**Development of the Mealtime Emotions Measure for adolescents (MEM-A): Gender differences in emotional responses to family mealtimes and eating psychopathology**

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Running head:  *Mealtime Emotions Measure*

**Abstract**

This study aimed to examine the factor structure of the Mealtime Emotions Measure for adolescents (MEM-A), a novel measure of emotional responses experienced during family mealtimes. Additionally, it examined gender differences in mealtime emotions and also the relationships between mealtime emotions and levels of eating psychopathology, when controlling for anxiety or depression. Adolescent participants (N = 527; 282 girls, 245 boys) with a mean age of 15.9 years completed the new mealtime measure for adolescents (MEM-A), in addition to questions about family mealtime atmosphere, and measures assessing symptoms of anxiety, depression, and eating psychopathology. Factor analysis produced a three factor solution for the MEM-A with two subscales relating to different types of negative mealtime emotions (*Anxiety-related mealtime emotions* and *Anger-related mealtime emotions*) and one subscale relating to *Positive mealtime emotions*. Generally, girls reported experiencing more Anxiety-related mealtime emotions compared to boys. Having conducted separate analyses controlling for levels of either anxiety or depression, there were several significant associations for both girls and boys between mealtime emotions, particularly Anxiety-related emotions, and eating psychopathology. The findings suggest that some mealtime emotions are associated with increased eating psychopathology. Replication and detailed examination of these emotional responses is required.

**Development of the Mealtime Emotions Measure for adolescents (MEM-A): Gender differences in emotional responses to family mealtimes and eating psychopathology.**

There are numerous benefits to adolescents sharing mealtimes with their family. In particular, more frequent family mealtimes have been associated with healthier eating behaviours among adolescents (e.g., Gilman et al. 2000; Neumark-Sztainer, Hannan, Story, Croll & Perry et al., 2003; Neumark-Sztainer, Wall, Story & Fulkerson, 2004). In addition to *frequency* of family mealtimes, the *atmosphere* during the mealtime has also been shown to have cross-sectional associations with adolescent dietary behaviour. For instance, adolescents from families with a more positive emotional atmosphere at mealtimes reportedly eat meals together more frequently and have healthier diets (Berge, 2011). Furthermore, perceptions of more positive mealtime atmospheres have been associated with reduced levels of disordered eating behaviour among adolescents (Neumark-Sztainer et al., 2004; White, Haycraft & Meyer, 2014a). Despite the lack of longitudinal research, these existing studies highlight the potential importance of mealtime atmosphere in relation to healthier eating behaviours.

Family mealtimes should be a time for pleasure and enjoyment (Carson, 2006). However, while family mealtimes are often viewed positively by adolescents (e.g., Fulkerson, Neumark-Sztainer & Story, 2006), this is not the case for all teens. For example, some adolescents report arguments during mealtimes (Boutelle, Lytle, Murray, Birnbaum & Story, 2001; Neumark-Sztainer, Story, Ackard, Moe & Perry, 2000) and rate mealtimes as unpleasant or only occasionally pleasant (Burnier, Dubois & Girard, 2011). Furthermore, negative mealtime atmospheres are associated with eating behaviour. For instance, recalled levels of mealtime communication-based stress have been linked with anorexic attitudes among college age women (Worobey, 2002). Similarly, a greater number of negative recollections of mealtime experiences have been reported by women with bulimic disorders compared to controls (Miller, McCluskey-Fawcett & Irving, 1993). Hence, it is likely that a

variety of emotions are associated with family mealtimes, and that these emotions are associated with eating psychopathology.

Although research highlights the importance of the mealtime atmosphere in relation to eating behaviour (e.g., Neumark-Sztainer et al., 2004; White et al., 2014a), little is known about the reasons why adolescents may experience different emotional responses to family mealtimes. Fulkerson and colleagues suggested that the psychosocial health (e.g., levels of depressed mood, body satisfaction, self-esteem) of the adolescent may influence their perception of mealtimes, with more negative perceptions being found among those with poorer psychosocial health (Fulkerson, Strauss, Neumark-Sztainer, Story & Boutelle, 2007). This suggests that adolescents' emotional experiences at mealtimes may be related to their levels of psychological symptoms, such as anxiety and depression. Anxiety and depression have both been linked with levels of disordered eating in adolescents (e.g., Hou et al., 2013). Therefore, it is plausible that these symptoms may also contribute to the relationship between emotional aspects of mealtimes and eating psychopathology.

