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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*

28   **Abstract**

29   This study aimed to examine the factor structure of the Mealtime Emotions Measure for

30   adolescents (MEM-A), a novel measure of emotional responses experienced during family

31   mealtimes. Additionally, it examined gender differences in mealtime emotions and also the

32   relationships between mealtime emotions and levels of eating psychopathology, when

33   controlling for anxiety or depression. Adolescent participants (N = 527; 282 girls, 245 boys)

34   with a mean age of 15.9 years completed the new mealtime measure for adolescents (MEM-

35   A), in addition to questions about family mealtime atmosphere, and measures assessing

36   symptoms of anxiety, depression, and eating psychopathology. Factor analysis produced a

37   three factor solution for the MEM-A with two subscales relating to different types of negative

38   mealtime emotions (*Anxiety-related mealtime emotions* and *Anger-related mealtime*

39   *emotions*) and one subscale relating to *Positive mealtime emotions*. Generally, girls reported

40   experiencing more Anxiety-related mealtime emotions compared to boys. Having conducted

41   separate analyses controlling for levels of either anxiety or depression, there were several

42   significant associations for both girls and boys between mealtime emotions, particularly

43   Anxiety-related emotions, and eating psychopathology. The findings suggest that some

44   mealtime emotions are associated with increased eating psychopathology. Replication and

45   detailed examination of these emotional responses is required.

46

47   **Keywords:** Anxiety; Depression; Positive mealtime emotions; Negative mealtime emotions;

48   Family mealtime environment; Eating behaviours; Anger.

49   **Development of the Mealtime Emotions Measure for adolescents (MEM-A): Gender**

50   **differences in emotional responses to family mealtimes and eating psychopathology.**

51

52   There are numerous benefits to adolescents sharing mealtimes with their family. In

53   particular, more frequent family mealtimes have been associated with healthier eating

54   behaviours among adolescents (e.g., Gilman et al. 2000; Neumark-Sztainer, Hannan, Story,

55   Croll & Perry et al., 2003; Neumark-Sztainer, Wall, Story & Fulkerson, 2004). In addition to

56   *frequency* of family mealtimes, the *atmosphere* during the mealtime has also been shown to

57   have cross-sectional associations with adolescent dietary behaviour. For instance,

58   adolescents from families with a more positive emotional atmosphere at mealtimes

59   reportedly eat meals together more frequently and have healthier diets (Berge, 2011).

60   Furthermore, perceptions of more positive mealtime atmospheres have been associated with

61   reduced levels of disordered eating behaviour among adolescents (Neumark-Sztainer et al.,

62   2004; White, Haycraft & Meyer, 2014a). Despite the lack of longitudinal research, these

63   existing studies highlight the potential importance of mealtime atmosphere in relation to

64   healthier eating behaviours.

65   Family mealtimes should be a time for pleasure and enjoyment (Carson, 2006).

66   However, while family mealtimes are often viewed positively by adolescents (e.g., Fulkerson,

67   Neumark-Sztainer & Story, 2006), this is not the case for all teens. For example, some

68   adolescents report arguments during mealtimes (Boutelle, Lytle, Murray, Birnbaum & Story,

69   2001; Neumark-Sztainer, Story, Ackard, Moe & Perry, 2000) and rate mealtimes as

70   unpleasant or only occasionally pleasant (Burnier, Dubois & Girard, 2011). Furthermore,

71   negative mealtime atmospheres are associated with eating behaviour. For instance, recalled

72   levels of mealtime communication-based stress have been linked with anorexic attitudes

73   among college age women (Worobey, 2002). Similarly, a greater number of negative

74   recollections of mealtime experiences have been reported by women with bulimic disorders

75   compared to controls (Miller, McCluskey-Fawcett & Irving, 1993). Hence, it is likely that a

76   variety of emotions are associated with family mealtimes, and that these emotions are

77   associated with eating psychopathology.

78   Although research highlights the importance of the mealtime atmosphere in relation

79   to eating behaviour (e.g., Neumark-Sztainer et al., 2004; White et al., 2014a), little is known

80   about the reasons why adolescents may experience different emotional responses to family

81   mealtimes. Fulkerson and colleagues suggested that the psychosocial health (e.g., levels of

82   depressed mood, body satisfaction, self-esteem) of the adolescent may influence their

83   perception of mealtimes, with more negative perceptions being found among those with

84   poorer psychosocial health (Fulkerson, Strauss, Neumark-Sztainer, Story & Boutelle, 2007).

