Family mealtimes and eating psychopathology: The role of anxiety and depression among adolescent girls and boys.

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Running head: Family mealtimes and psychopathology in adolescents

Abstract

Characteristics of family mealtimes are associated with disordered eating behaviours. However, little is known about the relationships between characteristics of family mealtimes and disordered eating attitudes, or how symptoms of anxiety or depression may contribute to these relationships. This study therefore aimed to examine differences between adolescent girls and boys in the relationship between family mealtime characteristics and eating psychopathology, and to explore the influence of anxiety and depression on this relationship. Adolescents (N = 535; 286 girls and 249 boys) aged 14 to 18 years completed self-report measures of family mealtime characteristics, eating psychopathology, anxiety and depression. Reports of more frequent family mealtimes, a more positive mealtime atmosphere and a high level of priority placed on mealtimes were all associated with significantly lower levels of eating-disordered attitudes among girls only. For boys, all four mealtime measures (higher mealtime frequency, more positive mealtime atmosphere, greater priority of mealtimes and higher levels of mealtime structure) were associated with lower levels of depression. Among girls, several of the family mealtime and eating psychopathology relationships were partially or fully mediated by either anxiety or depression. While these findings require longitudinal replication, family mealtimes are likely to be important in promoting psychological well-being among both girls and boys. Families should be encouraged to think beyond the frequency of mealtimes and to foster a positive mealtime environment which may help to promote adolescent psychological wellbeing, and might even protect young females against the development of eating psychopathology.

Key words: Family mealtime frequency; family mealtime priority; family mealtime atmosphere; family mealtime environment; anxiety; depression; eating disorders.

51 **Family mealtimes and eating psychopathology:**

52 **The role of anxiety and depression among adolescent girls and boys.**

53

54 Family mealtimes are important in promoting positive dietary behaviours among
55 adolescents (e.g., Neumark-Sztainer, Hannan, Story, Croll & Perry, 2003). For example, an
56 increased frequency of family mealtimes has been associated with healthier diets (e.g.,
57 Gilman et al., 2000), a reduced likelihood of overweight or obesity (e.g., Fulkerson, Kubik,
58 Story, Lytle, & Arcan, 2009), and the prevention of extreme weight control behaviours, such
59 as the use of laxatives, diet pills, diuretics or self-induced vomiting (Neumark-Sztainer, Wall,
60 Story & Fulkerson, 2004). Additionally, positive family mealtime environments (including
61 placing a high priority on family meals, positive mealtime atmosphere and greater mealtime
62 structure) are also considered to be protective against adolescents engaging in extreme
63 weight control behaviours (Neumark-Sztainer et al., 2004).

64

65 In addition to their relationship with eating behaviours, characteristics of family
66 mealtimes have also been linked with depression, with lower levels of depressive symptoms
67 related to more frequent family meals among both boys and girls (Eisenberg, Olson,
68 Neumark-Sztainer, Story, & Bearinger, 2004; Fulkerson, Story, Mellin, Leffert, Neumark-
69 Sztainer & French, 2006). Furthermore, depressive symptoms have been negatively related
70 to mealtime priority, but only among overweight boys (Fulkerson, Strauss, Neumark-
71 Sztainer, Story & Boutelle, 2007). Despite these associations between depression and family
72 mealtime characteristics (e.g., Eisenberg et al., 2004), and the established co-morbidities of
73 anxiety and depression (e.g., Brady & Kendall, 1992), little research has examined the
74 relationship between family mealtimes and anxiety.

75

76 It is common for mental health symptoms to co-occur among adolescents (e.g.,
77 Lewinsohn, Hops, Roberts, Seeley & Andrews, 1993). For example, there is a reported link

between disordered eating and high levels of anxiety and depression (Hou et al., 2013; McCabe & Vincent, 2003). However, despite the established relationships between disordered eating and family mealtime characteristics (Neumark-Sztainer et al., 2004), and between anxiety and depression (Hou et al., 203; McCabe & Vincent, 2003), little is known about the extent to which anxiety and depression may contribute to the relationship between family mealtimes characteristics and eating psychopathology.