Differences in certain emotional responses to family mealtimes have also be seen between girls and boys. Although research to date has only examined responses to food stimuli, and not mealtimes, findings suggest that the experience of positive emotional responses (happiness) to food may differ for girls and boys, with boys reporting 'happier' responses to food images than girls (e.g., McNamara, Hay, Katsikitis & Chur-Hansen, 2008). However, research examining gender differences in negative emotional responses to food, such as disgust or fear, have been inconsistent (Davey, Buckland, Tantow & Dallos, 1998; McNamara et al., 2008). It may be the case that in naturally occurring mealtime situations, such as family mealtimes, emotional responses may differ for girls and boys. Indeed, gender differences are well-established among adolescents in terms of their levels of eating psychopathology (e.g., Goodwin, Haycraft, Willis & Meyer, 2011; Haycraft, Goodwin & Meyer, 2014; White et al., 2014a), anxiety (e.g., Leikanger & Larsson, 2012; White et al., 2014a) and depression (e.g., Ferreiro, Seoane & Senra, 2011), with higher levels typically observed among girls.

In summary, family mealtimes can be linked to both positive (e.g., Fulkerson et al., 2006) and negative (e.g., Boutelle et al., 2001; Burnier et al., 2011; Neumark-Sztainer et al., 2000) emotional experiences for teenagers. While there are established associations between more positive mealtime atmospheres and reduced disordered eating behaviours (e.g., Neumark-Sztainer et al., 2004; White et al., 2014a), little is known about those factors that might be associated with less positive mealtime experiences. One reason for the absence of such research to date is the lack of an appropriate measure. Although a measure exists to assess the atmosphere during family mealtimes (Neumark-Sztainer et al., 2004), this focuses primarily on the experience of mealtime communication and enjoyment, rather than on emotional tone. There is a need for a mealtime measure which explores a wider range of both positive and negative emotions specifically related to mealtimes. Once it has been established what type of emotions occur among adolescents at family mealtimes, interventions can be developed to assist in targeting these emotions with the aim of increasing positivity of mealtimes.

Therefore, the current study has four aims. First, to examine the factor structure of a new measure designed to assess emotional experiences during mealtimes. Second, to test the concurrent validity of the new measure by comparing the subscale and global scores with the scores for the existing measure of mealtime atmosphere (Neumark-Sztainer et al., 2004). Third, to extend previous research on emotional responses to food (Davey et al., 1998; McNamara et al., 2008) to a broader focus on family mealtimes, and consider gender differences in these emotional experiences. In keeping with the findings of McNamara and colleagues (2008), it is hypothesised that boys will report higher levels of positive mealtime emotions than girls, but that there will be no gender differences in levels of negative mealtime emotions. Finally, to extend the research examining associations between mealtime atmosphere and eating psychopathology (Neumark-Sztainer et al., 2004), the relationships between emotional experiences of mealtimes and eating psychopathology will be examined for each gender. Based on the findings of Hou and colleagues (2013) and White et al. (2014a), anxiety or depression will be controlled for (separately) when examining

associations between mealtime emotions and eating psychopathology. It is hypothesised that anxiety and depression will contribute to the relationship between emotional responses to mealtimes and eating psychopathology.

## Method

*Participants*

A sample of 535 adolescents was recruited from five schools and sixth-form colleges across three counties within the UK. Eight participants, who did not answer any questions related to mealtime emotions, were removed leaving a final sample of 527 adolescents (282 girls and 245 boys) with a mean age of 15.9 years (SD = 1.11; range = 14.5 to 18.7 years). To ensure a range of eating psychopathology representative of a community sample (Fairburn & Beglin, 1994), this final sample included 23 participants who identified that they were currently seeking, or had previously sought, professional help or treatment for their eating behaviour. Participants were asked to provide their weight and height to enable calculation of age and gender adjusted BMI Z scores (Child Growth Foundation, 1996); 67.9% of the sample (n = 358) provided this information. The mean BMI Z scores for girls was -0.15 (SD = 1.13, range = -3.99 to 3.11) and 0.24 (SD = 1.32, range = -6.68 to 4.17) for boys, indicating generally healthy weights. Ethnicity data were available for 85.8% of the sample and indicated that the sample was predominantly white British (74.4%). The majority of the sample reported their first language as English (92.4%), with missing data for 2.1%.

*Procedure*

Following institutional review board ethical approval, each participant provided informed consent before participation. Participants completed a questionnaire pack (either online or on paper) during school/college time. The questionnaire pack consisted of the following measures.

