

# Risk Factors for Disordered Eating During Early and Middle Adolescence: A Two Year Longitudinal Study of Mainland Chinese Boys and Girls

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**Abstract** Even though reliable eating disorder risk factors have been identified among adolescent girls, little is known about predictors of increased vulnerability within specific phases of adolescence or among adolescent boys, particularly in highly populated non-Western contexts. In this study, early and middle adolescent boys ( $n=1,271$ ) and girls ( $n=1,415$ ) from Chongqing, China completed validated measures of eating disorder pathology and putative risk factors at baseline and 2 years follow-up. Multivariate models for boys of each age group indicated increases in disordered eating at follow-up were predicted by higher initial body mass index, negative affect and body dissatisfaction levels as well as attendant increases in perceived appearance pressure from mass media, body dissatisfaction, negative affect between assessments. High baseline levels of reported appearance pressure from parents and dating partners contributed, respectively, to prediction models of younger and older boys. More distinct constellations of significant predictors emerged in multivariate models of early versus middle adolescent girls. Together, findings indicated body dissatisfaction and negative affect were fairly robust risk factors for exacerbations in disturbances across samples while risk factors such as perceived pressure from desired/prospective dating partners were salient only during particular phases of adolescence.

**Keywords** Disordered eating · Risk factors · Adolescents · China · Gender

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Eating disorders and sub-clinical eating disturbances typically emerge in adolescence, affect up to 12 % of girls and young women (e.g., Machado et al. 2007; Smink et al. 2012; Stice et al. 2009), and carry substantial risks for morbidity, disability, and premature mortality (e.g., Arcelus et al. 2011; Thomas et al. 2009; Wade et al. 2012). Fortunately, overlapping socio-cultural accounts (e.g., Stice 2001; Thompson et al. 1999) have identified modifiable risk factors that serve as key foci for prevention and treatment.

Specifically, perceived appearance-based social pressure from parents, peers, and/or mass media has been found to predict later increases in body dissatisfaction and disordered eating (e.g., Gardner et al. 2000; McCabe and Ricciardelli 2005; McKnight Investigators 2003; Presnell et al. 2004; Stice 2001; Wertheim et al. 2001). Comprehensive reviews have also concluded weight and body dissatisfaction are among the most reliable risk factors for disordered eating (e.g., Jacobi et al. 2004; Stice 2002; Wertheim et al. 2009). Furthermore, elevations in negative affect might explain, in part, why some, not all, body dissatisfied people develop clinically significant disturbances (Stice 2001; Wade et al. 2012).

Notwithstanding associated empirical support, sociocultural models from which these risk factors were derived have not explicitly addressed developmental variations between samples and little is known about their relative effects within and across particular phases of adolescence. During early adolescence (ages 10–13), weight and adipose increases with the onset of puberty conflict with a thin feminine ideal and contribute to increases in perceived appearance pressure, body dissatisfaction, and negative affect for some girls (e.g., Thompson et al. 1999). However, body image and eating disturbances often peak later, during middle adolescence (ages 14 to 17), for girls (e.g., Bearman et al. 2006; Chen and Jackson 2008, 2012; Jones 2004; Presnell et al. 2004; Rosenblum and Lewis 1999; Smink et al. 2012; Wade et al. 2008). Hence, the potency of certain putative risk factors may

also increase from early to middle adolescence. For example, aside from continuing increases in body mass index (BMI), maturation of brain areas that process social information (Nelson et al. 2005), corresponds to increased self-consciousness, especially for girls (Rankin et al. 2004). As a result, appearance self-scrutiny, negative affect, and sensitivity to social feedback about appearance might increase (Striegel-Moore et al. 1993).

Studies of adolescent time use also suggest effects of appearance pressure from specific sources (parents, friends, media) vary depending on phase of adolescence. In Larson and Verma's (1999) cross-cultural review, early adolescence was characterized by dramatic declines in time spent with parents and increases in friend and peer contact. By middle adolescence, affiliation with mixed-sex groups typically increases for both sexes and facilitates progression to dyadic romantic relationships (e.g., Collins et al. 2009). This pattern intimates that actual and reported appearance pressure from parents becomes less salient from early to middle adolescence while effects of reported pressure from friends and dating partners increase. Conversely, because media consumption is ubiquitous throughout adolescence and movies, television, the internet and magazines are powerful purveyors of attractiveness ideals (Grabe et al. 2008; Thompson et al. 1999), the impact of pressure from mass media may extend across both phases (Larson and Verma 1999; Lloyd et al. 2008).

Another issue meriting attention is the paucity of longitudinal work on diverse adolescent populations. High rates and potentially lethal effects of eating disorders made research and intervention on young Western females a justifiable priority. However, less is known about the applicability of "established" risk factors to understanding disturbances among males who comprise 10–30 % of anorexia and bulimia sufferers (Hoek and van Hoeken 2003; Hudson et al. 2007; Rastam et al. 1989) and up to 40 % of binge eating disorder cases (Muisse et al. 2003). Overall severity is comparable between affected men and women yet psychiatric co-morbidity, suicide attempts, and social impairment are more typical of males (Bramon-Bosch et al. 2000; Jones and Morgan 2010). Men seeking treatment also face stigma and susceptibility to misdiagnosis from misconceptions that only females are affected (Striegel-Moore and Bulik 2007).

In general, BMI and muscle mass increases from puberty onset to late adolescence should result in reduced body dissatisfaction for males because body size more closely approximates mesomorphic ideals (e.g., Ricciardelli and McCabe 2003). However, dissatisfaction can persist or increase for overweight and underweight boys (e.g., Paxton et al. 2006; Presnell et al. 2004) and weight loss concerns detract from positive body image of adolescent boys more than muscularity concerns do (Jones et al. 2008). Like girls, boys spend more time with peers and romantic partners by middle adolescence but discuss physical attractiveness goals less (Jones 2004) and non-social goals more than girls do (Rose and Rudolph 2006). Hence,

appearance pressure from friendships might be less relevant to boys than girls. Relatively increased screen time, i.e., television, videogame, computer use (Olds et al. 2009) and time spent alone for adolescent boys (Larson and Verma 1999; Lloyd et al. 2008) imply mass media pressure and intrapersonal influences (negative affect, body dissatisfaction) are more salient to disordered eating among boys in the transition from early to middle adolescence while interpersonal transactions focused on physical appearance are somewhat more impactful for girls.

