differences in social cultural norms, attitudes, and weight-related behaviors as we discussed above. The literature is sparse regarding the role of acculturation in regulating the overweight-depressive symptoms association. Acculturation can be described as the process by which minority individuals balance and adapt their own cultural behaviors and beliefs with those of majority culture when they encounter challenges of cultural views and practices from mainstream society.<sup>62</sup> Enhanced risks of body image dissatisfaction and eating disorders among more highly acculturated non-Western women were reported in previous study.<sup>28</sup> This enhanced risk has been suggested to relate to the internalization of Western body ideal, which tends to be especially hard to meet for non-Western girls whose skin color and ethnically defined physical features may be in contrast to the ideal.<sup>28, 62</sup> Simultaneously, among Hispanic and Asian adolescents in the United States, acculturation tends to increase the risk of overweight and its behavioral risk factors such as fast food consumption and sedentary behavior.<sup>63</sup> Therefore, highly acculturated adolescents may be at risk both of becoming overweight and of endorsing unrealistically thin body-image ideals. The large discrepancy between their

body size and their ideal body size may make them especially prone to depression. In addition, other culturally relevant variables, such as cultural conflict, may be able to provide explanation for the mixed observations in our study. Defined as the negative affect and cognitive dissonance resulting from an attempt to assimilate values and expectations of the majority culture and the culture of origin, cultural conflict may especially affect those minority adolescents who have strong ties to their families' cultures to experience of body image dissatisfaction, psychological distress, and maladaptive eating behaviors.<sup>62</sup> Fresh evidence can be found from a recent study among South Asian American women, in which cultural conflict was significantly associated with teasing and body image dissatisfaction.<sup>62</sup> Recent cross-cultural studies also reported greater overall body-image dissatisfaction and maladaptive attitudes among Asian women and Hispanic youth who were identified with a stronger adherence and affiliation with traditional Asian or Mexican cultural values than their highly acculturated counterparts.<sup>25,29</sup> Finally, another possible explanation may be the influence of pubertal development in associations of overweight, body image, and depressive symptoms experience. As well documented in the current body of literature, gender differences in pubertal development in terms of pubertal timing and velocity of transition result in different patterns of body fat accumulation, which may in turn be related to different experience of body image concerns and risk of adolescent depression.<sup>64</sup> Specifically, driven by both growth and sex hormones, adolescents during puberty experience sexual maturation and a fast accumulation in both lean and fat mass. Early maturation in both boys and girls has been suggested to enhance the risk of being overweight and further influence the severity of obesity in adulthood.<sup>41,42</sup> For boys, in addition to the increase in fat mass accumulation, most of the weight gain is explained by an increase in muscle tissue, whereas for girls the physical changes of puberty involve significant deposition of fat mass on abdomen, buttocks, and thighs.<sup>43</sup> The increase in fat mass accumulation is significantly greater in girls than boys. Because of this additional weight and body fat, puberty is associated with a rise in body dissatisfaction.<sup>44</sup> Significant relationships between early onset of menarche and lower ratings of body image were observed in large-scale studies.<sup>45</sup> In our study, pubertal status was measured by one single item asking for age of menarche (for girls) or physical change (for boys), which may not be able to capture the developmental process of pubertal status. Future studies should incorporate more objective measures of pubertal development for investigation of its interacting relations with ethnicity and acculturation on associations of overweight, body image, and psychological well-being.

When both gender and ethnicity were considered, significant effect modification of ethnicity in the mediation pathways was observed in Asian girls. In this study, we did not further differentiate adolescents into specific different cultural background within the same ethnic category (eg, differentiate Chinese, Vietnamese, Korean, and Japanese adolescents). Future studies can focus on exploring both within- and between-ethnic group differences in the influence of acculturation on associations among overweight, body image, and depressive symptoms. In addition, body image dissatisfaction was assessed using comparison of subject's selection of silhouette drawings for actual and ideal body size.<sup>37</sup> Although this method has been used in quite a few studies, it may not reflect the multidimensional aspects of body image that not only include physical appearance and "the body's competence or fitness, biological integrity or health/illness"<sup>37</sup> but also expand to evaluative, cognitive, and behavioral components.<sup>65</sup> Development of a valid multidimensional instrument of body image assessment is needed for better assessing its associations with overweight and psychological well-being.