Mealtime Emotions Measure – Adolescents (MEM-A; Appendix 1)

The MEM-A is a self-report measure developed to assess adolescents' emotional responses to family mealtimes. The measure was developed based on existing mealtime literature from both the adolescent and clinical eating disorders field (Long, Wallis, Leung & Meyer, 2012; Long, Wallis, Leung, Arcelus & Meyer, 2012), and in collaboration with psychologists and psychiatrists working in the eating disorders and obesity fields. After development, the measure was piloted with a separate sample of adolescents and minor amendments were made to the wording to improve clarity before the MEM-A was administered as part of the current study. The measure is based around the anchor question *"How often do you feel the following during typical family mealtimes?"*. Participants rate how often 15 different emotional responses are experienced on a seven-point Likert scale from 'never' to 'always' with several items reverse scored. The 15 items include responses relating to both emotional and physical comfort. Higher scores relate to more emotional responses to family mealtimes. Following the factor analysis, 13 items were retained, pertaining to three subscales (further details are presented in the Results section). A copy of the final version of the MEM-A, and its scoring details, can be found in Appendix 1.

Project-EAT Atmosphere of family meals (Neumark-Sztainer et al., 2000; Neumark-Sztainer et al., 2004)

Four items assessed mealtime atmosphere. Two items related to enjoyment of mealtimes (e.g., "*I enjoy eating meals with my family"*) and two items tapped mealtime communication (e.g., "*In my family, mealtime is a time for talking with other family members"*). Items were rated on a four-point scale from strongly disagree to strongly agree. Mean scores were calculated with higher scores representing a more positive mealtime atmosphere. Reliability in the current sample was high (Cronbach's alpha = 0.84).

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

The 28-item EDE-Q (version 6.0) is a self-report measure of eating psychopathology. It consists of 22 items which assess eating disordered attitudes. It also contains six items

which assess eating disordered behaviours, but these were not used in this study. A recent factor analysis of 22 attitudinal items of the EDE-Q recommends an alternative three factor structure for use in research with adolescents (White, Haycraft, Goodwin & Meyer, 2014b). The three subscales are: Shape and Weight Concerns (e.g., *"On how many of the past 28 days have you had a desire to have a totally flat stomach?"*); Restriction (e.g., *"On how many of the past 28 days have you been deliberately trying to limit the amount of food you eat to influence your shape or weight?"*); and Preoccupation and Eating Concern (e.g., *"Over the past 28 days, how concerned have you been about other people seeing you eat?"*). Items are rated on a seven-point scale (0-6), with a global score calculated as a mean of the subscale scores. Higher levels of eating psychopathology are indicated by higher scores. Reliability in the current sample for the three new subscales and the global score was high; Shape and Weight Concerns (10 items; Cronbach's alpha = 0.96); Restriction (five items; Cronbach's alpha = 0.88); Preoccupation and Eating Concern (seven items; Cronbach's alpha = 0.87); and global score (Cronbach's alpha = 0.89).

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

The HADS is a brief 14 item self-report measure which consists of two seven-item subscales: Anxiety (e.g., *"Worrying thoughts go through my mind"*) and Depression (e.g., *"I still enjoy the things I used to enjoy"*). Each question is rated on a four point scale (0-3), with scores ranging from 0-21 for each subscale. Higher levels of psychopathology are indicated by higher scores. Reliability in the current sample was high for Anxiety (Cronbah's alpha = 0.82) and moderate for Depression (Cronbach's alpha = 0.70).

*Data analysis*

To examine the first aim of the study, which was to explore the factor structure of the MEM-A, an exploratory factor analysis (EFA) was conducted using principal axis factoring with a promax rotation to allow for inter-correlation among factors. Factor retention was based on the examination of the Scree plot, as suggested by Cattell (1966) and Eigenvalues

over 1.0, as suggested by Kaiser (1961). Items loading clearly onto one factor above the cut off of 0.3, as recommended by Kline (1994), were retained. As the Shapiro-Wilk test indicated that the data were not normally distributed, non-parametric tests were subsequently used. To assess the intercorrelation among factors, one-tailed Spearman's rho correlations were conducted.

Before any further analyses were conducted, multivariate outliers were detected for MEM-A, Project-EAT mealtime atmosphere, HADS, and EDE-Q scores through computing squared Mahalanobis distance ($D^2$) for each participant. Byrne (2010) suggested that the $D^2$ value of an outlier will be uniquely distant from other $D^2$ values. As a result of this analysis three participants (all boys) were excluded from the sample at this point.

To assess the concurrent validity of the MEM-A (aim 2), Spearman's rho correlations were conducted to examine associations between the scores on the MEM-A and Project-EAT mealtime atmosphere. Additionally, to determine gender differences in emotional responses to mealtimes (aim 3), Mann Whitney U tests were conducted on girls' and boys' scores on the MEM-A. Further Mann Whitney U tests were conducted to examine gender differences on girls' and boys' Project-EAT atmosphere, HADS and EDE-Q scores. The fourth aim was to examine the relationships between emotional responses to mealtimes and eating psychopathology when controlling for either anxiety or depression. Initially, Spearman's rho one-tailed correlations were conducted to determine the relationships between HADS and EDE-Q scores. Finally, partial correlations were conducted to examine the relationship between MEM-A and EDE-Q scores when controlling for either HADS anxiety or depression. Missing data were excluded from all analyses. This study adopted a significance level of $p \leq .01$ to reduce the risk of type 1 errors. Statistical analyses were performed using SPSS version 21.

