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Abstract

Predictors and outcomes of weight concerns in pre-adolescent and adolescent girls are well known, but few models have incorporated concerns reported directly by mothers as a predictor, and both eating and exercise outcomes. Using questionnaires, a comprehensive model of 232 pre-adolescent and early adolescent girls' weight concerns, eating restraint, and exercise behavior was tested. Structural equation modeling showed that daughters' weight concerns was predicted primarily by their perceptions of their mothers' concerns about the daughters' weight, as well as by daughters' BMI, appearance conversations with friends, and perceived media pressure. Mothers' concerns with their daughters' weight were indirectly associated with daughters' own concerns, via the daughters' perceptions of their mothers' concerns. Daughters' concerns with their weight were a strong predictor of eating restraint, but not exercise behavior.

‘Mum’s the Word’: Predictors and Outcomes of Weight Concerns in Pre-Adolescent and Early Adolescent Girls

Pressures to achieve a socially desirable physique are pervasive among young women, and become particularly apparent during the formative years (Dohnt & Tiggemann, 2006). Such pressures are coupled with an emphasis on unrealistic standards of attractiveness, which for girls are often synonymous with being as thin as possible (Thøgersen-Ntoumani, Ntoumanis, & Nikitaras, 2010). The physical changes accompanying early adolescence take girls further away from this ideal. Hence, often girls’ weight concerns increase from early to mid-adolescence (Lam & McHale, 2012; May et al., 2006). In turn, excessive weight concerns is an important risk factor of disordered eating, including eating restraint which is associated with diverse outcomes such as reduced fruit and vegetable intake (Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006), depressive symptoms (Cooper, Rose, & Turner, 2005), suicide ideation and attempts (Brausch & Gutierrez, 2009; Crow, Eisenberg, Story, & Neumark-Sztainer, 2008), and weight gain (Neumark-Sztainer, Wall, Story, & Standish, 2012). Given that the prevalence of weight concerns and disordered eating behaviors is common amongst adolescents (Loth, Wall, Larson, & Neumark-Sztainer, 2015), identifying key antecedents of weight concerns has important health-related implications.

The aim of the present study was to develop and test an integrative model (see Figure 1) that examined how social (media and peers), parental (mother’s concerns about their daughters’ body weight), and biological (objectively recorded BMI) factors predicted pre-adolescent and early adolescent girls’ concerns about body weight, as well as associated outcomes such as eating restraint and exercise behavior.

Parents are thought to influence the weight concerns of their offspring (e.g., via active encouragement to diet or comments to their child about the child's weight; Balantekin, Savage, Marini, & Birch, 2014). Most research examining the role of parents (e.g., Thøgersen-Ntoumani, Ntoumanis, & Nikitaras, 2010) has used young peoples' reports of parental influence with only a few studies including a combination of parents' own reports of their attitudes and behaviors with their offspring's reports (Rodgers & Chabrol, 2009). The limited research that has used both types of reports has found that children's perceptions of parental encouragement *and* parents' actual behaviors are important determinants of weight concerns and body dissatisfaction (Haines, Neumark-Sztainer, Hannan, & Robinson-O'Brien, 2008). Mothers' concerns about their own body weight have been related to greater maternal encouragement of their daughters to lose weight (e.g., Francis & Birch, 2005). However, this research has been mainly conducted with children rather than adolescents, and as yet, it has not combined parental and adolescent reports in structural models in which other potentially important influences on weight concerns are also considered.

Besides parents, social factors such as peers and the media also contribute to the development of weight concerns and eating restraint in girls (e.g., see the revised tripartite influence model by Shroff & Thompson, 2006). It has been reported that adolescents create an 'appearance culture', partly through peer conversations about appearance. According to van Tergouw (2011), the more conversations girls have with other girls about their appearance, the more likely it is that they will engage in appearance comparisons and become dissatisfied with their bodies. This has been empirically supported in studies showing that appearance conversations with peers often contribute to the internalization of media ideals of thinness for females, and are associated with peer criticism about appearance, and body image dissatisfaction

(Jones, Vigfusdottir, & Lee, 2004; Lawler & Nixon, 2011). However, to our knowledge, only a few studies have examined the relation between peer conversations and eating pathology, and not just dieting (e.g., Bardone-Cone, Brownstone, Higgins, Fitzsimmons-Craft, & Harney, 2013). Further, the role of appearance conversations with friends, when controlling for other socio-biological predictors of weight concerns in adolescents, has not been previously tested.