Although family mealtimes have an important role in the prevention of disordered eating behaviours, this function may differ for boys and girls, with longitudinal evidence suggesting a protective role of family mealtimes among adolescent girls but not boys (Neumark-Sztainer, Wall, Haines, Story, Sherwood & van den Berg, 2007; Neumark-Sztainer, Eisenberg, Fulkerson, Story & Larson, 2008). Specifically, it has been suggested that mealtime experiences may differ for girls and boys, with girls being influenced more by family relationships which may enable them to benefit more from the shared meal experience (Neumark-Sztainer et al., 2008). Furthermore, it is well reported that adolescent girls and boys differ in their levels of eating psychopathology (e.g., Goodwin, Haycraft, Willis & Meyer, 2011), depression (e.g., Ferreiro, Seoane & Senra, 2011; Hankin, Abramson, Moffirr, Silva, McGee & Angell, 1998) and anxiety (e.g., Leikanger & Larsson, 2012), with girls typically reporting greater levels of psychopathology than boys.

In summary, family mealtimes are important for the development of positive dietary behaviours and in protecting against disordered eating behaviours. However, gender differences and links with anxiety and depression have also been highlighted. To date, current research has focused on the relationships between family mealtime characteristics and disordered eating behaviours alone, using specific questions to assess unhealthy weight control behaviours (extreme and less extreme), binge eating with loss of control and chronic dieting (Neumark-Sztainer et al., 2004). No research has used a well-validated measure of eating psychopathology in order to fully examine the relationship between family mealtimes

and disordered eating attitudes and behaviours. This would be beneficial to enable comparisons between samples of adolescents regarding the levels of eating psychopathology reported. Furthermore, no research has examined the mediating effects of anxiety and depression on the relationship between family mealtimes and disordered eating attitudes. Therefore, the aims of this study are two-fold. First, to replicate and extend previous research examining gender differences in the relationships between family mealtime characteristics (frequency, atmosphere, structure and priority) and disordered eating behaviour and attitudes within a sample of adolescents. Following on from the work of Neumark-Sztainer and colleagues (2004), it is hypothesised that more *frequent* family mealtimes, a more *positive* mealtime atmosphere, a higher *priority* placed on mealtimes and a higher level of *structure* at mealtimes will be associated with significantly lower levels of disordered eating attitudes and behaviours. The second aim is to extend previous findings by examining the mediating role of anxiety and depression in the relationship between family mealtime characteristics and disordered eating attitudes. Bringing together the findings of Neumark-Sztainer and colleagues (2004), Eisenberg and colleagues (2004), Hou and colleagues (2013) and McCabe and Vincent (2003), it is hypothesised that the relationship between family mealtime characteristics and disordered eating attitudes will be mediated by anxiety and depression levels.

Method

Participants

A sample of 535 participants (286 girls, 249 boys) with a mean age of 15.9 years (range = 14.5 to 18.7 years; *SD* = 1.11) was recruited through state (non-private) schools and colleges from three counties in England. Participants (*n* = 38) who indicated that they had either previously sought, or were currently seeking, professional help or treatment for their eating behaviour (*n* = 24) (or did not answer a screening question related to this; *n* = 14) were retained in the final sample in order to obtain a range of eating psychopathology

representative of a school-based or community sample (Fairburn & Beglin, 1994). BMI scores were able to be calculated for 67.9% of the sample using self-reported height and weight data. These values were converted to BMI Z scores to account for age and gender (Child Growth Foundation, 1996), producing a mean value of .07 (range = -6.68 to 4.17; *SD* = 1.24). The sample was 74% white British, however ethnicity data were missing for 14% of the sample. English was the first language for 92% of the sample, with missing data for 2%.