## Results

*Factor structure of the MEM-A*

A four factor structure was produced by the initial EFA conducted on the 15 items of the MEM-A. However, within this structure, one factor consisted only of two items. Previously, it has been recommended that a minimum of three items is needed per factor (Hatcher, 1994), and hence these two items were removed from the analysis. As shown in Table 1, a second EFA was conducted with the remaining 13 items which produced a three factor structure. A three factor structure was also supported the scree plot analysis (Cattell, 1966).

INSERT TABLE 1 ABOUT HERE

Factor 1 included items concerning nervousness, embarrassment and anxiety related to family mealtimes, and so will be described as *MEM-A: Anxiety-related mealtime emotions.* This factor accounted for 36.9% of the variance. Three items relating to feelings of frustration, anger and stress during family mealtimes comprised Factor 2, subsequently described as *MEM-A: Anger-related mealtime emotions,* and accounted for 10.0% of the variance. Factor 3 included items related to positive emotions connected to family mealtimes (e.g., feeling happy and comfortable within the mealtime environment), and will subsequently be described as *Positive mealtime emotions.* This factor accounted for 6.18% of the variance. All three factors were found to significantly intercorrelate: Anxiety-related mealtime emotions and Anger-related mealtime emotions ($r = 0.63$, $p < .001$); Anger-related mealtime emotions and Positive mealtime emotions ($r = -0.33$, $p < .001$); and Anxiety-related mealtime emotions and Positive mealtime emotions ($r = -0.33$, $p < .001$).

*Scoring of the MEM-A*

The remaining 13 items constitute the complete measure (see Appendix 1). Subscale scores are calculated based on the mean of the items within each subscale (Anxiety-related mealtime emotions: items 1, 3, 5, 6, 7 and 8; Anger-related mealtime emotions; items 2, 10 and 11; and Positive mealtime emotions; 4, 9, 12 and 13). In order to calculate the global score, items from the Positive mealtime emotions subscale are required to be reverse scored. The global score is then calculated based on a mean of all 13 items. A higher global

score is indicative of a more negative emotional response to family mealtimes. Within this sample, reliability for the MEM-A global score was high (Cronbach's alpha = 0.86).

*Concurrent validity of the MEM-A*

No significant associations were found between MEM-A Anxiety-related mealtime emotions and Project-EAT mealtime atmosphere. However, significant negative associations were found between MEM-A Anger-related mealtime emotions and Project-Eat mealtime atmosphere ($r = -0.17$, $p <.001$), and MEM-A global and Project-EAT mealtime atmosphere ($r = -0.38$, $p < .001$). Furthermore, a significant positive association was found between MEM-A Positive mealtime emotions and Project-EAT mealtime atmosphere ($r = 0.50$, $p < .001$).

*Characteristics of the sample*

Mean scores for girls and boys, and Mann Whitney U test scores, are shown in Table 2.

INSERT TABLE 2 ABOUT HERE

The third aim of the study was to examine gender differences in emotional responses to mealtimes. No significant differences were found between girls' and boys' scores for MEM-A Anger, MEM-A Positive or MEM-A global. However, significant gender differences were found for MEM-A Anxiety. When examining gender differences among the remaining scores, no significant differences were found between girls' and boys' scores for Project-EAT Mealtime atmosphere or HADS depression. Significant gender differences were found for EDE-Q and HADS anxiety scores, with girls reporting higher scores than boys. Girls' and boys' HADS scores for both anxiety and depression were similar to previous research (White, Leach, Sims, Atkinson & Cottrell, 1999). As significant gender differences were

found for one MEM-A subscale and all EDE-Q scores, further analyses were conducted separately for girls and boys.

*Emotional responses to mealtimes and eating psychopathology*

The fourth aim of the study was to examine the relationships between emotional responses to mealtimes and eating psychopathology, when controlling for anxiety or depression for each gender. However, as a prerequisite, Spearman's rho one-tailed correlations were first conducted to examine associations between emotional responses to mealtimes (MEM-A), eating psychopathology (EDE-Q), anxiety and depression (HADS) scores for both girls and boys, as shown in Table 3.

INSERT TABLE 3 ABOUT HERE

*Girls*

For girls, there were four significant findings. First, significant positive associations were found between MEM-A Anxiety, MEM-A Anger, MEM-A global scores and all EDE-Q scores. Second, significant negative associations were found between MEM-A Positive and all EDE-Q scores. Third, significant positive associations were found between MEM-A Anxiety, MEM-A Anger, MEM-A global scores and HADS Anxiety and Depression. Finally, significant negative associations were also found between MEM-A Positive and HADS Anxiety and Depression.