Media also play an important role in relaying weight and appearance-related information via the transmission of the thin beauty ideal. A review of previous meta-analyses concluded that mass media (e.g., TV and magazines) have a powerful influence on body-image related constructs, including weight concerns (Lopez-Guimera, Levine, Sanchez-Carracedo, & Fauquet, 2010). As a result, media pressure is an important construct to include in any model examining predictors and outcomes of weight concerns.

Adolescent girls' weight status, (as assessed by BMI), is also an important variable to take into consideration in the examination of predictors of weight concerns and eating restraint. Not surprisingly, research shows that parents tend to be more concerned about their children's weight, and are more likely to actively encourage them to lose weight if their child is overweight or obese (Schreiber et al., 2014). Unfortunately, most previous studies have relied on self-reported height and weight (e.g., Field et al., 2005; Jones & Crawford, 2006; Papp, Urban, Czegledo, Babusa, & Tury, 2013), despite common underreporting of weight, thus possibly leading to inaccurate estimates of the associations between parental concerns and child BMI. Thus, in the present study, we employed objective assessment of BMI by measuring the adolescents' height and weight.

Most research examining behavioral outcomes of weight concerns in young people has focused on diet or eating-related constructs (such as eating restraint). Eating-related and exercise behaviors are seldom considered concurrently (Taylor, Wilson, Slater, & Mohr, 2011). This is surprising as exercise is an effective method of weight control and may contribute to weight loss in conjunction with dieting (Ho et al., 2013). For example, in a review of correlational studies and randomized trials, Pronk and Wing (2012) showed that the benefits of exercise for long-term weight maintenance were observed with different types of populations, diets, and exercise interventions. Hence, a unique aspect of the current study is that it estimates the effects of socio-biological and maternal factors on both eating restraint and exercise. Importantly, such effects are hypothesized to be distal and indirect via children's weight concerns.

The present study extends previous scattered findings into a coherent and comprehensive model that tests the relative associations of social, biological, and maternal (assessed by both mother and daughter reports) factors to body weight concerns. We extended previous literature on adolescent weight concerns in a number of ways. First, we examined the viability of a structural model incorporating mothers' concerns about their child's weight (operationalized as mothers' own reports of encouragement for their daughter to lose weight), and daughters' perceptions of maternal concerns, along with other known socio-biological influences on weight concerns, in an effort to establish the relative contribution of these factors. Second, we adopted a stringent statistical approach allowing for the simultaneous examination of several predictors (biological, media, peers, parental variables), and outcomes of weight concerns. Third, we added exercise behavior as an outcome to the model. Fourth, we included a relatively large sample of mothers and daughters. Previous studies have included fewer than 115 pairs (Rodgers & Chabrol, 2009), thus potentially compromising statistical power. Finally, in contrast to most

previous studies, objective (rather than self-reported) measures of height and weight were obtained.

It was hypothesized that support would be found for a model in which BMI, perceptions of mothers' concerns, peer appearance conversations, and media pressure would all positively predict the weight concerns of the daughters. In turn, daughters' weight concerns were expected to positively predict eating restraint and exercise behaviors. Additionally, in a separate logistic regression analysis we expected to find that mother concerns and perceived mother concerns about daughter's weight, BMI, media pressures, and peer appearance conversations would positively predict the risk of eating disorders.