85   This suggests that adolescents' emotional experiences at mealtimes may be related to their

86   levels of psychological symptoms, such as anxiety and depression. Anxiety and depression

87   have both been linked with levels of disordered eating in adolescents (e.g., Hou et al., 2013).

88   Therefore, it is plausible that these symptoms may also contribute to the relationship

89   between emotional aspects of mealtimes and eating psychopathology.

90   Differences in certain emotional responses to family mealtimes have also be seen

91   between girls and boys. Although research to date has only examined responses to food

92   stimuli, and not mealtimes, findings suggest that the experience of positive emotional

93   responses (happiness) to food may differ for girls and boys, with boys reporting 'happier'

94   responses to food images than girls (e.g., McNamara, Hay, Katsikitis & Chur-Hansen, 2008).

95   However, research examining gender differences in negative emotional responses to food,

96   such as disgust or fear, have been inconsistent (Davey, Buckland, Tantow & Dallos, 1998;

97   McNamara et al., 2008). It may be the case that in naturally occurring mealtime situations,

98   such as family mealtimes, emotional responses may differ for girls and boys. Indeed, gender

99   differences are well-established among adolescents in terms of their levels of eating

100   psychopathology (e.g., Goodwin, Haycraft, Willis & Meyer, 2011; Haycraft, Goodwin &

101   Meyer, 2014; White et al., 2014a), anxiety (e.g., Leikanger & Larsson, 2012; White et al.,

102   2014a) and depression (e.g., Ferreiro, Seoane & Senra, 2011), with higher levels typically

103   observed among girls.

104   In summary, family mealtimes can be linked to both positive (e.g., Fulkerson et al.,

105   2006) and negative (e.g., Boutelle et al., 2001; Burnier et al., 2011; Neumark-Sztainer et al.,

106   2000) emotional experiences for teenagers. While there are established associations

107   between more positive mealtime atmospheres and reduced disordered eating behaviours

108   (e.g., Neumark-Sztainer et al., 2004; White et al., 2014a), little is known about those factors

109   that might be associated with less positive mealtime experiences. One reason for the

110   absence of such research to date is the lack of an appropriate measure. Although a measure

111   exists to assess the atmosphere during family mealtimes (Neumark-Sztainer et al., 2004),

112   this focuses primarily on the experience of mealtime communication and enjoyment, rather

113   than on emotional tone. There is a need for a mealtime measure which explores a wider

114   range of both positive and negative emotions specifically related to mealtimes.

115   Therefore, the current study has four aims. First, to examine the factor structure of a

116   new measure designed to assess emotional experiences during mealtimes. Second, to test

117   the concurrent validity of the new measure by comparing the subscale and global scores

118   with the scores for the existing measure of mealtime atmosphere (Neumark-Sztainer et al.,

119   2004). Third, to extend previous research on emotional responses to food (Davey et al.,

120   1998; McNamara et al., 2008) to a broader focus on family mealtimes, and consider gender

121   differences in these emotional experiences. In keeping with the findings of McNamara and

122   colleagues (2008), it is hypothesised that boys will report higher levels of positive mealtime

123   emotions than girls, but that there will be no gender differences in levels of negative

124   mealtime emotions. Finally, to extend the research examining associations between

125   mealtime atmosphere and eating psychopathology (Neumark-Sztainer et al., 2004), the

126   relationships between emotional experiences of mealtimes and eating psychopathology will

127   be examined for each gender. Based on the findings of Hou and colleagues (2013) and

128   White et al. (2014a), anxiety or depression will be controlled for (separately) when examining

129   associations between mealtime emotions and eating psychopathology. It is hypothesised

130   that anxiety and depression will contribute to the relationship between emotional responses

131   to mealtimes and eating psychopathology.

132

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 &

160 Meyer, 2012; Long, Wallis, Leung, Arcelus & Meyer, 2012), and in collaboration with

161 psychologists and psychiatrists working in the eating disorders and obesity fields. After

162 development, the measure was piloted with a separate sample of adolescents and minor

163 amendments were made to the wording to improve clarity before the MEM-A was

164 administered as part of the current study. The measure is based around the anchor question

165 *"How often do you feel the following during typical family mealtimes?"*. Participants rate how

166 often 15 different emotional responses are experienced on a seven-point Likert scale from

167 'never' to 'always' with several items reverse scored. The 15 items include responses

168 relating to both emotional and physical comfort. Higher scores relate to more emotional

169 responses to family mealtimes. Following the factor analysis, 13 items were retained,

170 pertaining to three subscales (further details are presented in the Results section). A copy of

171 the final version of the MEM-A, and its scoring details, can be found in Appendix 1.