*Boys*

In contrast to girls, among boys there were no significant associations between MEM-A Positive and any EDE-Q scores. Similarly, no significant associations were found between MEM-A Anger, MEM-A global score and EDE-Q restriction subscale. There were four significant findings. First, significant positive associations were found between Anxiety-related mealtime emotions and all EDE-Q scores. Second, significant positive associations were also found for MEM-A Anger and MEM-A global scores with EDE-Q Shape and Weight

Concern, Preoccupation and Eating Concern and EDE-Q global scores. Third, significant positive associations were found between MEM-A Anxiety, MEM-A Anger, MEM-A global scores and HADS Anxiety and Depression scores. Finally, significant negative associations were found between MEM-A Positive and HADS Anxiety and Depression scores.

Several significant associations were found between emotional responses to mealtimes, eating psychopathology and anxiety and/or depression. Therefore, one-tailed partial correlations were subsequently conducted to examine the relationships between emotional responses to mealtimes and eating psychopathology when controlling for either anxiety or depression.

*Partial correlations: Anxiety*

The results of the partial correlations examining the associations between MEM-A and EDE-Q scores, when controlling for HADS anxiety for both girls and boys are shown in Table 4.

INSERT TABLE 4 ABOUT HERE

*Girls*

As shown in Table 4, no significant associations remained between MEM-A Anger and all EDE-Q scores when controlling for HADS Anxiety. Similarly, no significant associations remained between MEM-A Positive and EDE-Q Shape and Weight Concerns or Restriction subscales. However, significant positive associations did remain between MEM-A Anxiety, MEM-A global scores and all EDE-Q scores. Furthermore, significant negative associations remained between MEM-A Positive and EDE-Q Preoccupation and Eating Concern and global scores.

*Boys*

For boys, when controlling for HADS Anxiety, no significant associations remained between MEM-A Anger, MEM-A Positive or MEM-A global scores and any EDE-Q scores

(see Table 4). Furthermore, no significant associations remained between MEM-A Anxiety and EDE-Q Shape and Weight Concerns or global scores. However, significant positive associations did remain between MEM-A Anxiety and EDE-Q Restriction and Preoccupation and Eating Concern subscales.

*Partial correlations: Depression*

The results of the partial correlations examining the associations between MEM-A and EDE-Q scores, when controlling for HADS depression for both girls and boys are shown in Table 5.

INSERT TABLE 5 ABOUT HERE

*Girls*

Significant positive associations remained between MEM-A Anxiety, MEM-A Anger, MEM-A global scores and all EDE-Q scores when controlling for HADS Depression. Furthermore, significant negative associations remained between MEM-A Positive and all EDE-Q scores.

*Boys*

When controlling for HADS Depression, no significant associations remained between MEM-A Positive and any EDE-Q scores (Table 5). Furthermore, no significant associations remained between MEM-A Anger and EDE-Q Preoccupation and Eating Concern subscale scores. However, significant positive associations did remain between MEM-A Anxiety, MEM-A global scores and all EDE-Q scores. Similarly, significant associations also remained between MEM-A Anger and EDE-Q Shape and Weight Concern, Restriction and global scores.

**Discussion**

This study had four aims. First, to examine the structural validity of a new measure designed to assess emotional responses to family mealtimes, the Mealtime Emotions

Measure for adolescents (MEM-A). Second, to test the concurrent validity of the new measure. Third, to examine gender differences in emotional responses to family mealtimes. Finally, to examine the relationships between emotional responses to family mealtimes and eating psychopathology when controlling for anxiety or depression for both girls and boys. The findings of the factor analysis resulted in a three factor model of the MEM-A, producing a measure that assesses a range of emotional responses to family mealtimes. The model includes two subscales assessing negative emotional responses. The first related broadly to internalising emotions (Anxiety-related mealtime emotions), while the second reflected more externalising emotions (Anger-related mealtime emotions).  A further subscale assessed positive emotional responses to mealtimes and physical comfort (Positive mealtime emotions), in addition to a global score. Concurrent validity of the MEM-A when examined against the mealtime atmosphere subscale from the Project-EAT survey (Neumark-Sztainer et al., 2000; 2004) was highest for the positive mealtime emotions subscale.

There were significant gender differences in levels of anxiety-related emotions experienced at family meals (e.g., embarrassment, nervousness, distress), with higher levels reported by girls. However, no gender differences were found for the levels of anger-related, or positive mealtime emotions experienced, which did not support the study's hypothesis. When examining the relationship between mealtime emotional responses and eating psychopathology, whilst controlling for anxiety or depression, multiple significant associations were found for both girls and boys, with a higher number of significant associations remaining when controlling for depression than anxiety. This provides support for the final study hypothesis.