Measures and procedure

After obtaining institutional review board ethical approval, parental consent was sought for all participants under the age of 18 years either via opt-out letters sent home to parents, or via the school providing consent on behalf of the parents. In addition, all participants provided informed consent or assent and were invited to complete a questionnaire, either online via a survey website, or on paper. The questionnaire pack consisted of three measures presented in the following order:

Project-EAT Family Mealtime Questions

Participants were asked to complete questions from the Project EAT-I (Eating Among Teens) survey (Neumark-Sztainer, Story, Ackard, Moe & Perry, 2000; Neumark-Sztainer et al., 2004). This measure comprises four sub-components: family meal frequency (1 item), priority of family meals (5 items), atmosphere of family meals (4 items), and structure/rules of family meals (5 items). Frequency of family mealtimes was assessed based on the response to the question: *"During the past seven days, how many times did all, or most, of your family living in your house eat a meal together?"* Response options were never, 1-2 times, 3-4 times, 5-6 times, 7 times, or more than 7 times. Mean scores were calculated using the midpoints of the response category selected (e.g., 1.5, 3.5, 5.5, 7.0, 10.0), as described by Neumark-Sztainer and colleagues (2000). Responses to priority of family meals, atmosphere of family meals and structure/rules of family meals were rated on a four-point scale from strongly disagree (1) to strongly agree (4). Scores were calculated based on the mean of the

total subscale score, with a higher score representing a higher level of priority placed on mealtimes, a more positive mealtime atmosphere or more structure/rules placed on mealtimes. Reliability in the current sample was acceptable for priority of family meals (Cronbach's alpha = .78) and structure/rules of family meals (Cronbach's alpha = .70), and good for atmosphere of family meals (Cronbach's alpha = .84).

Hospital and Anxiety Depression Scale (HADS; Zigmond & Snaith, 1983)

The HADS is a 14-item self-report measure of anxiety and depression. The items are split equally between two subscales (anxiety and depression) with higher scores indicative of increased psychopathology. The HADS has been validated as a useful screening tool for adolescents in the community and in clinical settings (e.g., White, Leach, Sims, Atkinson & Cottrell, 1999). Reliability in the current sample was good for anxiety (Cronbach's alpha = .82) and acceptable for depression (Cronbach's alpha = .70).

Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994; 2008)

The EDE-Q (version 6.0) is a 28-item self-report version of the Eating Disorder Examination (EDE) which was developed by Cooper and Fairbairn (1987) to measure eating psychopathology. Recent research has proposed an alternative three subscale structure for the attitudinal questions of the EDE-Q for use in research with community samples of adolescents (White, Haycraft, Goodwin & Meyer, in press). The three subscales reported by White and colleagues (in press) are: Shape and Weight Concerns (10 items), Restriction (5 items) and Preoccupation and Eating Concern (7 items). Items are rated on a seven point Likert scale (0-6), with a global score calculated as a mean of the three subscales. Higher scores indicate greater levels of disturbance in eating attitudes. Frequencies of key eating-disordered behaviours were also measured via the EDE-Q: dietary restraint; objective binge episodes; self-induced vomiting; laxative misuse; and excessive exercise. Reliability in the current sample was high for Shape and Weight Concerns (Cronbach's alpha = .96) and

188 good for Restriction (Cronbach's alpha = .88), Preoccupation and Eating Concern
189 (Cronbach's alpha = .87) and the global score (Cronbach's alpha = .89).
190
191 *Data analysis*
192 The Shapiro-Wilk statistic indicated that all variables were non-normally distributed.
193 Preliminary non-parametric tests of difference (Mann-Whitney U tests) conducted on Project-
194 EAT Mealtime, HADS and EDE-Q scores identified some significant gender differences (see
195 Table 1). As a result, subsequent analyses were conducted separately for girls and boys.
196 Spearman's rho one-tailed correlations were used to examine the relationships of Project-
197 EAT Mealtime scores (Frequency, Priority, Atmosphere and Structure) with EDE-Q and
198 HADS scores. A significance level of $p < .01$ was adopted given the high number of
199 correlations conducted, to reduce the risk of type 1 errors.
200
201 To test the study's second hypothesis, mediation analyses were conducted to
202 examine if significant relationships between Project-EAT Mealtime scores and EDE-Q global
203 score were mediated by HADS Anxiety or Depression scores. The global EDE-Q score was
204 used as the dependent variable for all mediation analyses, which were conducted in
205 accordance with Baron and Kenny (1986). The following associations were examined for
206 significance: the independent variable (IV) predicting the dependent variable (DV); the IV
207 predicting the mediator; and the mediator predicting the DV (when controlling for the IV).
208 According to Baron and Kenny, if all these associations are significant, then the relationship
209 between the IV and the DV (when controlling for the mediator) is subsequently examined. If
210 the effect of the IV on the DV is less when controlling for the mediator, mediation has
211 occurred. Full mediation occurs when the relationship between the IV and DV is no longer
212 significant when controlling for the mediator (Baron & Kenny, 1986; Haycraft & Blissett,
213 2010; Holmbeck, 2002). Sobel tests were conducted to assess the significance of partial
214 mediations (Sobel, 1982). All regressions were one tailed and a significance level of $p < .05$
215 was adopted for the mediational analyses in view of the smaller number of analyses being