Empirically, early studies (e.g., Leon et al. 1995; Wichstrøm 2000) included adolescent and emerging adult males but were conducted before key sociocultural risk factors had been identified. Hence, indirect support for the applicability of established eating disorder risk factors among adolescent males stems from research on changes in body dissatisfaction and body change strategies, wherein prospective effects have emerged for measures of appearance pressure (e.g., McCabe and Ricciardelli 2005; Presnell et al. 2004; Ricciardelli and McCabe 2003) and negative affect (e.g., Bearman et al. 2006; Paxton et al. 2006; Presnell et al. 2004; Ricciardelli and McCabe 2003). In the only large-scale Western study to consider age group differences, Paxton et al. (2006) found initial BMI predicted subsequent body dissatisfaction in both early and middle adolescent boys. However, an interpersonal factor, peer appearance teasing, emerged as a predictor only for younger boys while an intra-personal factor, depression, was a predictor only for the older cohort.

Non-Western adolescents have also been neglected in longitudinal evaluations, despite increasingly documented eating disturbances (Smink et al. 2012; Lee et al. 2010). Following S. Lee and colleagues' pioneering work on disordered eating in Hong Kong (e.g., Lee and Lee 1996, 2000), researchers have found body image and eating disturbances are common among adolescents in rapidly developing China (Chen and Jackson 2008; Chen et al. 2006; Jackson and Chen 2010a; Xie et al. 2006). Fatness concerns, body dissatisfaction, negative affect, and appearance pressure from close peer relations and mass media have been implicated as eating disorder risk factors among Chinese adolescents (Jackson and Chen 2008a, b, 2011). However, while filial piety is emphasized in Asian contexts (Goodwin and Tang 1996) and family cohesion/conflict have links to eating concerns in Chinese samples (e.g., Lee and Lee 1996), researchers have yet to consider the impact of perceived appearance pressure from parents longitudinally or disentangle effects of reported pressure from friends versus desired/actual dating partners which could have differential effects on early and middle adolescents. Finally, even though large samples are recommended to ensure reasonable power when studying risk factors for onset or lower risk groups (Stice et al. 2012b), this standard has not been met very often in studies from Western or non-Western contexts.

In sum, little is known about effects of established eating disorder risk factors within particular phases of adolescence,

samples of adolescent boys, or adolescents in non-Western countries. Assessing their impact within understudied groups can elucidate the degree of generalizability of sociocultural model features across diverse groups and provide empirical underpinnings for tailoring prevention and interventions applicable to specific adolescent sub-populations. In this 2 years prospective study, we assessed the impact of baseline levels of appearance pressure, negative affect and body dissatisfaction and changes in these experiences over time on disordered eating among early and middle adolescents in China. We expected that perceived appearance pressure would contribute to prediction models across groups but reported pressure from parents and prospective dating partners would have stronger effects in early and middle adolescent groups, respectively. We also explored whether pressure from interpersonal sources would be more salient in prediction models of girls while perceived media pressure and intrapersonal distress (i.e., negative affect) would be more relevant to prediction models of boys.

## Method

### Participants

Participants were drawn from 47 classrooms of six large schools in Chongqing, China. From an eligible sample of 2,820 adolescents, 2,686 (95.24 %) completed the Time 1 (T1) assessment. The early adolescent sample was comprised of seventh and eighth grade students (687 boys, 787 girls) between 11 and 13 years old ( $M=12.66$  years,  $SD=0.49$  years). Most were of Han majority descent (96.3 %) or from eight of China's 56 ethnic minorities, notably Tu (1.6 %), Maio (1.3 %), and Man (0.3 %). At baseline 3.7 % reported a current dating relationship compared to 9.5 % at follow-up. Only 7.2 % had a BMI over 23 ( $M=18.65$   $SD=2.97$ ), the level at which obesity-related diseases rise sharply in Asia-Pacific samples (World Health Organization 2000). Of those who completed the baseline, 68.0 % (449 boys, 560 girls) also completed the 2 years follow-up.

The middle adolescent group (584 boys, 628 girls) was drawn from tenth grade classes, ranged from 14 to 16 years ( $M=15.57$   $SD=0.73$  years) and was chiefly Han (97.4 %) or from six minorities, notably the Tu (1.7 %). The percentage reporting a current dating relationship increased from 14.3 % at baseline to 20.5 % at follow-up. Twelve percent had a BMI over 23 ( $M=20.15$   $SD=2.64$ ). Finally, 65.2 % (356 boys, 434 girls) of the sample completed the follow-up.

For father's education, 27.2 % of the total sample reported less than high school completion, 40.7 % reported high school completion and 32.1 % reported post-secondary education. For mother's education, rates were 20.2 % for less than high school completion, 40.5 % for high school completion, and 39.3 % for higher education. Monthly household

income in Yuan (¥) was estimated to be less than ¥1,000 by 10.9 %, ¥1,000–2,999 by 41.5 %, ¥3,000–4,999 by 27.8 % and ¥5,000 or more [denoting an upper middle class SES] by 14.6 % (1 USD=about 6.2¥).

### Procedure

After receiving ethics approval from Southwest University, Chongqing, all contacted settings permitted the study. Before each assessment, informed consent was obtained from a parent or legal guardian of each eligible child under age 18. During each assessment, teachers gave research volunteers a survey packet including an overview of the study, an informed consent, the scales, and contact information for students distressed by body image or eating problems. Surveys were completed in class and returned to teachers separately from consents. Data collection occurred during March–April of 2009 and 2011, respectively. Scales had been translated previously into Chinese and back-translated into English by two Ph.D. candidates in English at SWU to ensure item meanings were as originally intended.