The concurrent validity of the MEM-A with Project-EAT mealtime atmosphere highlights similarities within the assessment of the perception of mealtime positivity. However, it is of particular interest that no significant associations were found between anxiety-related mealtime emotions and the Project-EAT mealtime atmosphere scores, which suggests novelty in the assessment of this particular range of negative emotions (e.g., embarrassment, nervousness) within a mealtime measure. This also highlights the MEM-A

to be a multidimensional tool assessing both positive and negative emotions within a family mealtime.

It is of interest that girls and boys do not appear to differ in their perception of negative emotions related to anger or positive emotions at family mealtimes. This is in contrast to the findings of McNamara and colleagues (2008) who reported gender differences in positive emotions (happiness), but supports the lack of gender differences found among the negative emotions investigated (fear and disgust) in response to food generally. However, McNamara's research was based on only three specific emotions and used experimental food-stimuli (pictures of food displayed during school or university classes) as opposed to asking for perceptions of a more naturalistic setting, such as mealtimes, which may explain the variation in results. The higher levels of negative emotions related to anxiety experienced at family mealtimes by girls highlights the presence of gender differences within some emotional responses to mealtimes. It may be the case that these elevated levels of anxiety-related negative emotions are specifically associated with the elevated levels of eating psychopathology found among girls compared to boys. Higher levels of eating psychopathology are often related to negative emotions such as guilt and embarrassment (Long et al., 2012) and consequently it may be that mealtimes are an arena in which many of these emotions are experienced. Eating psychopathology scores were lower in boys than girls which align with other findings with adolescents (e.g., Haycraft et al., 2014) and might contribute to the different patterns of findings found in this study for girls and boys.

Similar to the findings of Neumark-Sztainer and colleagues (2004), the current study found associations between emotional responses to mealtimes and eating psychopathology. However, controlling for anxiety and depression had an influence on these relationships for both boys and girls. That fewer relationships remained when controlling for anxiety compared to depression suggests that anxiety may be a more central factor associated with emotional experiences of family mealtimes in comparison to depression. However, for both girls and boys, when controlling for anxiety or depression, several significant associations

remained, particularly among higher levels of anxiety-related mealtime emotions and higher levels of eating psychopathology. This highlights the presence of mealtime specific emotions in addition to more general levels of anxiety and depression, which may be associated with levels of eating psychopathology. These mealtime-specific emotions need to be considered within future research and this research provides support for the MEM-A as an effective instrument for this purpose.

This study has several methodological strengths. First, the sample size within this study is above both the recommended 'good' sample size for factor analysis (n > 300) as suggested by Comrey and Lee (1992), and the recommendation of at least 10 participants per item (Nunnally, 1978).  Second, participants were recruited from a range of schools across three counties within the UK, which aids the representativeness of the sample. Third, the development and validation of the MEM-A, a specific measure for mealtime emotions among adolescents, have been shown to be good, resulting in a valid measure that is suitable for use in future research among adolescents. However, there are also some limitations to the study. Although the geographic variation in recruitment may assist with the representativeness of the sample, the adolescents within the current sample are predominantly white British, which creates homogeneity within the sample and limits generalisability. Further research is therefore needed to explore emotional responses to family mealtimes among other ethnic groups. In addition, a confirmatory factor analysis with a further sample of adolescents is required in order to confirm the factor structure of the MEM-A. Furthermore, reliability of the MEM-A should be examined through conducting a test re-test study to explore if emotional responses to family mealtimes change over time and identify which factors these emotions may be associated with. Finally, it is acknowledged that the MEM-A assesses emotions which have minimal, yet important, overlap with those controlled for in our analyses (i.e., anxiety) and so the results have been interpreted with due caution.

Although the MEM-A has been developed to assess emotional responses to family mealtimes among adolescents, the measure could also be adapted for use to explore the

emotions associated with family mealtimes within alternative populations (e.g., younger children or parents), or other mealtime contexts (e.g., University halls or an eating disorder unit). However, the factor structure would need to be examined for each new population before the measure could be validation for such use.

In summary, the findings of this study highlight the MEM-A as a novel multidimensional tool to assess various emotional responses to family mealtimes, highlighting that family mealtimes may be an arena where a variety of both positive and negative emotions are experienced. The associations between mealtime emotions, particularly those related to anxiety, and eating psychopathology highlight the importance of promoting a positive mealtime environment which might help in reducing eating disordered attitudes and behaviours among adolescents. Future research should consider the broader range of mealtime-specific emotions among adolescents, the subsequent relationships with eating psychopathology, and any additional factors which may influence these feelings among adolescents. Future research should also explore the intensity of such mealtime-specific emotions in addition to the frequency as this could also provide important information about adolescents' perceptions of the family mealtime. Learning more about mealtime-specific emotions reported by adolescents could lead the way for the development of interventions to target these emotions and increase positivity towards family mealtimes and positive eating behaviours. Families should be encouraged to consider the emotional element of the mealtime environment and the interactions which occur during this time, with the aim of creating a beneficial, positive atmosphere for adolescents.