172

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

174 et al., 2004)

175   Four items assessed mealtime atmosphere. Two items related to enjoyment of

176 mealtimes (e.g., "*I enjoy eating meals with my family")* and two items tapped mealtime

177 communication (e.g., "*In my family, mealtime is a time for talking with other family*

178 *members"*). Items were rated on a four-point scale from strongly disagree to strongly agree.

179 Mean scores were calculated with higher scores representing a more positive mealtime

180 atmosphere. Reliability in the current sample was high (Cronbach's alpha = 0.84).

181

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

183   The 28-item EDE-Q (version 6.0) is a self-report measure of eating psychopathology.

184 It consists of 22 items which assess eating disordered attitudes. It also contains six items

185 which assess eating disordered behaviours, but these were not used in this study. A recent

186 factor analysis of 22 attitudinal items of the EDE-Q recommends an alternative three factor

187 structure for use in research with adolescents (White, Haycraft, Goodwin & Meyer, 2014b).

188   The three subscales are: Shape and Weight Concerns (e.g., *"On how many of the past 28*

189   *days have you had a desire to have a totally flat stomach?"*); Restriction (e.g., *"On how many*

190   *of the past 28 days have you been deliberately trying to limit the amount of food you eat to*

191   *influence your shape or weight?"*); and Preoccupation and Eating Concern (e.g., *"Over the*

192   *past 28 days, how concerned have you been about other people seeing you eat?"*). Items

193   are rated on a seven-point scale (0-6), with a global score calculated as a mean of the

194   subscale scores. Higher levels of eating psychopathology are indicated by higher scores.

195   Reliability in the current sample for the three new subscales and the global score was high;

196   Shape and Weight Concerns (10 items; Cronbach's alpha = 0.96); Restriction (five items;

197   Cronbach's alpha = 0.88); Preoccupation and Eating Concern (seven items; Cronbach's

198   alpha = 0.87); and global score (Cronbach's alpha = 0.89).

199

200   <u>Hospital and Anxiety Depression Scale (HADS; Zigmond & Snaith, 1983)</u>

201   The HADS is a brief 14 item self-report measure which consists of two seven-item

202   subscales: Anxiety (e.g., *"Worrying thoughts go through my mind"*) and Depression (e.g., *"I*

203   *still enjoy the things I used to enjoy"*). Each question is rated on a four point scale (0-3), with

204   scores ranging from 0-21 for each subscale. Higher levels of psychopathology are indicated

205   by higher scores. Reliability in the current sample was high for Anxiety (Cronbah's alpha =

206   0.82) and moderate for Depression (Cronbach's alpha = 0.70).

207

208   *Data analysis*

209   To examine the first aim of the study, which was to explore the factor structure of the

210   MEM-A, an exploratory factor analysis (EFA) was conducted using principal axis factoring

211   with a promax rotation to allow for inter-correlation among factors. Factor retention was

212   based on the examination of the Scree plot, as suggested by Cattell (1966) and Eigenvalues

213   over 1.0, as suggested by Kaiser (1961). Items loading clearly onto one factor above the cut

214   off of 0.3, as recommended by Kline (1994), were retained. As the Shapiro-Wilk test

215   indicated that the data were not normally distributed, non-parametric tests were

216 subsequently used. To assess the intercorrelation among factors, one-tailed Spearman's rho

217 correlations were conducted.

218   Before any further analyses were conducted, multivariate outliers were detected for

219 MEM-A, Project-EAT mealtime atmosphere, HADS, and EDE-Q scores through computing

220 squared Mahalanobis distance (D^2) for each participant. Byrne (2010) suggested that the D^2

221 value of an outlier will be uniquely distant from other D^2 values. As a result of this analysis

222 three participants (all boys) were excluded from the sample at this point.