run and the lower chance of type I errors occurring. Missing data were excluded from all analyses.

Results

Descriptive statistics for Project-EAT Mealtime, EDE-Q and HADS scores and results of the Mann-Whitney U tests of difference for girls and boys are shown in Table 1.

INSERT TABLE 1 ABOUT HERE

All EDE-Q attitudinal scores were significantly higher among the girls than the boys. In addition, girls' mean HADS Anxiety scores were significantly higher than boys' scores. Both HADS Anxiety and Depression scores for girls and boys were comparable to previous research with adolescents (White et al., 1999).

Associations of mealtime characteristics with eating pathology, anxiety and depression

A series of one-tailed Spearman's rho correlations were conducted for girls (Table 2) and boys (Table 3) to examine associations between all Project-EAT Mealtime, EDE-Q and HADS scores.

INSERT TABLE 2 ABOUT HERE

Girls

In relation to EDE-Q attitudes, significant negative associations were found between Project-EAT Mealtime, Priority and Atmosphere and both EDE-Q Shape and Weight Concerns and EDE-Q global subscales. Significant negative associations were also found between Project-EAT Mealtime Frequency and Priority and EDE-Q Restriction scores. Furthermore, significant negative associations were also found between Project-EAT Mealtime Priority and Atmosphere and EDE-Q Preoccupation and Eating Concern scores.

With regard to EDE-Q behaviours, significant negative relationships were found between Project-EAT Mealtime Frequency, Priority and Atmosphere and EDE-Q Dietary Restraint. Additionally, significant negative relationships were found between Project-EAT Mealtime Atmosphere and EDE-Q Self-induced Vomiting, and between Project-EAT Mealtime Priority and EDE-Q Excessive Exercise.

Also, among girls, significant negative associations were found between Project-EAT Mealtime Priority and HADS Anxiety scores, and between Project-EAT Mealtime Frequency and HADS Depression scores. In addition, significant negative associations were found between Project-EAT Mealtime Atmosphere and both HADS Anxiety and Depression scores. No other relationships were found to be significant.

INSERT TABLE 3 ABOUT HERE

Boys

In relation to EDE-Q attitudes, no significant relationships were found between any of the Project-EAT Mealtime subscales (Frequency, Priority, Atmosphere or Structure) and any EDE-Q subscale or global scores. With regard to EDE-Q behaviours, significant negative associations were found between Project-EAT Mealtime Priority and EDE-Q Laxative Misuse, and between Project-EAT Mealtime Priority and EDE-Q Excessive Exercise.

Also among boys, a significant negative association was found between Project-EAT Mealtime Priority and HADS Anxiety scores. In addition, there were significant negative associations between all Project-EAT Mealtime subscales and HADS Depression scores. No other relationships were found to be significant.

In order to confirm associations between eating psychopathology, anxiety and depression, a further series of one-tailed Spearman's correlations was conducted.

Significant, positive associations were found between EDE-Q scores (both at global and subscale level) and HADS Anxiety and Depression scores for girls ($r > 0.26$, $p \leq .001$ in all cases). For boys, no significant relationships were found between EDE-Q Shape and Weight Concerns, Restriction or global scores and HADS Depression scores ($r < 0.14$, $p > .01$). However, a significant, positive relationship was found between EDE-Q Preoccupation and Eating Concern scores and HADS Depression scores ($r = 0.22$, $p = .001$). Similarly, significant, positive relationships were found between all EDE-Q scores and HADS Anxiety scores ($r > 0.32$, $p < 001$).