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*Table 1: Pattern matrix of the exploratory factor analysis conducted with principal axis factoring using promax rotation on the Mealtime Emotion Measure (MEM-A) among adolescent girls and boys (n=463).*

| MEM-A items (item number) | Anxiety-related mealtime emotions | Anger-related mealtime emotions | Positive mealtime emotions |
|---|---|---|---|
| Nervous (5) | **0.90** | -0.13 | 0.02 |
| Embarrassed (6) | **0.76** | -0.03 | 0.05 |
| Distressed (7) | **0.74** | -0.03 | -0.00 |
| Emotionally confused (8) | **0.65** | 0.02 | -0.02 |
| Anxious (1) | **0.60** | 0.16 | -0.07 |
| Guilty (3) | **0.48** | 0.19 | 0.02 |
| Angry (10) | -0.06 | **0.86** | 0.00 |
| Frustrated (11) | 0.02 | **0.85** | 0.02 |
| Stressed (2) | 0.37 | **0.50** | -0.03 |
| Comfortable within the physical environment (13) | -0.08 | 0.12 | **0.75** |
| Happy (9) | 0.16 | -0.07 | **0.69** |
| Relaxed (4) | 0.04 | -0.13 | **0.60** |
| In control of the way you feel emotionally during mealtimes  (12) | -0.12 | 0.08 | **0.58** |
| Eigenvalue | 5.23 | 1.84 | 1.16 |
| Percentage of variance | 36.9 | 10.0 | 6.18 |
| Cronbach's alpha | 0.84 | 0.83 | 0.73 |

Note: Two items were discarded from the measure after the initial exploratory factor analysis. These items were "Emotionally supported by your parents during mealtimes" and "Emotionally supported by other family members during mealtimes".

*Table 2: Mean values (and standard deviations) for MEM-A, Project-EAT, EDE-Q and HADS*

*scores for girls (n = 282) and boys (n = 242), and Mann-Whitney U test of difference scores.*

| | Girls | Boys | Mann-Whitney U-Test | |
| --- | --- | --- | --- | --- |
| | Mean (SD) | Mean (SD) | Z | P |
| **MEM-A** (range of possible scores 0 to 7) | | | | |
| Anxiety-related mealtime emotions | 1.68 (0.92) | 1.48 (0.83) | 3.31 | p=.001 |
| Anger-related mealtime emotions | 2.26 (1.28) | 2.02 (1.22) | 2.54 | NS |
| Positive mealtime emotions | 5.28 (1.24) | 5.26 (1.38) | 0.27 | NS |
| Global | 2.12 (0.91) | 2.00 (0.81) | 1.39 | NS |
| **Project-EAT** (range of possible scores 0 to 4) | | | | |
| Mealtime atmosphere | 2.88 (0.69) | 2.85 (0.71) | 0.26 | NS |
| **EDE-Q** (range of possible scores 0 to 6) | | | | |
| Shape and Weight Concern | 2.82 (1.92) | 0.82 (1.18) | 11.9 | p<.001 |
| Restriction | 1.91 (1.72) | 0.61 (1.00) | 9.84 | p<.001 |
| Preoccupation and Eating Concern | 1.14 (1.28) | 0.36 (0.74) | 8.66 | p<.001 |
| Global | 1.95 (1.50) | 0.58 (0.83) | 11.4 | p<.001 |
| **HADS** (range of possible scores 0 to 21) | | | | |
| Anxiety | 7.49 (4.27) | 5.98 (3.88) | 3.77 | p<.001 |
| Depression | 4.07 (3.32) | 4.13 (2.96) | 0.83 | NS |

NS: p >.05

*Table 3: One-tailed Spearman's rho correlations examining associations between MEM-A*