### Measures

*Eating Disorder Diagnosis Scale (EDDS; Stice et al. 2000)* This 22-item self-report screen is based on DSM-IV eating disorder criteria. A symptom composite, calculated by summing 18 standardized EDDS items, excluding height, weight, birth control pill use, and missed menstrual periods, is internally consistent, stable, and has excellent concordance with other self-report measures of disordered eating and diagnoses based on structured interviews (Stice et al. 2000). Principal components analyses (PCA) on Chinese adolescents of each sex indicate all items load on one a priori factor (Jackson and Chen 2008b). Validity support for the EDDS in Chinese samples has been found in adolescent samples from Chongqing (Jackson and Chen 2010a) and different regions of mainland China (Chen and Jackson 2008; Jackson and Chen 2007). Longitudinal studies of Chongqing adolescents (Jackson and Chen 2008a, b; 2011) found high EDDS composite scores are related to reports of heightened body image/eating concerns, negative affect, negative appearance evaluation fears, appearance comparisons and perceived appearance pressure. In this study, the composite had satisfactory alphas for early adolescent girls (T1  $\alpha=0.79$ , T2  $\alpha=0.85$ ) and boys (T1  $\alpha=0.78$ , T2  $\alpha=0.85$ ) and middle adolescent girls (T1  $\alpha=0.81$ , T2  $\alpha=0.82$ ) and boys (T1  $\alpha=0.78$ , T2  $\alpha=0.84$ ).

*Satisfaction and Dissatisfaction with Body Parts Scale (Stice 2001)* This nine-item scale queries personal dissatisfaction with body parts from 1 = *extremely satisfied* to 5 = *extremely dissatisfied*. Total scores were calculated by summing responses to each item. The scale has sound psychometrics

(e.g., Stice 2001) and univariate structures comprised of all items in Chinese samples (Jackson and Chen 2011). In this study, alphas were high for early adolescent girls (T1  $\alpha=0.89$ , T2  $\alpha=0.92$ ), and boys (T1  $\alpha=0.90$ , T2  $\alpha=0.95$ ), as well as middle adolescent girls (T1  $\alpha=0.86$ , T2  $\alpha=0.88$ ) and boys (T1  $\alpha=0.87$ , T2  $\alpha=0.92$ ).

**Negative Affect Scale (PANAS; Watson et al. 1988)** Students rated how often they had 20 affective experiences in the last month from 1 = *never or little of the time* to 4 = *most of the time*. Only Negative Affect (NA) was of interest and responses to 11 NA items were summed to garner total scores. The original PANAS factor structure was replicated in Chinese samples (Jackson and Chen 2008a) except “Alert” loaded with NA items, not Positive Affect. Alphas were good for early adolescent girls (T1  $\alpha=0.82$ , T2  $\alpha=0.84$ ) and boys (T1  $\alpha=0.83$ , T2  $\alpha=0.86$ ) and middle adolescent girls (T1  $\alpha=0.82$ , T2  $\alpha=0.81$ ) and boys (T1  $\alpha=0.82$ , T2  $\alpha=0.83$ ).

**Perceived Sociocultural Pressure Scale (PSPS; Stice and Agras 1998)** The PSPS has eight items that assess perceived pressure to be thin from one’s appearance from friends, family, dating partner, and mass media. Items have been modified slightly to reflect pressure to change physical appearance or have a “certain kind of physical appearance” (e.g., Jackson and Chen 2008a, b), in part, because disordered eating in Chinese samples does not always narrowly reflect appearance preoccupations with being thinner or fear of fatness (e.g., Lee 1995; Lee et al. 1991). In this study, “dating partner” items were also changed to include one’s “current dating partner or people I would like to date” to increase applicability to all respondents, including those not currently dating. Subscale items were rated between 0 = *None* and 4 = *A lot* and summed to provide subscale totals. Because the goal was to assess effects of pressure from each source separately rather than as a general composite, PCA with varimax rotation were performed in each T1 sample based on a pre-specified number of factors (i.e., four) reflecting the four sources of pressure described above. In each sample, interpretable solutions resulted based on Kaiser-Meyer-Olkin (KMO) values between 0.79 and 0.81 and significant Bartlett’s test values (all  $p$ ’s < 0.001). Variance explained by factor solutions ranged from 84.71 % to 87.60 % for middle adolescent boys and girls, respectively. Crucially, in each sample, media items loaded together on one factor as did item-pairs reflecting friend, parent and dating partner pressure.

Regarding validity, higher PSPS scores correlate with or increase risk for exacerbations in disordered eating (Chen et al. 2007; Jackson and Chen 2007, 2008a, c, d, 2011) and correspond to elevations on other appearance pressure scales, fear of negative appearance evaluation, fatness concerns, body dissatisfaction, negative affect and peer appearance comparisons within Chongqing adolescent samples (Chen and Jackson

2009; Jackson and Chen 2008a, b, b, 2011). Across assessments in this study, alphas were acceptable to excellent for early adolescent girls ( $\alpha=0.77$  to  $\alpha=0.90$ ) and boys ( $\alpha=0.76$  to  $\alpha=0.90$ ) as well as middle adolescent girls ( $\alpha=0.76$  to  $\alpha=0.92$ ) and boys ( $\alpha=0.70$  to  $\alpha=0.89$ ).

**Sociodemographic data** Age, sex, ethnicity, parental education, income, height, weight, and relationship status (not dating versus dating) were queried. Birth date and student number were solicited to permit matching of T1 and T2 surveys while ensuring participant anonymity.

## Design and Analysis

Analyses were performed with SPSS Version 20. Preliminary analyses included missing data assessment and imputation performed on the entire sample and multicollinearity evaluation on measures within each sample. Next, gender differences on research measures were assessed, followed by chi-square analyses and t-tests examining age group differences on demographics in each sex. Within each sex, 2 × 2 repeated measures analyses of covariance (ANCOVAs) assessed effects of Time and Age Group on disordered eating, appearance pressure, negative affect, and body dissatisfaction, controlling for demographic differences.