The mediating roles of anxiety and depression in the relationship between Project-EAT scores and EDE-Q global scores

Mediation analyses were only conducted where there were significant correlations between: 1) a Project-EAT Mealtime score and EDE-Q global scores; 2) a Project-EAT Mealtime score and either HADS Anxiety or Depression scores; and 3) HADS Anxiety or Depression scores and EDE-Q global scores. In view of the absence of significant relationships between the IV (Project-EAT Mealtime) and DV (EDE-Q global) for boys, mediational analyses were only conducted for girls.

Mealtime frequency and eating psychopathology among girls

Project-EAT Mealtime Frequency negatively predicted EDE-Q global score ($\beta = -.17$, $R^2 = .03$, $p = .004$). In addition, Project-EAT Mealtime Frequency negatively predicted HADS Depression scores ($\beta = -.15$, $R^2 = .02$, $p = .007$). In the final regression analysis, the relationship between the HADS Depression and the EDE-Q global was examined when controlling for the Project-EAT Mealtime Frequency. HADS Depression positively predicted EDE-Q global score ($\beta = .26$, $p < .001$). The final step was to examine the relationship between Project-EAT Mealtime Frequency and EDE-Q global score when controlling for HADS Depression. The relationship between Project-EAT Mealtime Frequency and EDE-Q global score was still significant ($p = .013$), although the effect was lower, suggesting a

partial mediation. A Sobel test performed on this relationship found this partial mediation to be significant (Z = -2.12, p = .034).

Mealtime priority and eating psychopathology among girls

Project-EAT Mealtime Priority negatively predicted EDE-Q global score (β = -.24, R^2 = .06, p < .001). Likewise, Project-EAT Mealtime Priority negatively predicted HADS Anxiety levels (β = -.19, R^2 = .04, p = .001). The final regression analysis found that when controlling for Project-EAT Mealtime Priority, HADS Anxiety positively predicted EDE-Q global score (β = .39, p<.001). However, when controlling for HADS Anxiety the relationship between Project-EAT Mealtime Priority and EDE-Q global score was still significant (β = -.17, p = .002), but with a lower effect than in the second regression, suggesting a partial mediation. The significance of this partial mediation was confirmed via a Sobel test (Z = -2.80, p = .005).

Mealtime atmosphere, anxiety and eating psychopathology among girls

Project-EAT Mealtime Atmosphere negatively predicted EDE-Q global score (β = -.21, R^2 = .04, p = .001). In addition, Project-EAT Mealtime Atmosphere negatively predicted levels of HADS Anxiety (β = -.31, R^2 = .10, p < .001). A further regression analysis found HADS Anxiety positively predicted EDE-Q global score when controlling for Project-EAT Mealtime Atmosphere (β = .41, p < .001). However, when controlling for HADS Anxiety the relationship between Project-EAT Mealtime Atmosphere and EDE-Q global score was no longer significant (β = -.09, p = .075), highlighting a full mediational pathway.

Mealtime atmosphere, depression and eating psychopathology among girls

Project-EAT Mealtime Atmosphere was shown to negatively predict EDE-Q global score (β = -.21, R^2 = .04, p = .001). In addition, Project-EAT Mealtime Atmosphere negatively predicted levels of HADS Depression (β = -.33, R^2 = .11, p < .001). Next, HADS Depression positively predicted EDE-Q global score when controlling for Project-EAT

Mealtime Atmosphere (β = .23, p < .001). At the final stage of the analysis, the relationship between Project-EAT Mealtime Atmosphere and EDE-Q global score remained significant when controlling for HADS Depression (β = -.11, p = .045), however again with a lower effect which suggested a partial mediation. A Sobel test found this partial mediation to be significant (Z = -2.94, p = .003).

In summary, the results of the mediational analyses conducted among girls indicate that the relationship between Project-EAT Mealtime Frequency and EDE-Q global score is partially mediated by HADS Depression. Similarly, the relationship between Project-EAT Mealtime Priority and EDE-Q global score is partially mediated by HADS Anxiety. Furthermore, the relationship between Project-EAT Mealtime Atmosphere and EDE-Q global score is partially mediated by HADS Anxiety. However, the relationship between Project-EAT Mealtime Atmosphere and EDE-Q global score is fully mediated by HADS Depression levels, as shown in Figure 1.