*subscale and global scores, EDE-Q and HADS scores for girls and boys.*

| | MEM-A scores | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Girls | | | | Boys | | | |
| | Anxiety-related mealtime emotions | Anger-related mealtime emotions | Positive mealtime emotions | MEM-A Global[1] | Anxiety-related mealtime emotions | Anger-related mealtime emotions | Positive mealtime emotions | MEM-A Global |
| **EDE-Q** | | | | | | | | |
| Shape and Weight Concern | 0.35** | 0.24** | -0.32** | 0.37** | 0.22** | 0.25** | -0.13 | 0.21* |
| Restriction | 0.33** | 0.19** | -0.22** | 0.31** | 0.17* | 0.13 | -0.11 | 0.14 |
| Preoccupation and Eating Concern | 0.43** | 0.26** | -0.33** | 0.42** | 0.29** | 0.19* | -0.10 | 0.20* |
| Global | 0.39** | 0.25** | -0.32** | 0.40** | 0.26** | 0.25** | -0.15 | 0.23** |
| **HADS** | | | | | | | | |
| Anxiety | 0.45** | 0.38** | -0.46** | 0.55** | 0.39** | 0.43** | -0.35** | 0.48** |
| Depression | 0.40** | 0.35** | -0.47** | 0.53** | 0.23** | 0.23** | -0.43** | 0.43** |

*p≤.01, **p≤.001.

Note: In order to calculate the MEM-A global score items from the Positive mealtime emotions subscale (4, 9, 12 and 13) are first required to be reverse scored. The global score is then based on the mean of all 13 items.

*Table 4: One-tailed partial correlations examining the associations between emotional responses to mealtimes and eating psychopathology when controlling for anxiety, for girls and boys.*

| | MEM-A scores | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Girls** | | | | **Boys** | | | |
| | Anxiety-related mealtime emotions | Anger-related mealtime emotions | Positive mealtime emotions | MEM-A Global | Anxiety-related mealtime emotions | Anger-related mealtime emotions | Positive mealtime emotions | MEM-A Global |
| **EDE-Q** | | | | | | | | |
| Shape and Weight Concern | 0.24** | 0.11 | -0.14 | 0.20* | 0.13 | 0.11 | -0.05 | 0.13 |
| Restriction | 0.32** | 0.09 | -0.09 | 0.22** | 0.16* | 0.06 | 0.01 | 0.09 |
| Preoccupation and Eating Concern | 0.44** | 0.14 | -0.17* | 0.34** | 0.21** | -0.01 | -0.06 | 0.13 |
| Global | 0.35** | 0.12 | -0.17* | 0.27** | 0.14 | 0.09 | -0.01 | 0.10 |

*p≤.01, **p≤.001.

Table 5: One-tailed partial correlations examining the associations between emotional responses to mealtimes and eating psychopathology when controlling for depression, for girls and boys.

| | MEM-A scores | | | | | | | |
| | Girls | | | | Boys | | | |
| | Anxiety-related mealtime emotions | Anger-related mealtime emotions | Positive mealtime emotions | Global | Anxiety-related mealtime emotions | Anger-related mealtime emotions | Positive mealtime emotions | Global |
|---|---|---|---|---|---|---|---|---|
| **EDE-Q** | | | | | | | | |
| Shape and Weight Concern | 0.32** | 0.20** | -0.23** | 0.31** | 0.22** | 0.22** | -0.08 | 0.23** |
| Restriction | 0.41** | 0.18* | -0.20** | 0.35** | 0.23** | 0.16* | -0.04 | 0.20* |
| Preoccupation and Eating Concern | 0.47** | 0.20* | -0.22** | 0.40** | 0.28** | 0.10 | -0.03 | 0.19* |
| Global | 0.42** | 0.21** | -0.26** | 0.38** | 0.23** | 0.20* | -0.03 | 0.20* |

*p≤.01, **p≤.001.

**Appendix 1: Mealtime Emotions Measure for adolescents (MEM-A)**

How often do you feel the following during typical family mealtimes? *(Please rate your response on the scale by selecting the answer that best describes your experience).*

| | Never | | Sometimes | | | Always | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 1. Anxious | | | | | | | |
| 2. Stressed | | | | | | | |
| 3. Guilty | | | | | | | |
| 4. Relaxed | | | | | | | |
| 5. Nervous | | | | | | | |
| 6. Embarrassed | | | | | | | |
| 7. Distressed | | | | | | | |
| 8. Emotionally confused | | | | | | | |
| 9. Happy | | | | | | | |
| 10. Angry | | | | | | | |
| 11. Frustrated | | | | | | | |
| 12. In control of the way you feel emotionally during mealtimes | | | | | | | |
| 13. Comfortable within the physical mealtime environment | | | | | | | |

**Scoring of the MEM-A**

The MEM-A yields three specific subscales and a global subscale.

Subscale scores are calculated based on the mean of the items within each subscale: **Anxiety-related mealtime emotions**: items 1, 3, 5, 6, 7 and 8; **Anger-related mealtime emotions**; items 2, 10 and 11; and **Positive mealtime emotions**; 4, 9, 12 and 13.

In order to calculate the **global score**, the four items from the Positive mealtime emotions subscale are required to be reverse scored. The global score is then calculated based on a mean of all 13 items. A higher global score is indicative of a more negative emotional response to family mealtimes.