Main analyses were conducted separately for early and middle adolescent samples of each sex. First, partial correlation analyses were conducted between T2 EDDS scores and T1 demographics (i.e., age, ethnicity, relationship status, parents’ education levels, household income, BMI), hypothesized risk factors (T1), and associated concomitants (T2), controlling for T1 EDDS scores. This strategy generated estimates of association between T2 EDDS scores and each predictor independent of baseline eating disturbances or overlaps among predictors, similar to Jones (2004) approach. Subsequently, in each multivariate regression model T2 EDDS score was the criterion measure. In Block 1, T1 EDDS scores was a covariate with significant T1 demographic partial correlates of T2 EDDS scores ( $p < 0.05$ ). Measures of appearance pressure, negative affect and body dissatisfaction were entered to evaluate combined and unique effects of T1 putative risk factors (Block 2) and T2 concomitants (Block 3) respectively, on changes in eating pathology, independent of baseline EDDS levels and significant demographics.

## Results

### Preliminary Analyses

Boys who completed the follow-up were younger ( $n=798$ ;  $M=13.86$   $SD=1.53$ ) than boys who did not ( $n=473$ ;  $M=$

14.16  $SD=1.53$ ),  $F(1, 1,269)=12.01, p<0.001$ , but no other demographic differences were found between these groups. Controlling for age, no between groups differences emerged for BMI, T1 eating disturbances or psychosocial measures,  $F(8, 1,261)=1.58, p>0.125$ . Girls who completed the follow-up were also younger ( $n=1,001; M=13.73 SD=1.57$ ) than “non-completers” ( $n=414; M=14.56 SD=1.55$ ),  $F(1, 1412)=21.21, p<0.001$ , but groups did not differ on other demographics. Using age as a covariate, these groups did not differ on any interval-level measure,  $F(8, 1405)=0.65, p>0.73$ . Finally, proportionally more girls (70.7 %) than boys (62.8 %) completed the follow-up,  $\chi^2(1, N=2,686)=19.17, p<0.001$ .

Rates of missing data on T1 indices ranged from 0 % for age and sex to 5.3 % for income. After concluding follow-up data were not missing at random, missing values were imputed via the expectation-maximization (EM) method to control for biases from missing data because this approach provides less biased estimates than case-wise deletion (Schafer and Graham 2002). EM results were similar to those garnered from list-wise deletion of missing data. Multicollinearity was not evident in any sample as reflected by associated variance inflation factor values.

In gender comparison analyses, the only demographic difference was for BMI which was higher for boys ( $M=19.48 SD=3.10$ ) than girls ( $M=19.19 SD=2.75$ ),  $t(1,2684)=2.64, p<0.008$ . A multivariate analysis of covariance, controlling for BMI, revealed an overall gender effect on the main research scales,  $F(14,2670)=45.78, p<0.001$ . Girls scored higher ( $p<0.03$ ) on all measures except T2 appearance pressure from parents ( $p>0.42$ ) and dating partners ( $p>0.86$ ).

Early and middle adolescent boys differed on relationship status [ $\chi^2(1, 1271)=39.07, p<0.001$ ], education of father [ $\chi^2(2, 1271)=9.36, p<0.009$ ] and mother [ $\chi^2(2, 1271)=23.40, p<0.001$ ], household income [ $\chi^2(62, 1271)=84.26, p<0.03$ ], and BMI [ $t(1, 1269)=-5.65, p<0.001$ ] but not ethnicity [ $\chi^2(9, 1271)=9.36, p>0.40$ ]. Controlling for these covariates, repeated measures ANCOVAs found the overall sample reported more appearance pressure from parents, peers and mass media, and increases in body dissatisfaction over two years. Early adolescent boys reported more eating disturbances and appearance pressure from parents, friends and mass media while middle adolescent boys endorsed more body dissatisfaction (Table 1).

Early and middle adolescent girls differed on relationship status [ $\chi^2(1, 1415)=58.26, p<0.001$ ], education of father [ $\chi^2(2, 1415)=34.46, p<0.001$ ] and mother [ $\chi^2(2, 1415)=33.09, p<0.001$ ], as well as BMI [ $t(1, 1413)=-14.31, p<0.001$ ] but not ethnicity [ $\chi^2(7, 1415)=12.08, p>0.098$ ], or income [ $\chi^2(82, 1415)=93.10, p>0.189$ ]. Controlling for these covariates, the overall sample reported increases in eating disturbances, body dissatisfaction and appearance pressure from parents during the study. Furthermore, early and middle

adolescent groups reported more appearance pressure from parents and body dissatisfaction, respectively. Significant or marginally-significant Time x Age Group interactions indicated that early adolescent girls experienced substantial increases in eating disturbances, appearance pressure, and body dissatisfaction from T1 to T2 while middle adolescent girls reported corresponding decreases or less substantial increases over time (Table 2).

## Main Analyses

### Prediction Models for Samples of Adolescent Boys

BMI was the only significant T1 demographic partial correlate of T2 EDDS scores for early ( $r=0.13, p<0.001$ ) and middle ( $r=0.15, p<0.001$ ) adolescents. All hypothesized risk factors (T1) and concomitants (T2) were related to T2 EDDS scores, controlling for baseline EDDS scores. Partial correlation coefficients ranged between  $r=0.10, p<0.01$  and  $r=0.39, p<0.001$ .

For early adolescent boys, T1 risk factors (Block 2) combined for significant variance in T2 EDDS scores, beyond baseline EDDS and BMI levels (Block 1). Heightened appearance pressure from parents, negative affect and body dissatisfaction made unique contributions within Block 2. T2 concomitants (Block 3) added substantially to the model. Notably, however, in the initial regression run, T2 appearance pressure from dating partner had positive partial correlation ( $r=0.21, p<0.001$ ) and negative standardized beta ( $\beta=-0.06$ ) values with T2 EDDS scores, suggesting effects within the block were inflated artificially by suppressed error variance. After re-running the equation without this measure, combined and unique effects of Block 3 predictors were comparable except a previously-significant effect for appearance pressure from friends ( $p<0.032$ ) was marginally significant ( $p<0.065$ ) (Table 3). The overall model explained  $R^2=0.43$  [ $F(13, 673)=40.57, p<0.0001$ ] of the variance in disordered eating at follow-up.