Method

Participants and Procedure

Two hundred and thirty two pre-adolescent and adolescent girls (and their mothers), enrolled in summer camps in Athens, Greece took part in the present study. The mean age of the mothers was 43.98 ($SD = 4.41$; age range = 34-59), while the daughters were aged between 10 and 16 years, and had a mean age of 12.26 ($SD = 1.43$). The mean BMI of the daughters was 19.84 ($SD = 3.08$), with 79.10% either underweight or normal weight (there are currently no established cut-off points for underweight in children and adolescents), 18.60% were overweight, and 2.30% were obese, according to Cole, Bellizi, Flegal and Dietz's (2000) age- and sex-specific criteria for classifying overweight and obesity in children. All participating girls and their mothers provided written consent forms; participants were treated according to the APA ethical guidelines.

Measures

Mother variables. An adapted 4-item version of Moreno and Thelen's (1993) Family History of Eating Survey, previously used by Thelen and Cormier (1995), was used to assess the mothers' concerns about their daughters' weight. Three out of four items refer to the number of times the mother has told her daughter that she "weighs too much", "to eat less food or eat different foods in order to lose weight or keep from gaining weight", or that she should "exercise in order to lose weight or keep from gaining weight" in the past 12 months. The final item asks the mother how often she has "kept her daughter from eating foods that she likes so that she will lose weight or keep from gaining weight". All items were measured on a scale ranging from 1 = *never*, 2 = *1-2 times*, 3 = *3-5 times*, 4 = *6-10 times*, to 5 = *11 or more times*. High levels of internal consistency ($\alpha = .84 - .95$) for this version of the scale have been reported by Thelen and Cormier (1995).

Daughter variables.

Body mass index (BMI). The daughters' height (in meters) and weight (in kilograms) measurements were taken by a trained research assistant, following the completion of the questionnaires, in a private room. Height was measured to the nearest centimeter using a SECA stadiometer, and weight was measured using a TANITA scale. To calculate BMI, the formula $\text{weight (kg) / height (m)}^2$ was used.

Perceptions of maternal concerns about daughters' weight. The same scale as the one used to assess mothers' concerns about their daughters' weight was used to measure the daughters' perceptions of their mothers' concerns about their weight (i.e., Thelen & Cormier's, 1995, scale). Only the stem differed slightly: "during the past 12 months, please indicate how

many times your mother has ever told, or done, the following to you”. Thelen and Cormier reported acceptable internal consistency for this version of the scale ($\alpha = .83$).

Peer appearance conversations. The degree to which the daughters talked with their friends about their appearance, and how to enhance it, was measured using a 5-item scale developed by Jones et al. (2004). An example item is “My friends and I talk about what we can do to look our best”, and the questions are rated using a scale ranging from 1 (*never*) to 5 (*very often*). Jones et al. and Jones (2004) have previously provided evidence for the scale’s adequate levels of reliability and validity.

Media pressures. The 7-item media pressures subscale from the Sociocultural Attitudes towards Appearance Scale-3 (SATAQ-3; Thompson, van den Berg, Roehrig, Guarda, & Heinberg, 2004) was used to measure perceptions of media pressures. An example item is ‘I’ve felt pressure from TV or magazines to be thin’ and response options range from 1 (*definitely disagree*) to 5 (*definitely agree*). Thompson et al. reported evidence of excellent convergent validity of the scale. One item (No 6; “I’ve felt pressure from TV or magazines to exercise”) was deleted as many children reported it as being irrelevant.

Daughters’ weight concerns. Weight concerns of the daughters were assessed using Killen et al.’s (1994) 5-item Weight Concerns Scale. An example item is “Do you ever feel fat” with response options for Items 1, 2 and 5 ranging from 1 (*never*) to 5 (*always*). Item 3 used a 7-point scale and Item 4 used a 4-point scale. Individual item scores were transformed into a 0-100 score, and the scale score then represented the average of all items. A cut-off score of 52 or above was identified by Killen et al., (1994) to indicate risk of eating disorders in adolescent

girls. Killen et al. reported evidence of excellent reliability, and good sensitivity to change over time for this scale.