Discussion

The aims of this study were twofold. First, to replicate and extend previous research by Neumark-Sztainer and colleagues (2004) examining gender differences in the relationship between characteristics of family mealtimes (frequency, atmosphere, structure and priority) and disordered eating attitudes and behaviours in adolescents. Second, to examine the mediating effect of anxiety and depression on the relationship between mealtime characteristics and disordered eating attitudes. The findings of this study show a significant inverse relationship between characteristics of family mealtimes (frequency, priority and atmosphere) and disordered eating attitudes among girls. In addition, mediational analyses revealed that several of these relationships were mediated partially or fully by girls' anxiety and depression levels. These findings for girls, and the lack of significant associations for boys, provide partial support for the study's first and second hypotheses. However, despite the lack of significant relationships with disordered eating

356 attitudes among boys, significant negative relationships were found between all family
357 mealtime characteristics and levels of depression.
358
359 For girls, the significant relationships found in this study between aspects of family
360 mealtimes and disordered eating attitudes and behaviours provide partial support for
361 previous research examining the relationship between family mealtime characteristics and
362 unhealthy weight control behaviours (extreme and less extreme), binge eating with a loss of
363 control, and chronic dieting (Neumark-Sztainer et al, 2004). However, fewer significant
364 relationships were found between mealtime characteristics and disordered eating behaviours
365 in this study compared to the findings of Neumark-Sztainer and colleagues (2004), which
366 may be a reflection of the different measures used. For instance, the current study assessed
367 disordered eating behaviours occurring during the last 28-days whereas previous research
368 (Neumark-Sztainer et al., 2004) examined the occurrence of behaviours over a previous 12
369 month period, which may account for some of the differences, perhaps due to accuracy of
370 recall.
371
372 The findings from the current study and previous research (Fulkerson et al., 2007;
373 Neumark-Sztainer et al., 2004; Neumark-Sztainer et al., 2007; Neumark-Sztainer et al.,
374 2008) highlight associations between certain characteristics of family mealtimes and eating
375 psychopathology. However, the relationship between certain mealtime characteristics and
376 eating psychopathology may not be as direct as perhaps previously thought. The findings of
377 this study also suggest that for girls, anxiety and depression levels may play an important
378 role in the relationship. Specifically, the current findings highlight that family mealtime factors
379 may be more important in predicting eating psychopathology in girls who are also
380 experiencing low mood or symptoms of anxiety. The contribution of anxiety and depression
381 levels to the relationship between mealtime characteristics and disordered eating attitudes
382 reinforces the complexity of this relationship and the need to prioritise the promotion of
383 psychological well-being among girls.

For boys, family mealtimes were not found to be directly related to disordered eating attitudes, and hence similar to previous findings (e.g., Neumark-Sztainer et al., 2007; Neumark-Sztainer et al., 2008), family mealtimes may not have the same protective function for eating psychopathology for boys. However, the significant relationships between family mealtimes and depression again highlight the important role that family mealtimes may have for adolescents' psychological well-being, particularly boys. Furthermore, research has previously reported the emotional benefits of family mealtimes, with negative associations reported between family mealtime frequency and depressive symptoms among adolescent girls and boys (Eisenberg et al., 2004). Given that eating disorders are less prevalent in adolescent males (Kjelsås, Bjørnstrøm & Gunnar Götestam, 2004), these results suggest that family mealtimes might be more useful for buffering against boys developing low mood by providing a forum within which to interact and discuss issues (Ackard & Neumark-Sztainer, 2001).