In the middle adolescent sample, T1 measures (Block 2) explained significant variance in T2 EDDS scores, beyond T1 EDDS and BMI levels (Block 1). Within Block 2, perceived appearance pressure from desired/current dating partner, negative affect and body dissatisfaction made unique contributions. In Block 3, however, T2 reports of appearance pressure from dating partner once again had positive partial correlation ( $r=0.14, p<0.001$ ) and negative standardized beta ( $\beta=-0.12$ ) values. Excluding this measure from the model resulted in an attenuated effect for T2 negative affect ( $p<0.072$ ) compared to the original regression run ( $p<0.05$ ). Regardless, T2 concomitants combined for significant variance in the criterion with unique effects for body dissatisfaction and media pressure. Overall,  $R^2=0.48$  [ $F(13, 570)=38.31, p<0.0001$ ] in T2 EDDS scores was explained (Table 3).

**Table 1** Descriptive statistics and univariate statistics for research measures among adolescent boys ( $n=1,271$ )

Measure	Sample		Univariate F-values					
	Early Adolescent	Middle Adolescent	Time		Age Group		Time Age x Group	
	$M \pm SD$	$M \pm SD$	$F$	$\eta^2$	$F$	$\eta^2$	$F$	$\eta^2$
T1 EDDS Symptom Composite	-0.76±8.62	-2.85±7.08						
T2 EDDS Symptom Composite	-0.55±8.59	-3.21±6.69	1.47	0.00	62.16**	0.04	2.89†	0.00
T1 Appearance Pressure (Parents)	3.39±1.93	3.03±1.65						
T2 Appearance Pressure (Parents)	3.99±1.89	3.62±1.81	11.70**	0.01	27.41**	0.02	0.03	0.00
T1 Appearance Pressure (Friends)	3.72±1.93	3.59±1.64						
T2 Appearance Pressure (Friends)	4.12±1.99	3.86±1.78	6.21*	0.01	9.90*	0.01	0.43	0.00
T1 Appearance Pressure (Dating Partner)	4.10±2.36	4.07±2.09						
T2 Appearance Pressure (Dating Partner)	4.47±2.21	4.24±2.02	2.06	0.00	2.79	0.00	1.81	0.00
T1 Appearance Pressure (Media)	3.51±2.13	3.26±1.85						
T2 Appearance Pressure (Media)	4.03±2.17	3.85±2.00	7.52*	0.01	6.70*	0.01	0.30	0.00
T1 Negative Affect	22.51±5.50	22.13±4.96						
T2 Negative Affect	20.36±6.35	19.95±5.68	0.01	0.00	1.82	0.00	0.00	0.00
T1 Body Dissatisfaction	14.47±8.88	15.12±6.98						
T2 Body Dissatisfaction	15.46±8.38	15.14±6.35	47.27**	0.04	4.08*	0.00	3.33†	0.00

†  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.001$

#### Prediction Models for Samples of Adolescent Girls

No T1 demographics were related to T2 EDDS scores among early adolescent girls, independent of baseline EDDS scores (all  $p$ 's  $> 0.124$ ). However, among middle adolescent girls, age was a partial correlate of T2 EDDS levels ( $r = -0.10$ ,  $p < 0.001$ ).

Except for T1 reports of appearance pressure from parents ( $p < 0.076$ ), and body dissatisfaction ( $p < 0.051$ ) in the early adolescent group, all T1 and T2 psychosocial measures were related to T2 EDDS scores of girls, independent of baseline EDDS scores. Significant partial correlation coefficients ranged from  $r = 0.09$ ,  $p < 0.01$  to  $r = 0.34$ ,  $p < 0.001$ .

**Table 2** Descriptive statistics and univariate statistics for research measures among adolescent girls ( $n=1,415$ )

Measure	Sample		Univariate F-values					
	Early Adolescent	Middle Adolescent	Time		Age Group		Time x Age Group	
	$M \pm SD$	$M \pm SD$	$F$	$\eta^2$	$F$	$\eta^2$	$F$	$\eta^2$
T1 EDDS Symptom Composite	0.94±8.67	2.64±8.87						
T2 EDDS Symptom Composite	2.30±9.15	1.39±7.48	26.13**	0.02	2.45	0.00	12.51**	0.01
T1 Appearance Pressure (Parents)	3.37±1.75	3.47±1.75						
T2 Appearance Pressure (Parents)	3.84±1.86	3.64±1.72	6.09*	0.00	10.77**	0.01	3.15†	0.00
T1 Appearance Pressure (Friends)	3.85±1.84	4.29±1.76						
T2 Appearance Pressure (Friends)	4.12±1.81	4.16±1.82	2.90	0.00	1.03	0.00	5.32*	0.00
T1 Appearance Pressure (Dating Partner)	4.16±2.23	4.68±2.18						
T2 Appearance Pressure (Dating Partner)	4.35±2.09	4.37±2.00	1.13	0.00	0.73	0.00	12.22**	0.01
T1 Appearance Pressure (Media)	4.03±2.22	4.42±2.25						
T2 Appearance Pressure (Media)	4.33±2.14	4.22±2.04	1.73	0.00	0.00	0.00	6.09*	0.00
T1 Negative Affect	23.29±5.30	23.63±4.91						
T2 Negative Affect	21.29±5.92	21.19±5.42	1.33	0.00	0.40	0.00	1.84	0.00
T1 Body Dissatisfaction	17.80±7.47	21.80±6.68						
T2 Body Dissatisfaction	19.75±7.31	20.94±8.11	101.69**	0.06	5.04*	0.00	38.15**	0.03