Eating restraint. Eating restraint was measured using the eating restraint sub-scale from the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994). Participants were asked to indicate on how many of the last 28 days they have tried to restrict their eating in various ways. An example item is “in the past 28 days, have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?”. Response anchors range from 1 to 7 (1 = *no days*; 2 = *1-5 days*; 3 = *6-12 days*; 4 = *13-15 days*; 5 = *16-22 days*; 6 = *23-27 days*; 7 = *every day*). The EDE-Q is reliable, and has good concurrent and criterion validity (Mond, Hay, Rodgers, Owen, & Beaumont, 2004a, 2004b).

Exercise behaviors. Godin and Shephard’s (1985) leisure-time exercise questionnaire was used as a measure of exercise behavior during a typical week outside the camp. Participants were asked to report how often (i.e., frequency) they engaged in mild, moderate, and strenuous exercise for 20 minutes or more during a typical week. Examples of mild, moderate, and strenuous physical activities were provided to the participants. A total exercise score in metabolic equivalents (METs) was derived by weighting the frequency of mild, moderate, and strenuous activities by their respective MET values (*mild* = 3, *moderate* = 5, *strenuous* = 9). Jacobs, Ainsworth, Hartman, and Leon (1993) reported this scale as reliable and as possessing good concurrent validity when compared to various objective activity monitors and fitness indices.

Data Analysis

Internal consistency of measured variables was assessed using Cronbach's alpha. To examine the bivariate relations between the measured constructs, Pearson correlations were computed. Structural equation modeling (SEM) was used to examine the hypothesized structural relations between all measured variables, controlling for age. Analyses were conducted using Mplus 7.2 (Muthén & Muthén, 1998-2012), using a robust maximum likelihood (MLR) estimator. A full-indicator approach (i.e., no item parceling) was used to test the hypothesized model. Model fit was determined using the χ^2 test. As the chi-square test is sensitive to large sample sizes, slight deviations to the hypothesized model may lead to a significant chi-square value, suggesting a poor model fit. Whilst a non-significant chi-square is desirable, in practice most published models with non-significant chi-square values have very few degrees of freedom (e.g., observed variable models with no latent variables), and/or a very small sample size. To overcome this potential problem with the chi-square statistic, model fit was also determined using other goodness-of-fit indices. These include the comparative fit index (CFI), Tucker Lewis index (TLI), and root mean square error of approximation (RMSEA). Specifically, a good model fit should be indicated by a non-significant χ^2 , with CFI and TLI values around .95, RMSEA about .05 respectively (Hu & Bentler, 1999). We also examined the total indirect effect of each independent variable on each dependent variable.

Further, a binary logistic regression analysis was conducted to examine the contributions of mothers' concerns about their daughters' weight, peer appearance conversations, and media pressures (independent variables) to risks of developing an eating disorder (defined as weight concerns scores above 52, as per Killen et al.'s, 1994 criteria). In this analysis, the dependent variable was dichotomized (0=*no risk*; 1=*risk*).

Results

Descriptive Statistics and Correlation Analyses

Cronbach alphas and Pearson correlations of measured constructs are presented in Table 1. As expected, significant correlations ($r = .24$ to $.63$, $p < .01$) were found between mothers' concerns about their daughters' weight, daughters' BMI, daughters' perceptions of their mothers' concerns about their weight, daughters' weight concerns, peer appearance conversation, media pressures, and eating restraint. Self-reported exercise behaviors of the child were weakly related to eating restraint ($r = .11$, $p < .05$), but it was not associated with other measured constructs.

Structural Equation Modeling

A graphical representation of the tested SEM model is presented in Figure 1. As daughter's age was correlated with most of the included constructs, we controlled for this variable in our analyses. The model fit was acceptable, $\chi^2(416) = 711.15$, $p < .01$, CFI = .94, TLI = .93, RMSEA = .05. Specifically, we found that daughters' BMI had direct effects on mothers' concerns about their daughters' weight, daughters' perceptions of their mothers' concerns about their weight, daughters' weight concerns, and peer appearance conversation. Also, maternal concerns predicted fairly strongly daughters' perceptions of their mothers' concerns, which in turn predicted the daughters' weight concerns. Daughters' weight concerns were also predicted by peer appearance conversation, and media pressures. In turn, we found that daughters' weight concerns were strongly related to eating restraint; however, it did not predict exercise behaviors.