223   To assess the concurrent validity of the MEM-A (aim 2), Spearman's rho correlations

224 were conducted to examine associations between the scores on the MEM-A and Project-

225 EAT mealtime atmosphere. Additionally, to determine gender differences in emotional

226 responses to mealtimes (aim 3), Mann Whitney U tests were conducted on girls' and boys'

227 scores on the MEM-A. Further Mann Whitney U tests were conducted to examine gender

228 differences on girls' and boys' Project-EAT atmosphere, HADS and EDE-Q scores. The

229 fourth aim was to examine the relationships between emotional responses to mealtimes and

230 eating psychopathology when controlling for either anxiety or depression. Initially,

231 Spearman's rho one-tailed correlations were conducted to determine the relationships

232 between HADS and EDE-Q scores. Finally, partial correlations were conducted to examine

233 the relationship between MEM-A and EDE-Q scores when controlling for either HADS

234 anxiety or depression. Missing data were excluded from all analyses. This study adopted a

235 significance level of $p \leq .01$ to reduce the risk of type 1 errors.

236

237   **Results**

238 *Factor structure of the MEM-A*

239   A four factor structure was produced by the initial EFA conducted on the 15 items of

240 the MEM-A. However, within this structure, one factor consisted only of two items.

241 Previously, it has been recommended that a minimum of three items is needed per factor

242 (Hatcher, 1994), and hence these two items were removed from the analysis. As shown in

243 Table 1, a second EFA was conducted with the remaining 13 items which produced a three

244 factor structure. A three factor structure was also supported the scree plot analysis (Cattell,

245 1966).

246 INSERT TABLE 1 ABOUT HERE

247 Factor 1 included items concerning nervousness, embarrassment and anxiety related

248 to family mealtimes, and so will be described as *MEM-A: Anxiety-related mealtime emotions*.

249 This factor accounted for 36.9% of the variance. Three items relating to feelings of

250 frustration, anger and stress during family mealtimes comprised Factor 2, subsequently

251 described as *MEM-A: Anger-related mealtime emotions,* and accounted for 10.0% of the

252 variance. Factor 3 included items related to positive emotions connected to family mealtimes

253 (e.g., feeling happy and comfortable within the mealtime environment), and will subsequently

254 be described as *Positive mealtime emotions*. This factor accounted for 6.18% of the

255 variance. All three factors were found to significantly intercorrelate: Anxiety-related mealtime

256 emotions and Anger-related mealtime emotions ($r = 0.63$, $p < .001$); Anger-related mealtime

257 emotions and Positive mealtime emotions ($r = -0.33$, $p < .001$); and Anxiety-related mealtime

258 emotions and Positive mealtime emotions ($r = -0.33$, $p < .001$).

259

260 *Scoring of the MEM-A*

261 The remaining 13 items constitute the complete measure (see Appendix 1). Subscale

262 scores are calculated based on the mean of the items within each subscale (Anxiety-related

263 mealtime emotions: items 1, 3, 5, 6, 7 and 8; Anger-related mealtime emotions; items 2, 10

264 and 11; and Positive mealtime emotions; 4, 9, 12 and 13). In order to calculate the global

265 score, items from the Positive mealtime emotions subscale are required to be reverse

266 scored. The global score is then calculated based on a mean of all 13 items. A higher global

267 score is indicative of a more negative emotional response to family mealtimes. Within this

268 sample, reliability for the MEM-A global score was high (Cronbach's alpha = 0.86).

269

270 *Concurrent validity of the MEM-A*

271   No significant associations were found between MEM-A Anxiety-related mealtime

272   emotions and Project-EAT mealtime atmosphere. However, significant negative associations

273   were found between MEM-A Anger-related mealtime emotions and Project-Eat mealtime

274   atmosphere (r = -0.17, p <.001), and MEM-A global and Project-EAT mealtime atmosphere

275   (r = -0.38, p < .001). Furthermore, a significant positive association was found between

276   MEM-A Positive mealtime emotions and Project-EAT mealtime atmosphere (r = 0.50, p <

277   .001).

278

279   *Characteristics of the sample*

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

281   2.

282

283   INSERT TABLE 2 ABOUT HERE

284

285   The third aim of the study was to examine gender differences in emotional responses

286   to mealtimes. No significant differences were found between girls' and boys' scores for

287   MEM-A Anger, MEM-A Positive or MEM-A global. However, significant gender differences

288   were found for MEM-A Anxiety. When examining gender differences among the remaining

289   scores, no significant differences were found between girls' and boys' scores for Project-EAT

290   Mealtime atmosphere or HADS depression. Significant gender differences were found for

291   EDE-Q and HADS anxiety scores, with girls reporting higher scores than boys. Girls' and

292   boys' HADS scores for both anxiety and depression were similar to previous research

293   (White, Leach, Sims, Atkinson & Cottrell, 1999). As significant gender differences were

294   found for one MEM-A subscale and all EDE-Q scores, further analyses were conducted

295   separately for girls and boys.