In conclusion, our study revealed different associations of overweight, body image dissatisfaction, and depressive symptoms experienced across gender and acculturation levels



in Asian and Hispanic adolescent populations. Our findings may greatly contribute to better understanding the association of overweight, and depressive symptoms in adolescents.

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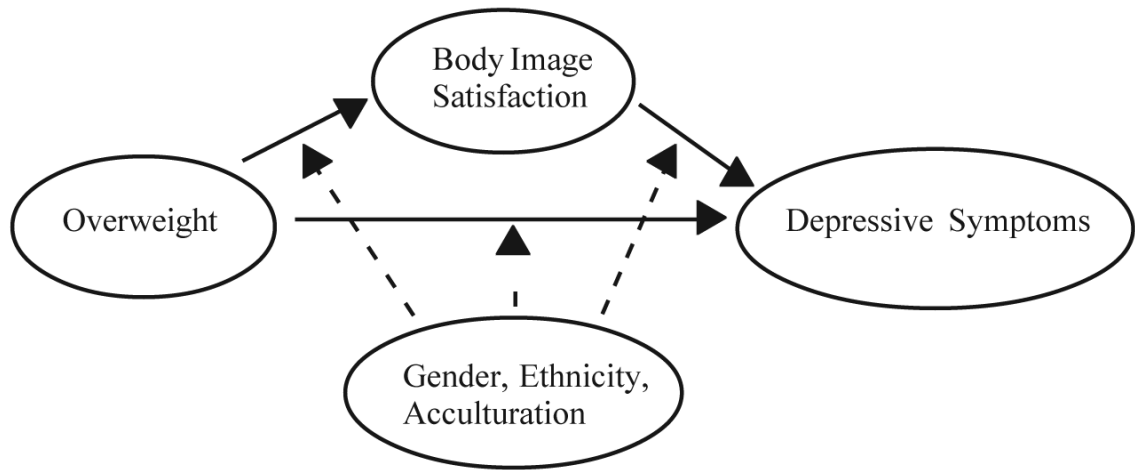
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**Figure 1. Hypothetical Mediation and Moderation Model**

Note.

Solid lines represent direct and indirect pathways. Dotted lines represent moderation effects on intermediate pathways.

Table 1

Sample Characteristics in Seventh Grade by Gender

	Girls (n=648)		Boys (n=507)		All (N=1155)	
	n	%	n	%	n	%
<b>Age (years)</b>						
10	0	0	1	0.2	1	0.1
11	2	0.3	5	1	7	0.6
12	505	77.9	376	74.3	881	76.3
13	139	21.5	121	23.9	260	22.5
14	2	0.3	3	0.6	5	0.4
<b>Ethnicity</b>						
Asian	201	31	174	34.3	375	32.5
Hispanic	447	69	333	65.7	780	67.5
<b>SES</b>						
Low	232	35.8	153	30.2	385	33.3
Medium	201	31	184	36.3	385	33.3
High	215	33.2	170	33.5	385	33.3
<b>Pubertal Status</b>						
Prepubertal	58	10.6	53	13.6	111	11.9
Peri-/postpubertal	488	89.4	336	86.4	824	88.1
<b>Ever Smoke a Whole Cigarette</b>	99	15.3	96	18.9	195	17.0
<b>Intervention Groups</b>						
Intervention	363	57.6	292	56.0	655	56.7
Control	215	42.4	285	44.0	500	43.3
<b>Overweight</b>						
In seventh grade	150	23.1*	150	29.6	300	26.0
In eighth grade	79	12.2*	83	16.4	162	14.0
<b>Mean SD</b>	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>
<b>Depressive Symptoms</b>						
In seventh grade	7.87*	3.65	7.28	3.41	7.62	3.56

	Mean	SD	Mean	SD	Mean	SD
In eighth grade	8.29*	4.1	7.2	3.66	7.83	3.95
<b>Body Image Dissatisfaction</b>	0.68*	0.98	0.42	1.18	0.57	1.1
<b>Acculturation</b>	27.12	4.27	26.6	4.96	26.9	4.59

Note.