Significant indirect effects were found (The numbers in the following parentheses represent the total indirect effect of each independent variable on each dependent variable): from daughters' BMI (total indirect effects $\beta = .41$), maternal concerns about daughters' weight ($\beta =$

.19), perceptions of their mothers' concerns ($\beta = .30$), peer appearance conversations ($\beta = .14$), and media pressures ($\beta = .24$) on eating restraint were found. The indirect effects from daughters' BMI ($\beta = .25$), and mothers' concerns about their daughters' weight ($\beta = .26$) on daughters' weight concerns were also significant. Finally, the indirect effect from daughters' BMI to perceptions of their mothers' concerns was also significant ($\beta = .37$).

Logistic Regression

A logistic regression analysis [$R^2 = .33$ (Cox and Snell), $R^2 = .50$ (Nagelkerke); Model $\chi^2(6) = 91.68$, $p < .001$] examined the contribution of each of the variables examined in the SEM model (but with observed scores) to the prediction of eating disorder risk (calculated from the daughters' weight concerns scores; see Method). Controlling for daughters' BMI ($OR = 1.36$; $CI = 1.14 - 1.63$) and age ($OR = .86$; $CI = .61 - 1.21$), the results showed that perceived maternal concerns ($OR = 2.31$; $CI = 1.44 - 3.71$) [but not mothers' own concerns about daughters' weight ($OR = .90$; $CI = .59 - 1.37$)], and media pressures ($OR = 1.81$; $CI = 1.25 - 2.61$) predicted the risk of developing eating disorders. Peer conversations ($OR = 1.28$; $CI = .80 - 2.06$) and age ($OR = .94$; $CI = .71 - 1.25$) did not significantly predict this risk.

Discussion

In the present study, the contributions of different social agents (mothers, peers, and media), as well as objective BMI were examined in a comprehensive model of predictors of weight concerns, eating restraint, and exercise behavior of pre-adolescent and adolescent girls. Our findings showed that perceptions of maternal concerns about daughters' weight, media pressure, and peer appearance conversations all significantly predicted weight concerns among pre-adolescent and adolescent girls, even after taking into consideration objectively measured

BMI. In turn, weight concerns predicted eating restraint in the expected direction, but failed to predict exercise behavior. These findings are in accordance with previous research with similar population groups (e.g., Haines et al., 2008; Keery et al., 2004).

A significant predictor of pre-adolescent and early adolescent girls' weight concerns was their perceptions of their mother's concerns about their body weight. This finding is congruent with previous research highlighting the key influence of parental factors in the development of weight concerns in pre-adolescents and adolescents (Field et al., 2001). We added to previous research by incorporating in our model not only daughters' perceptions of maternal concerns about their weight, but also mothers' concerns as rated by the mothers themselves. The size of the correlation between the daughters' objectively assessed BMI and their mothers' concerns about their weight was moderate rather than high. Previous research has shown that parents tend to be more worried about their child's weight when their child is overweight or obese (Schreiber et al., 2014), which was confirmed in the present study. However, the moderate, rather than high, correlation, suggests that other factors may determine maternal concern of their daughters' weight. Examining these would be an interesting avenue for future research. For example, it is possible that mothers' concerns about their own weight, whether justified or not, may be an important determinant.

Interestingly, the logistic regression analysis showed that mothers' concerns about their daughter's weight did not predict, while *perceptions* of mother's concerns was associated with, the risk of developing an eating disorder. Some previous studies (Field et al., 2005; Keery et al., 2006) have also found that weight-related outcomes in adolescents' are better predicted by adolescent-reported than parent-reported behaviors.