296

297   *Emotional responses to mealtimes and eating psychopathology*

298   The fourth aim of the study was to examine the relationships between emotional

299   responses to mealtimes and eating psychopathology, when controlling for anxiety or

300   depression for each gender. However, as a prerequisite, Spearman's rho one-tailed

301   correlations were first conducted to examine associations between emotional responses to

302   mealtimes (MEM-A), eating psychopathology (EDE-Q), anxiety and depression (HADS)

303   scores for both girls and boys, as shown in Table 3.

304

305   INSERT TABLE 3 ABOUT HERE

306   *Girls*

307   For girls, there were four significant findings. First, significant positive associations

308   were found between MEM-A Anxiety, MEM-A Anger, MEM-A global scores and all EDE-Q

309   scores. Second, significant negative associations were found between MEM-A Positive and

310   all EDE-Q scores. Third, significant positive associations were found between MEM-A

311   Anxiety, MEM-A Anger, MEM-A global scores and HADS Anxiety and Depression. Finally,

312   significant negative associations were also found between MEM-A Positive and HADS

313   Anxiety and Depression.

314

315   *Boys*

316   In contrast to girls, among boys there were no significant associations between

317   MEM-A Positive and any EDE-Q scores. Similarly, no significant associations were found

318   between MEM-A Anger, MEM-A global score and EDE-Q restriction subscale. There were

319   four significant findings. First, significant positive associations were found between Anxiety-

320   related mealtime emotions and all EDE-Q scores. Second, significant positive associations

321   were also found for MEM-A Anger and MEM-A global scores with EDE-Q Shape and Weight

322   Concern, Preoccupation and Eating Concern and EDE-Q global scores. Third, significant

323   positive associations were found between MEM-A Anxiety, MEM-A Anger, MEM-A global

324   scores and HADS Anxiety and Depression scores. Finally, significant negative associations

325   were found between MEM-A Positive and HADS Anxiety and Depression scores.

326

327   Several significant associations were found between emotional responses to

328 mealtimes, eating psychopathology and anxiety and/or depression. Therefore, one-tailed

329 partial correlations were subsequently conducted to examine the relationships between

330 emotional responses to mealtimes and eating psychopathology when controlling for either

331 anxiety or depression.

332

333 *Partial correlations: Anxiety*

334   The results of the partial correlations examining the associations between MEM-A

335 and EDE-Q scores, when controlling for HADS anxiety for both girls and boys are shown in

336 Table 4.

337   INSERT TABLE 4 ABOUT HERE

338 *Girls*

339   As shown in Table 4, no significant associations remained between MEM-A Anger

340 and all EDE-Q scores when controlling for HADS Anxiety. Similarly, no significant

341 associations remained between MEM-A Positive and EDE-Q Shape and Weight Concerns or

342 Restriction subscales. However, significant positive associations did remain between MEM-A

343 Anxiety, MEM-A global scores and all EDE-Q scores. Furthermore, significant negative

344 associations remained between MEM-A Positive and EDE-Q Preoccupation and Eating

345 Concern and global scores.

346

347 *Boys*

348   For boys, when controlling for HADS Anxiety, no significant associations remained

349 between MEM-A Anger, MEM-A Positive or MEM-A global scores and any EDE-Q scores

350 (see Table 4). Furthermore, no significant associations remained between MEM-A Anxiety

351 and EDE-Q Shape and Weight Concerns or global scores. However, significant positive

352 associations did remain between MEM-A Anxiety and EDE-Q Restriction and Preoccupation

353 and Eating Concern subscales.

354

Partial correlations: Depression

356   The results of the partial correlations examining the associations between MEM-A

357   and EDE-Q scores, when controlling for HADS depression for both girls and boys are shown

358   in Table 5.