Moderators: gender, ethnicity and acculturation; Predictor: overweight; Mediator: body image dissatisfaction; Dependent Variable: depressive symptoms; Other Covariates: age, pubertal status, smoking and intervention groups.

\* P<0.01

Table 2

## Final SEM of Mediation Tests on Gender Difference

	Boy	Girl
<b>Criterion 1</b>		
Overweight->BID	1.16(0.45)*	1.14(0.49)*
<b>Criterion 2</b>		
BID->Dep	-0.02(-0.03)	0.09(0.12)*
Overweight->Dep adjusted for BID	0.18(0.12)*	-0.12(-0.07)
<b>Criterion 3</b>		
Overweight->Dep	0.16(0.11)*	-0.02(-0.01)
<b>Criterion 4</b>		
Mediation Effect of BID	-0.02(-0.01)	0.11(0.06)*
<b>R-Square for Depressive Symptoms</b>	0.25	0.33
<b>Model Fitting</b>		
Chi-square(df, p)	496.3(244, <0.001)	
CFI	0.956	
RMSEA	0.042	

Note.

BID: Body Image Dissatisfaction. Dep: Depressive Symptoms. Criterion 1: relationship of overweight to mediator. Criterion 2: relationship of overweight and mediator to dependent variable (depressive symptoms). Criterion 3: relationship of overweight to dependent variable (depressive symptoms). Criterion 4: Mediation effect. Unstandardized and standardized (in parentheses) coefficients were presented.

\* P&lt;0.05.



**Table 3**  
**Final SEM of Mediation Tests by the Interplays of Gender With Acculturation and Ethnicity**

	Girl		Boy		Girl		Boy	
	Low AC	High AC	Low AC	High AC	Asian	Hispanic	Asian	Hispanic
<b>Criterion 1</b>								
Overweight->BID	1.01(0.45)*	1.05(0.46)*	1.29(0.49)*	1.14(0.49)*	1.24(0.33)*	1.15(0.54)*	1.36(0.44)*	1.04(0.45)*
<b>Criterion 2</b>								
BID->Dep	0.09(0.11)	0.16(0.18)*	0.06(0.11)	-0.09(-0.14)	0.13(0.16)*	0.08(0.09)	0.01(0.02)	-0.05(-0.08)
Overweight->Dep adjusted for BID	0.05(0.02)	-0.31(-0.15)*	0.15(0.10)	0.16(0.10)	-0.43(-0.14)*	-0.07(-0.04)	0.25(0.15)	0.18(0.14)*
<b>Criterion 3</b>								
Overweight->Dep	0.13(0.07)	-0.14(-0.07)	0.22(0.14)*	0.06(0.04)	-0.26(-0.09)	0.01(0.01)	0.26(0.15)*	0.12(0.11)
<b>Criterion 4</b>								
Mediation Effect of BID	0.09(0.05)	0.17(0.08)*	0.08(0.05)	-0.10(-0.07)	0.16(0.05)*	0.09(0.05)	0.01(0.008)	-0.05(-0.04)
<b>R-Square for Depressive Symptoms</b>	0.29	0.44	0.38	0.20	0.45	0.29	0.28	0.24
<b>Model Fitting</b>								
Chi-square (df, p)	325.0(228,<0.001)		405.1(228,<0.001)		342.6(228,<0.001)		378.0(228,<0.001)	
CFI	0.970		0.921		0.968		0.934	
RMSEA	0.039		0.06		0.039		0.051	

Note.

BID = Body Image Dissatisfaction

Dep = Depressive Symptoms

A C = Acculturation

Criteria 1: relationship of overweight to mediator

Criteria 2: relationship of overweight and mediator to dependent variable (depressive symptoms)

Criteria 3: relationship of overweight to dependent Variable (depressive symptoms)

Criteria 4: Mediation effect

Unstandardized and standardized (in parentheses) coefficients were presented

\* P<0.05