†  $p < 0.10$ ; \*  $p < 0.05$ ; \*\*  $p < 0.001$

**Table 3** Predictors of changes in eating disorder symptoms over two years among adolescent Chinese boys

Block Predictor <sup>1</sup>	Sample					
	Early Adolescent (n=687)			Middle Adolescent (n=584)		
	$\beta$	<i>t</i>	<i>p</i>	$\beta$	<i>t</i>	<i>p</i>
1 T1 EDDS	0.48	14.03	<b>0.001</b>	0.56	16.39	<b>0.001</b>
Body Mass Index	0.12	3.44	<b>0.001</b>	0.13	3.66	<b>0.001</b>
	R <sup>2</sup> Change=0.273 <i>F</i> (2,683)=128.62, <i>p</i> <0.001			R <sup>2</sup> Change=0.358 <i>F</i> (2,581)=161.84, <i>p</i> <0.001		
2 T1 Appearance Pressure (Parents)	0.09	2.33	<b>0.02</b>	-0.02	-0.39	0.70
T1 Appearance Pressure (Friends)	0.00	0.02	0.99	0.01	0.28	0.78
T1 Appearance Pressure (Dating)	0.00	0.07	0.94	0.123	2.67	<b>0.008</b>
T1 Appearance Pressure (Media)	0.05	1.32	0.19	0.06	1.53	0.13
T1 Negative Affect	0.10	2.90	<b>0.004</b>	0.09	2.61	<b>0.009</b>
T1 Body Dissatisfaction	0.10	2.78	<b>0.006</b>	0.10	2.80	<b>0.005</b>
	R <sup>2</sup> Change=0.041 <i>F</i> Change (6,677)=6.68, <i>p</i> <0.001			R <sup>2</sup> Change=0.049 <i>F</i> Change (6,575)=7.89, <i>p</i> <0.001		
3 T2 Appearance Pressure (Parents)	0.01	0.23	0.82	0.02	0.44	0.66
T2 Appearance Pressure (Friends)	0.08	1.85	0.07	0.03	0.81	0.42
T2 Appearance Pressure (Dating)	–	–	–	–	–	–
T2 Appearance Pressure (Media)	0.13	3.33	<b>0.001</b>	0.13	2.79	<b>0.006</b>
T2 Negative Affect	0.11	3.48	<b>0.001</b>	0.06	1.80	0.07
T2 Body Dissatisfaction	0.30	8.23	<b>0.001</b>	0.22	5.45	<b>0.001</b>
	R <sup>2</sup> Change=0.126 <i>F</i> Change (5,672)=30.13, <i>p</i> <0.001			R <sup>2</sup> Change=0.060 <i>F</i> Change (5,570)=12.74, <i>p</i> <0.001		

Among early adolescent girls, after controlling for baseline EDDS levels (Block 1), T1 measures (Block 2) explained modest, significant variance in T2 EDDS scores. Table 4 indicates negative affect was the only significant T1 predictor but increases in body dissatisfaction, negative affect, and perceived appearance pressure from media and friends between T1 and T2 (Block 3) also corresponded to exacerbations in T2 EDDS scores. Overall, the predictors explained  $R^2=0.33$  [ $F$  (13, 773)=28.85,  $p<0.0001$ ] in the criterion.

In the multivariate model for middle adolescent girls, higher EDDS scores and younger age at T1 explained substantial variance. Responses on T1 risk factor measures (Block 2) combined for added variance with unique contributions from perceived appearance pressure from desired/current dating partners and body dissatisfaction. Finally, elevated T2 EDDS scores corresponded to increases in T2 psychosocial measures (Block 3), albeit body dissatisfaction was the sole predictor with a unique impact (Table 4). The final model explained  $R^2=0.54$  in T2 EDDS scores [ $F$  (14, 613)=51.24,  $p<0.0001$ ].

**Discussion**

Using research on adolescent social development and patterns of time use as bases for predictions, this study is the first to

examine how initial responses on measures of eating disorder risk factors and changes in responses over time contribute to subsequent eating disturbances for boys and girls during early and middle adolescence. In general, factors derived from established sociocultural models (e.g., Stice 2001; Thompson et al. 1999), were salient to understanding increased eating disturbances among adolescent boys and girls in China.

Multivariate models for each sample of boys indicated baseline elevations in BMI, negative affect and body dissatisfaction predicted exacerbations in eating disturbances at follow-up. The impact of BMI replicated longitudinal effects found for young Chinese males but not females (Jackson and Chen 2008b) and converges with evidence that, relative to women, overweight or obese men more typically develop eating disorders (e.g., Andersen and Holman 1997; Keel et al. 1998). Perhaps relatively low, albeit rising, base rates of overweight in Chinese adolescents compared to peers in Western countries (Cui et al. 2010) contribute to stigma felt among heavier boys and compensatory eating behaviors aimed to bring BMI in line with perceived norms. Effects of body dissatisfaction and negative affect align with contentions that disordered eating can arise from negative subjective evaluations of physical appearance and attempts to distract from or express negative emotions (Stice 2001). Considered with conclusions of meta-analyses (e.g., Jacobi et al. 2004; Stice 2002)