Perceived media pressures were significant predictors of weight concerns in our pre-adolescent and adolescent sample. The role of media influence in weight-related concerns of young people was also highlighted in a meta-analysis by Lopez-Guimera et al. (2010). The path coefficient from peer appearance conversations to daughters' weight concerns was also significant, but smaller in size. It is possible that other peer-related variables, such as peer appearance pressure, could be more important predictors of weight concerns in this population than conversations about appearance.

The present results showed that daughters' weight concerns are associated with eating restraint, but not exercise behavior, despite the latter being an important contributor to weight loss and maintenance along with diet (Ho et al., 2013). Whilst self-presentation concerns can facilitate exercise behavior, for other individuals such concerns act as barriers to exercise participation (Hausenblas, Brewer & Van Raalte, 2004). For example, Melbye, Tenenbaum, and Eklund (2008) showed that women who reported higher body shame and body surveillance experienced higher social physique anxiety, and were not very likely to engage in exercise.

Limitations and Future Research Directions

Although the SEM model presented in this study provided some new insight into the contribution of various social agents to weight concerns and eating restraint in pre-adolescent and adolescent girls, there are some limitations which should be considered in the interpretation of these findings. For example, the cross-sectional design of the study precludes any causal inferences that can be made between the constructs. For example, it is possible that those individuals with the greatest weight concerns are more likely to perceive pressures to attain a certain physique than those without such concerns, rather than such pressures contributing to

weight concerns. Some previous longitudinal research, however, would suggest that the (perceived) behaviors of social agents are precursors of body image concerns (Field et al., 2001; van den Berg, Keery, Eisenberg, & Neumark-Sztainer, 2010). Further, factors other than those examined in the present study (e.g., thin-ideal internalization, peer appearance pressure and teasing) could be more, or as, influential as perceived mother concerns in predicting daughters' weight concerns, and risk of eating disorders. It would also be interesting in future research to examine additional predictors of maternal concerns about their daughters' weight, besides daughters' BMI. Such predictors could be, for example, media influence, or appearance-related conversations with other mothers. Finally, the relatively large age range of the sample is a limitation, given that age correlated with most of the variables in our study. Future studies should have sufficiently large sample sizes to separate and compare preadolescent and adolescent girls.

In conclusion, our findings indicate the importance of considering simultaneously the role of a variety of social agents (peers, media, and mothers) in studying weight concerns in pre-adolescent and adolescent girls. All three social agents seem to be important, and with regard to mothers, it seems that their daughters' perceptions of how concerned these mothers are with their daughters' weight are more important than how concerned these mothers report they actually are. However, it is possible that mothers' responses are biased by social desirability. Daughters' responses might reflect them picking up verbal and non-verbal communication from their mothers. Establishing open lines of communication between mothers and daughters in which such issues are discussed, and any misunderstandings are resolved can be beneficial for both daughters and mothers.

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Table 1

Descriptive Statistics, Internal Reliability and Correlation Coefficients for all Measured Variables

	<i>M (SD)</i>	Possible range	Cronbach's α	1	2	3	4	5	6	7	8
1. Daughters' age	12.26 (1.43)	9 – 16	-								
2. Mothers' concerns about their daughters' weight	2.35 (1.26)	1 – 5	.87	-.03							
3. Daughters' BMI	19.84 (3.08)	-	-	.32**	.56**						
4. Daughters' perceptions of their mothers' concerns about their weight	1.97 (1.04)	1 – 5	.84	.08	.63**	.50**					
5. Daughters' weight concerns	33.93 (24.33)	0 – 100	.83	.19**	.38**	.46**	.54**				
6. Peer appearance conversations	2.66 (1.01)	1 – 5	.86	.39**	.25**	.30**	.37**	.39**			
7. Media pressures	1.77 (1.02)	1 – 5	.93	.29**	.24**	.30**	.34**	.44**	.39**		

8. Eating restraint	2.07 (1.34)	1 – 7	.80	.15**	.36**	.42**	.54**	.56**	.39**	.49**	
9. Exercise behaviors	46.63 (54.11)	-	-	.17**	.05	.01	.05	.05	.09	.03	.11*

* $p < .05$, ** $p < .01$.