It is plausible that family mealtimes provide a context in which adolescents learn healthy dietary behaviours through modelling of eating behaviour (Larson, Neumark-Sztainer, Hannan & Story, 2007; Palfreyman, Haycraft & Meyer, 2012). Additionally, family mealtimes may help to build family relationships and provide an arena within which to discuss any problems; both of which may subsequently help to promote psychological well-being. However, even when controlling for family connectedness, the frequency of family meals has been reported as a predictor of reduced disordered eating behaviours amongst adolescent females (Neumark-Sztainer et al., 2008). This suggests that there may be other features occurring during the family meal, possibly not related to the quality of family relationships, which may also help to promote adolescents' psychological well-being. Problem-focused coping has been highlighted as a mediator of the relationship between family meal frequency and stress, drive for thinness and bulimic symptoms among adolescent girls longitudinally (Franko, Thompson, Affenito, Barton & Striegel-Moore, 2008).

412 Therefore, one model might suggest that the strategies and skills developed during family
413 mealtimes might help to promote psychological well-being among adolescents, and which
414 might subsequently reduce eating psychopathology among girls.
415
416 This study is the first to replicate the research by Neumark-Sztainer and colleagues
417 (2004) and helps increase our understanding of the characteristics of family mealtimes within
418 a British sample. The sample size is good and was obtained from several counties within
419 England, which increases the generalisability of the findings. Furthermore, the inclusion of
420 individuals who reported seeking professional help or treatment for their eating behaviour in
421 addition to those who have not, creates a diverse sample in relation to eating
422 psychopathology (Fairburn & Beglin, 1994). Mediational analyses increase our
423 understanding about additional influencing factors within previously reported relationships,
424 such as mealtime atmosphere and disordered eating behaviour (Neumark-Sztainer et al.,
425 2004). This subsequently highlights potential protective pathways for further interventions to
426 target which may reduce eating psychopathology. However, while this study makes several
427 advances to the field it is limited by its cross-sectional design. In addition, mealtimes may be
428 experienced, and reported more negatively, by adolescents who report higher levels of
429 psychopathology (Fulkerson et al., 2007), especially characteristics such as mealtime
430 atmosphere which is a subjective emotional construct. The use of self-reported BMI data is a
431 limitation as this may result in inaccurate reporting and it is also noteworthy that BMI values
432 could not be calculated for around one third of the sample due to missing data. Given the
433 established links between BMI and eating psychopathology (e.g., Haycraft, Goodwin &
434 Meyer, 2013), future research would benefit from obtaining objective BMI measurements in
435 order that BMI can be accounted for in the analyses. Although the current sample was
436 geographically varied, the high proportion of white British participants limits the
437 generalizability of the findings. Significant racial differences have previously been reported in
438 relation to family mealtime frequency (Neumark-Sztainer et al., 2003) and hence further
439 research is needed to examine the relationships between mealtime characteristics with

eating psychopathology among a more ethnically diverse sample of adolescents. Furthermore, participants were all recruited from state (not private) schools within the UK but specific details of the socio-economic status (SES) of families was not assessed which could further affect generalizability, particularly as differences in family meal frequency have also been reported based on SES (Neumark-Sztainer et al., 2003).

Having identified the contributions of anxiety and depression to the relationship between mealtime characteristics and eating psychopathology for girls, it would be beneficial for future research to explore other environmental factors which might influence the atmosphere at family mealtimes, including interactions between family members. In addition, importance needs to be placed on understanding more about the role of family mealtimes for young males, for whom they may be linked with lower levels of depression. The findings of this study highlight the importance of encouraging families of adolescents to concentrate on the quality and positivity of eating environments, in addition to the quantity of family meals, which may help to promote adolescent psychological well-being, and a lower level of disordered eating among girls. Information regarding the importance of family meals should be disseminated via schools to help encourage more families to make the time to eat together as a family.

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568 *Table 1: Mean values (and standard deviations) for Project-EAT mealtime, EDE-Q, and*
569 *HADS scores for girls and boys, and Mann-Whitney U test of difference scores.*