**Table 4** Predictors of changes in eating disorder symptoms over two years among adolescent Chinese girls

Block Predictor <sup>1</sup>	Sample					
	Early Adolescent ( <i>n</i> =787)			Middle Adolescent ( <i>n</i> =628)		
	$\beta$	<i>t</i>	<i>p</i>	$\beta$	<i>t</i>	<i>p</i>
1 T1 EDDS	0.48	15.12	<b>0.001</b>	0.66	22.00	<b>0.001</b>
Age	–	–	–	–0.08	–2.61	<b>0.01</b>
	R <sup>2</sup> Change=0.226 <i>F</i> (1,785)=228.62, <i>p</i> <0.001			R <sup>2</sup> Change=0.452 <i>F</i> (2,625)=257.82, <i>p</i> <0.001		
2 T1 Appearance Pressure (Parents)	–0.00	–0.09	0.93	0.01	0.31	0.76
T1 Appearance Pressure (Friends)	0.02	0.55	0.58	0.04	0.91	0.36
T1 Appearance Pressure (Dating)	0.04	1.06	0.29	0.09	2.07	<b>0.04</b>
T1 Appearance Pressure (Media)	0.04	1.05	0.30	–0.00	–0.03	0.98
T1 Negative Affect	0.08	2.36	<b>0.02</b>	0.03	0.99	0.32
T1 Body Dissatisfaction	0.06	1.71	0.09	0.09	2.63	<b>0.01</b>
	R <sup>2</sup> Change=0.018 <i>F</i> Change (6,779)=3.15, <i>p</i> <0.005			R <sup>2</sup> Change=0.025 <i>F</i> Change (6,619)=4.98, <i>p</i> <0.001		
3 T2 Appearance Pressure (Parents)	0.03	0.84	0.40	0.01	0.27	0.79
T2 Appearance Pressure (Friends)	0.09	1.95	<b>0.05</b>	0.05	1.31	0.59
T2 Appearance Pressure (Dating)	0.05	1.11	0.27	0.00	0.13	0.90
T2 Appearance Pressure (Media)	0.12	2.75	<b>0.006</b>	0.07	1.83	0.07
T2 Negative Affect	0.08	2.45	<b>0.01</b>	0.04	1.11	0.27
T2 Body Dissatisfaction	0.27	7.74	<b>0.001</b>	0.30	7.35	<b>0.001</b>
	R <sup>2</sup> Change=0.115 <i>F</i> Change (6,773)=23.02, <i>p</i> <0.001			R <sup>2</sup> Change=0.062 <i>F</i> Change (6,613)=13.73, <i>p</i> <0.001		

and longitudinal effects among young Western (e.g., Presnell et al. 2004) and Chinese males (e.g., Chen and Jackson 2009; Jackson and Chen 2008a, 2011), negative affect and body dissatisfaction might be robust influences that extend across gender and culture lines. Increases in these experience over two years also predicted corresponding increases in eating disorder symptoms, especially among younger boys. In part, such effects could mirror developmental shifts towards greater introspection or self-consciousness and progressively more time alone during this transition (Larson and Verma 1999).

Multivariate findings for boys supported the hypothesis that perceived appearance pressure from specific sources resonate more deeply, depending on phase of adolescence. Paralleling contentions that interactions with parents decrease while contact with peers and potential romantic partners increase from early to middle adolescence (e.g., Collins et al. 2009; Larson and Verma 1999; Smetana et al. 2006), appearance pressure reported from parents was a risk factor only for early adolescent boys while perceived pressure from desired or current dating partners was a risk factor only for middle adolescent boys. It is unclear why reported parental pressure was not relevant for younger girls too but recent prospective research has found quality of interactions with parents during early adolescence predicts growth in body image satisfaction for males but not females, well into young adulthood (Holsen et al. 2012). The

impact of perceived pressure from desired or current dating partners was also notable because actual dating had no relations to eating disturbances and relevant empirical work has focused almost exclusively on girls (Paxton et al. 2005), albeit Jones and Crawford (2006) speculated that increased focus on potential romantic relationships is one reason high school boys become more embedded in the peer appearance culture.

Initial reports of appearance pressure from friends and mass media did not factor into either multivariate model for boys, perhaps due to shared variance with other predictors. Regardless, changes in perceived media pressure accompanied changes in reported eating disorder in both groups. Media portrayals of the thin ideal have been implicated in eating disturbances of females (Grabe et al. 2008) yet over 10 % of average weight adolescent Chinese boys would prefer to lose weight (Xie et al. 2006) and those who report heightened media pressure to be thin/lose weight are susceptible to body dissatisfaction (Jackson and Chen 2010b) and later eating disturbances (Jackson and Chen 2011). Longitudinal results reflecting positive relations between perceived media pressure and disordered eating suggest effective media literacy programs (Wilksch and Wade 2009) warrant consideration in a Chinese context.

Consistent with other research in China (e.g., Chen and Jackson 2008; 2012) and the West (e.g., Jones 2004), girls



were more likely than boys to report eating disorder pathology, appearance pressure, negative affect, and body dissatisfaction. Eating disturbances, body dissatisfaction and perceived appearance pressure increased over two years for early adolescent girls transitioning into middle adolescence but remained relatively stable or decreased for middle adolescent girls transitioning to late adolescence. This pattern and the negative association between baseline age and T2 EDDS scores among middle adolescent girls aligns with reports that disordered eating peaks during middle adolescence among girls (e.g., Chen and Jackson 2008, 2012; Rosenblum and Lewis 1999; Smink et al. 2012; Wade et al. 2008).

For early adolescent girls, negative affect was the only T1 risk factor to predict outcome, suggesting that, for some, dieting, binge eating, and compensatory behaviors were possible means of distracting from emotional distress or outlets for emotional release (Stice 2002). While baseline body dissatisfaction and appearance pressure levels did not contribute to the multivariate model, predictive effects of exacerbations in negative affect, body dissatisfaction, perceived mass media pressure over time were nearly identical to those found for early adolescent boys. Conceivably, these changes could indicate immersion in “appearance training” about clothes, looks, and attractiveness from mass media and friends during the transition to middle adolescence (Jones 2004) increases susceptibility to later eating disturbances.

On average, middle adolescent girls reported less eating pathology between evaluations, though disturbances were more likely to persist or worsen for those who reported high initial levels of body dissatisfaction and appearance pressure from dating partners as well as increases in body dissatisfaction during the study. Because this group is more broadly embedded in an appearance culture that emphasizes feminine attractiveness ideals than younger girls are (e.g., Jones 2004), body dissatisfaction could have been more salient. Hence, those most discontented with their bodies may have pursued disordered eating, in part, to combat dissatisfaction.