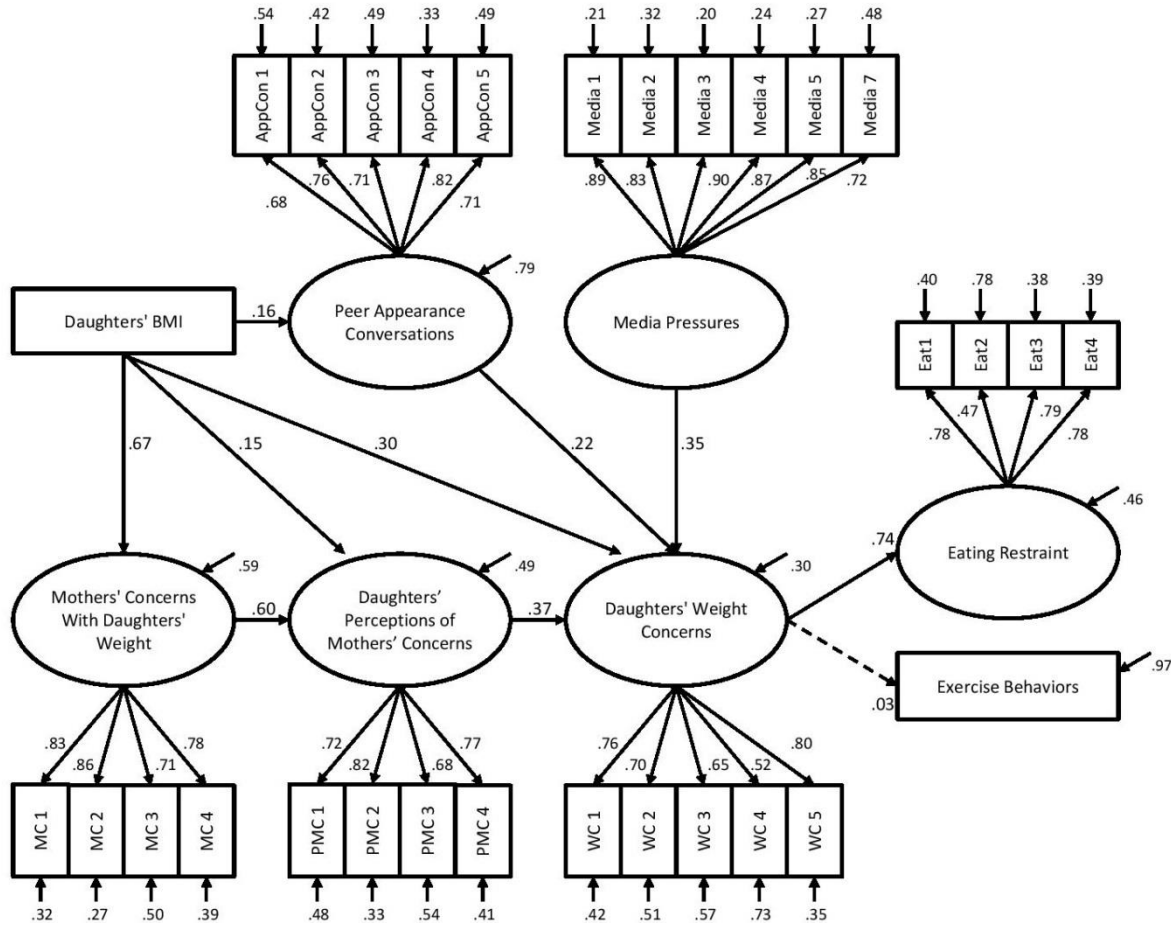


Figure 1. An integrative model of maternal, peer, media and BMI influences on body weight, eating restraint and exercise. All variables in the model were regressed on age, but this is not shown in the model for presentation simplicity purposes.

Note. Dotted line indicates a non-significant path; solid lines indicate significant paths. Arrows that do not connect two variables represent the error variance of a variable.