359   INSERT TABLE 5 ABOUT HERE

360   *Girls*

361   Significant positive associations remained between MEM-A Anxiety, MEM-A Anger,

362   MEM-A global scores and all EDE-Q scores when controlling for HADS Depression.

363   Furthermore, significant negative associations remained between MEM-A Positive and all

364   EDE-Q scores.

365

366   *Boys*

367   When controlling for HADS Depression, no significant associations remained

368   between MEM-A Positive and any EDE-Q scores (Table 5). Furthermore, no significant

369   associations remained between MEM-A Anger and EDE-Q Preoccupation and Eating

370   Concern subscale scores. However, significant positive associations did remain between

371   MEM-A Anxiety, MEM-A global scores and all EDE-Q scores. Similarly, significant

372   associations also remained between MEM-A Anger and EDE-Q Shape and Weight Concern,

373   Restriction and global scores.

374

375   **Discussion**

376   This study had four aims. First, to examine the structural validity of a new measure

377   designed to assess emotional responses to family mealtimes, the Mealtime Emotions

378   Measure for adolescents (MEM-A). Second, to test the concurrent validity of the new

379   measure. Third, to examine gender differences in emotional responses to family mealtimes.

380   Finally, to examine the relationships between emotional responses to family mealtimes and

381   eating psychopathology when controlling for anxiety or depression for both girls and boys.

382   The findings of the factor analysis resulted in a three factor model of the MEM-A, producing

383   a measure that assesses a range of emotional responses to family mealtimes. The model

384   includes two subscales assessing negative emotional responses. The first related broadly to

385   internalising emotions (Anxiety-related mealtime emotions), while the second reflected more

386   externalising emotions (Anger-related mealtime emotions). A further subscale assessed

387   positive emotional responses to mealtimes and physical comfort (Positive mealtime

388   emotions), in addition to a global score. Concurrent validity of the MEM-A when examined

389   against the mealtime atmosphere subscale from the Project-EAT survey (Neumark-Sztainer

390   et al., 2000; 2004) was highest for the positive mealtime emotions subscale.

391   There were significant gender differences in levels of anxiety-related emotions

392   experienced at family meals (e.g., embarrassment, nervousness, distress), with higher levels

393   reported by girls. However, no gender differences were found for the levels of anger-related,

394   or positive mealtime emotions experienced, which did not support the study's hypothesis.

395   When examining the relationship between mealtime emotional responses and eating

396   psychopathology, whilst controlling for anxiety or depression, multiple significant

397   associations were found for both girls and boys, with a higher number of significant

398   associations remaining when controlling for depression than anxiety. This provides support

399   for the final study hypothesis.

400   The concurrent validity of the MEM-A with Project-EAT mealtime atmosphere

401   highlights similarities within the assessment of the perception of mealtime positivity.

402   However, it is of particular interest that no significant associations were found between

403   anxiety-related mealtime emotions and the Project-EAT mealtime atmosphere scores, which

404   suggests novelty in the assessment of this particular range of negative emotions (e.g.,

405   embarrassment, nervousness) within a mealtime measure. This also highlights the MEM-A

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

407   mealtime.

408   It is of interest that girls and boys do not appear to differ in their perception of

409   negative emotions related to anger or positive emotions at family mealtimes. This is in

410 contrast to the findings of McNamara and colleagues (2008) who reported gender

411 differences in positive emotions (happiness), but supports the lack of gender differences

412 found among the negative emotions investigated (fear and disgust) in response to food

413 generally. However, McNamara's research was based on only three specific emotions and

414 used experimental food-stimuli (pictures of food displayed during school or university

415 classes) as opposed to asking for perceptions of a more naturalistic setting, such as

416 mealtimes, which may explain the variation in results. The higher levels of negative emotions

417 related to anxiety experienced at family mealtimes by girls highlights the presence of gender

418 differences within some emotional responses to mealtimes. It may be the case that these

419 elevated levels of anxiety-related negative emotions are specifically associated with the

420 elevated levels of eating psychopathology found among girls compared to boys. Higher

421 levels of eating psychopathology are often related to negative emotions such as guilt and

422 embarrassment (Long et al., 2012) and consequently it may be that mealtimes are an arena

423 in which many of these emotions are experienced. Eating psychopathology scores were

424 lower in boys than girls which align with other findings with adolescents (e.g., Haycraft et al.,

425 2014) and might contribute to the different patterns of findings found in this study for girls

426 and boys.

427   Similar to the findings of Neumark-Sztainer and colleagues (2004), the current study

428 found associations between emotional responses to mealtimes and eating psychopathology.