	Girls	Boys	Mann-Whitney U-test (Z score)
Project EAT mealtime questions			
Frequency of family meals	5.17 (2.95)	5.02 (3.11)	0.53
Priority of family meals	2.75 (0.71)	2.80 (0.69)	0.71
Atmosphere at family meals	2.88 (0.70)	2.86 (0.72)	0.04
Structure/rules at family meals	2.53 (0.64)	2.58 (0.63)	1.02
EDE-Q			
Shape and Weight Concerns	2.82 (1.92)	0.87 (1.27)	11.71***
Restriction	1.92 (1.74)	0.63 (1.07)	9.79***
Preoccupation and Eating Concern	1.15 (1.29)	0.40 (0.85)	8.46***
Global	1.95 (1.51)	0.62 (0.92)	11.26***
HADS			
Anxiety	7.50 (4.28)	6.12 (4.11)	3.62***
Depression	4.10 (3.32)	4.26 (3.22)	0.91

570 ***$p \leq .001$

571 Project-EAT: Project Eating Among Teens, EDE-Q: Eating Disorder Examination
572 Questionnaire, HADS: Hospital Anxiety and Depression Scale.

573

574 *Table 2: One-tailed Spearman's rho correlations between Project-EAT family mealtime*
575 *characteristics with EDE-Q and HADS scores, for girls (n = 286).*

	Frequency	Priority	Atmosphere	Structure
EDE-Q – Attitudinal items				
Shape and Weight Concerns	-0.18***	-0.24***	-0.19***	-0.06
Restriction	-0.15**	-0.23***	-0.11	0.02
Preoccupation and Eating Concern	-0.10	-0.18**	-0.20***	0.04
Global	-0.18**	-0.24***	-0.20***	-0.01
EDE-Q – Behavioural items				
Dietary Restraint	-0.19***	-0.21***	-0.25***	-0.11
Objective Binge Eating Episodes	0.02	-0.08	-0.02	0.05
Self-induced Vomiting	-0.05	-0.11	-0.15**	-0.06
Laxative Misuse	0.02	-0.02	-0.09	0.00
Excessive Exercise	-0.14	-0.17**	-0.05	0.00
HADS				
Anxiety	-0.13	-0.19***	-0.31***	-0.02
Depression	-0.16**	-0.14	-0.33***	-0.07

576 $^{**}p \leq .01$, $^{***}p \leq .001$

577 EDE-Q: Eating Disorder Examination Questionnaire, HADS: Hospital Anxiety and
578 Depression Scale.

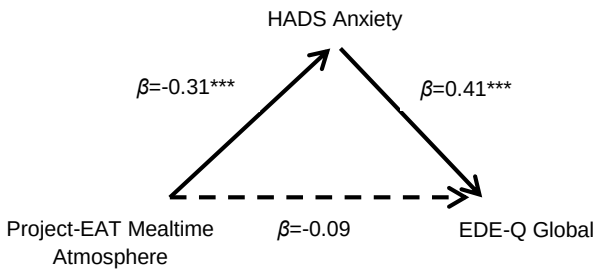
579

580 *Table 3: One-tailed Spearman's rho correlations between Project-EAT family mealtime*
581 *characteristics with EDE-Q and HADS scores, for boys (n* = 249*).*

	Frequency	Priority	Atmosphere	Structure
EDE-Q – Attitudinal items				
Shape and Weight Concerns	-0.04	-0.10	-0.05	0.05
Restriction	0.00	-0.01	0.04	0.06
Preoccupation and Eating Concern	-0.01	-0.11	-0.01	-0.02
Global	-0.05	-0.10	-0.04	0.04
EDE-Q – Behavioural items				
Dietary Restraint	-0.05	-0.06	-0.09	-0.03
Objective Binge Eating Episodes	-0.09	-0.15	-0.05	-0.01
Self-induced Vomiting	-0.03	-0.11	-0.02	-0.01
Laxative Misuse	-0.10	-0.18**	-0.06	0.02
Excessive Exercise	-0.06	-0.18**	-0.07	0.02
HADS				
Anxiety	-0.13	-0.26***	-0.15	-0.03
Depression	-0.33***	-0.30***	-0.36***	-0.17**

582 $^{**}p \leq .01$, $^{***}p \leq .001$

583 EDE-Q: Eating Disorder Examination Questionnaire, HADS: Hospital Anxiety and
584 Depression Scale.



*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

Figure 1: The full mediational pathway between Project-EAT Mealtime Atmosphere and EDE-Q global scores, for girls, when controlling for HADS Anxiety.