The hypothesis that effects of perceived pressure from interpersonal sources would be more prominent for girls did not receive compelling support. However, the salience of reported pressure from desired or current dating partners for risk among middle adolescent girls *and* boys highlights the possible import of distinguishing effects of reported pressure from dating partners versus friends on eating disturbances in this age group. Reviewers have concluded involvement in at least one romantic relationship is common by middle adolescence (Carver et al. 2003) and interactions with romantic partners are not only more frequent than interactions with family and friends but also more intense and marked by expressions of affection and current or anticipated sexual behavior (Collins et al. 2009). In this study, only small minorities of adolescents reported current dating relationships and such involvements were not related to outcomes even though

perceptions of pressure from desired or real dating partners were. Related to less frequent dating in the sample, Chan et al. (2010) concluded Chinese are more likely than Westerners to believe dating is pursued to find a marital partner and involves more relational obligations and mutual respect than hedonic aspiration, although it is uncertain whether Chinese groups de-emphasize physical attractiveness in choosing potential partners for dating or marriage. However, dovetailing with contentions of Paxton et al. (2005) who concluded dating behavior per se is not related to body dissatisfaction or eating behavior, the present results imply negative appearance feedback from dating partners *or* beliefs that one must look a certain way physically to be a desirable relationship partner might influence middle adolescents’ risk over an extended interval.

Finally, baseline EDDS levels were the strongest predictor of follow-up EDDS levels in all groups, but especially, middle adolescent girls. Despite overall decreases in disordered eating and reported appearance pressure from peers and mass media over time for this group, those having initial elevations in eating pathology were less likely to report later abatements. Because an unremitting course has especially damaging health effects, treatment must be highly proactive when middle adolescent girls present. Ideally, preventive interventions could be introduced in the transition to middle adolescence. Unfortunately, effect sizes of established interventions are smaller for younger than older adolescents (e.g., Müller and Stice 2013) so refining approaches for use in younger adolescent samples is a key focus for future work.

Overall, the impact of each prediction model was comparable to or exceeded models generated in larger longitudinal studies of Chinese (Jackson and Chen 2011) and Western samples (e.g., Leon et al. 1995; Wichstrøm 2000). Hence, features of sociocultural models might offer useful intervention foci in a Chinese context. Effects of body dissatisfaction and negative affect across samples suggest body acceptance is a useful target for adolescents in both age groups. Significant or marginally-significant effects of changes in perceived media pressure point to the value of examining effects of media type (movies/television, magazines, videogames, social media) and media model identification (Bell and Dittmar 2011) on eating disturbances and the use of media literacy and dissonance strategies to inoculate against the pursuit of unrealistic media ideals and appearance pressure. Regarding specific adolescent subgroups, effects of BMI elevations on boys here and elsewhere (Jackson and Chen 2008b) suggest components targeting healthy diet and exercise (e.g., Bruning-Brown et al. 2004) can benefit overweight males. Attractiveness and physical appearance issues arising in potential romantic relationships might be pertinent foci for older adolescents based on effects of reported pressure from current or desired dating partners. Finally, adaptations of internet-based programs (e.g., Bruning-Brown et al. 2004; Stice et al. 2012a)

may be especially useful in China where training of and access to qualified practitioners are significant barriers to accessing treatment (Gao et al. 2010; Lee and Lee 2000).

Despite its implications, the main limitations of the study must be noted. First, results may not extend to children, older age groups, longer follow-up intervals, non-urban Chinese adolescents or non-Chinese adolescents. Extensions using similar designs may clarify the extent to which generalizations can be made to such groups. Second, while there was no evidence that adolescents who were “distressed” at baseline were less likely to complete the second assessment, fewer older students completed the follow-up, possibly due to having graduated or prioritizing preparation for university entrance examinations which become increasingly important as high school progresses in China. The completion rate also differed as a function of sex, perhaps because some boys found the survey to be less personally salient and were less motivated to complete the follow-up. Third, positively skewed distributions of EDDS composite scores, particularly in samples of boys, may have attenuated the impact of predictors within regression models. Fourth, causal inferences cannot be made about risk factors because random assignment to experimental manipulations was not possible in controlling for extraneous influences.

Finally, culture-specific influences were not assessed in the study. For example, elevations in appearance pressure from specific sources emerged as risk factors or concomitants of disordered eating within each adolescent subgroup, yet the *nature and content* of appearance- and non-appearance-based social pressure that increases risk requires elaboration within Chinese contexts. Even though concerns that China’s one child policy would result in maladjusted generations of children and adolescents have not been borne out in recent studies, Chinese adolescents often cope with unprecedented demands of being their family’s sole hope for a brighter future and face the heavy future burden of elder care in a rapidly aging population (Wang and Fong 2009). Because entry into a top university is deemed the only path to a secure future for many young people in modern China, pressure to excel academically is tremendous and the school day can stretch from 8 a.m. to 10 p.m. Complementary culture-specific research can elucidate unique family, social network and school culture experiences that influence risk for eating disorder pathology within Chinese adolescent subgroups. Furthermore, little is known about mass media content that protects against or increases risk for eating disturbances in a Chinese context, although Xie et al. (2006) reported exposure to media from other Asian countries rather than the West corresponds more strongly to weight concerns of Chinese adolescents. China has about 300 million internet users under 30 years of age who spend an average of 18.7 h per week online (China Internet Network Information 2012). The intensity of internet use among China’s youth is worrisome in itself, yet little is known

about direct or indirect effects of internet use or content on body image and eating concerns within this group. This is another fruitful focus for culture-specific research.

In sum, this study indicated baseline responses on certain eating disorder risk factors (i.e., body dissatisfaction, negative affect) and associated change scores (i.e., increases in body dissatisfaction, negative affect, perceived appearance pressure from mass media) predicted exacerbations in disordered eating over 2 years across large samples of Chinese adolescents. Conversely, other risk factors (i.e., perceived appearance pressure from parents and prospective dating partners) were salient only to particular phases of adolescence. Aside from a need for replications to test the stability of findings across samples, advances may be forthcoming with the elaboration of culture-specific factors that mediate eating disturbances of Chinese adolescents. Finally, because gender and developmental phase are key contextual factors within which adolescent lives are situated, researchers should not assume “one size fits all” when examining eating disorder risk factors within adolescent populations, whether adopting culture-specific or “non-specific” approaches to their work.

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