429 However, controlling for anxiety and depression had an influence on these relationships for

430 both boys and girls. That fewer relationships remained when controlling for anxiety

431 compared to depression suggests that anxiety may be a more central factor associated with

432 emotional experiences of family mealtimes in comparison to depression. However, for both

433 girls and boys, when controlling for anxiety or depression, several significant associations

434 remained, particularly among higher levels of anxiety-related mealtime emotions and higher

435 levels of eating psychopathology. This highlights the presence of mealtime specific emotions

436 in addition to more general levels of anxiety and depression, which may be associated with

437 levels of eating psychopathology. These mealtime-specific emotions need to be considered

438   within future research and this research provides support for the MEM-A as an effective

439   instrument for this purpose.

440   This study has several methodological strengths. First, the sample size within this

441   study is above both the recommended 'good' sample size for factor analysis (n > 300) as

442   suggested by Comrey and Lee (1992), and the recommendation of at least 10 participants

443   per item (Nunnally, 1978). Second, participants were recruited from a range of schools

444   across three counties within the UK, which aids the representativeness of the sample. Third,

445   the development and validation of the MEM-A, a specific measure for mealtime emotions

446   among adolescents, have been shown to be good, resulting in a valid measure that is

447   suitable for use in future research among adolescents. However, there are also some

448   limitations to the study. Although the geographic variation in recruitment may assist with the

449   representativeness of the sample, the adolescents within the current sample are

450   predominantly white British, which creates homogeneity within the sample and limits

451   generalisability. Further research is therefore needed to explore emotional responses to

452   family mealtimes among other ethnic groups. In addition, a confirmatory factor analysis with

453   a further sample of adolescents is required in order to confirm the factor structure of the

454   MEM-A. Furthermore, reliability of the MEM-A should be examined through conducting a test

455   re-test study to explore if emotional responses to family mealtimes change over time and

456   identify which factors these emotions may be associated with. Finally, it is acknowledged

457   that the MEM-A assesses emotions which have minimal, yet important, overlap with those

458   controlled for in our analyses (i.e., anxiety) and so the results have been interpreted with due

459   caution.

460   In summary, the findings of this study highlight the MEM-A as a novel

461   multidimensional tool to assess various emotional responses to family mealtimes,

462   highlighting that family mealtimes may be an arena where a variety of both positive and

463   negative emotions are experienced. The associations between mealtime emotions,

464   particularly those related to anxiety, and eating psychopathology highlight the importance of

465   promoting a positive mealtime environment which might help in reducing eating disordered

466   attitudes and behaviours among adolescents. Future research should consider the broader

467   range of mealtime-specific emotions among adolescents, the subsequent relationships with

468   eating psychopathology, and any additional factors which may influence these feelings

469   among adolescents. Families should be encouraged to consider the emotional element of

470   the mealtime environment and the interactions which occur during this time, with the aim of

471   creating a beneficial, positive atmosphere for adolescents.

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561   *Table 1: Pattern matrix of the exploratory factor analysis conducted with principal axis*

562   *factoring using promax rotation on the Mealtime Emotion Measure (MEM-A) among*

563   *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

564

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

566   *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				
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				
Mealtime atmosphere	2.88 (0.69)	2.85 (0.71)	0.26	NS
EDE-Q				
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				
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

567   NS: p >.05

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

569   *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	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**

570   *p≤.01, **p≤.001.

571 *Table 4: One-tailed partial correlations examining the associations between emotional*

572 *responses to mealtimes and eating psychopathology when controlling for anxiety, for girls*

573 *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

574 *p≤.01, **p≤.001.

575 Table 5: One-tailed partial correlations examining the associations between emotional

576 responses to mealtimes and eating psychopathology when controlling for depression, for

577 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*

578 *p≤.01, **p≤.001.

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

580 How often do you feel the following during typical family mealtimes? *(Please rate your*
581 *response on the scale by selecting the answer that best describes your experience).*
582

	Never		Sometimes			Always		
	1	2	3	4	5	6	7	N/A
1. Anxious								
2. Stressed								
3. Guilty								
4. Relaxed								
5. Nervous								
6. Embarrassed								
7. Distressed								
8. Emotionally confused								
9. Happy								
10. Angry								
11. Frustrated								
12. Emotionally supported by your parents during mealtimes								
13. Emotionally supported by other family members during mealtimes								

583

Scoring of the MEM-A

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

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

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