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Recollections of Pressure to Eat During Childhood, But Not Picky Eating,

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Predict Young Adult Eating Behavior

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Abstract

26 Picky eating is a childhood behavior that vexes many parents and is a symptom in the
27 newer diagnosis of Avoidant/Restrictive Food Intake Disorder (ARFID) in adults.

28 Pressure to eat, a parental controlling feeding practice aimed at encouraging a child to eat
29 more, is associated with picky eating and a number of other childhood eating
30 concerns. Low intuitive eating, an insensitivity to internal hunger and satiety cues, is also
31 associated with a number of problem eating behaviors in adulthood. Whether picky
32 eating and pressure to eat are predictive of young adult eating behavior is relatively
33 unstudied. Current adult intuitive eating and disordered eating behaviors were self-
34 reported by 170 college students, along with childhood picky eating and pressure through
35 retrospective self- and parent reports. Hierarchical regression analyses revealed that
36 childhood parental pressure to eat, but not picky eating, predicted intuitive eating and
37 disordered eating symptoms in college students. These findings suggest that parental
38 pressure in childhood is associated with problematic eating patterns in young adulthood.
39 Additional research is needed to understand the extent to which parental pressure is a
40 reaction to or perhaps compounds the development of problematic eating behavior.

41 *Keywords:* Picky Eating, Avoidant Eating, Intuitive Eating, Eating Behavior, Pressure,
42 Disordered Eating

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70 eating prevalence remains stable across childhood and can take a chronic course,
71 sometimes persisting into adulthood (Kaur et al., 2015; Marchi & Cohen, 1990; Mascola,
72 Bryson, & Agras, 2010; Wildes et al., 2012). Picky eating and disordered eating in adults
73 appear to be separate but often comorbid conditions, with disordered eating groups
74 showing a higher level of clinical impairment and picky eating groups displaying higher
75 levels of social eating anxiety (Wildes et al., 2012). Longitudinal research has partially
76 supported the notion that childhood picky eating is predictive of disordered eating
77 psychopathology in young adulthood (Kotler, Choen, Davies, Pine, & Walsh, 2001;
78 Marchi & Cohen). Adults who identify as picky eaters have poor quality dietary intake,
79 and qualitative research indicates that these adults feel “unique” in their eating behaviors
80 and are often criticized for their “odd” eating choices (Blake, Bell, Freedman,
81 Colabianchi, & Liese, 2013; Blake & Bisogni, 2003). Furthermore, these adults often
82 attribute their pickiness to aversive childhood events and are frequently dissatisfied with
83 their picky eating (Blake & Bisogni, 2003).

84 Cross-sectional and longitudinal studies report that parental pressure to eat is
85 correlated with higher levels of childhood picky eating, lower levels of food intake, and
86 lower weight in children (Farrow & Blissett, 2008; Ventura & Birch, 2008). Using an
87 experimental approach, researchers showed that even mild encouragement to eat resulted
88 in increased negative affective responses, lowered preference for the target food, and a
89 reduced rate of targeted food intake over time (Galloway, Fiorito, Francis, & Birch, 2006;
90 Galloway, Fiorito, Lee, & Birch, 2005). Research has shown that children who received
91 higher levels of parental pressure to eat were more likely to limit their food intake, eat in
92 response to external factors such as emotion, and lack attention to hunger and satiety cues

93 (Carper, Fisher, & Birch, 2000; Strein & Bazelier, 2007). More recently, it has been
94 documented that negative feeding practices appear to have a direct influence on
95 children's eating behavior, rather than simply being a reaction to eating behavior that
96 parents perceive to be undesirable (Kiefner-Burnmeister, Hoffmann, Meers, Koball, &
97 Musher-Eizenman, 2014). Research on the outcomes of childhood parental pressure is
98 limited, but a retrospective study found that 70% of college students recalled a forced
99 consumption episode during their lifetime (Batsell, Brown, Ansfield, & Pashall, 2002).
100 Moreover, students who did so were more likely to be picky eaters in adulthood and were
101 more likely to be restrictive in their current eating behaviors than those who did not recall
102 a forced consumption episode.

103 Intuitive eating is an innate adaptive eating style characterized by eating in
104 response to internal cues of hunger and satiety. It is theorized that individuals who are
105 conscious of these internal cues will satisfy their internal hunger cravings in a natural,
106 nutritious, and non-restrictive way (Smith & Hawks, 2006; Tylka, 2006). Intuitive eaters
107 have higher psychological health indicators and physical health indicators including
108 improved dietary intake and healthy eating behaviors (e.g., eating breakfast; Dyke &
109 Drinkwater, 2013; Tylka, 2006). Intuitive eating may become disrupted by poor parental
110 feeding practices and individual dietary restraint (Herbert, Blechert, Hautzinger,
111 Matthias, & Herbert, 2013; Tylka, 2006). Retrospective accounts of parental food
112 monitoring and restriction in childhood has been linked to low intuitive eating in young
113 adults, and intuitive eating appears to be inversely related to disordered eating behaviors
114 (Denny, Loth, Eisenberg, & Neumark-Sztainer, 2013; Galloway, Farrow, & Martz, 2010;
115 Tylka, 2006).

139 mailed a questionnaire to a parent to complete and return to the researchers. Students
140 from the US and UK received class research credit, and US parents were given the
141 opportunity to win a \$50 gift card to a hardware store. After completing the
142 questionnaire, students in the US had their height and weight measured privately by a
143 trained research assistant in a separate room. Participants from the UK self-reported
144 height and weight measurements. After completing the questionnaires, the students
145 addressed envelopes so the researchers could mail questionnaires to their parents.

146 **Measurements**

147 **Background information.** Students provided demographic information and
148 indicated with whom the student lived as a child and now while at college. Parents
149 reported their height, weight, level of education, and occupation, in addition to answering
150 questions regarding the child's feeding history in middle childhood (ages 5-10). Body
151 Mass Index (BMI) was calculated from either measured or self-reported height and
152 weight.

153 **Pressure to eat.** Parents completed a retrospective version of the Child Feeding
154 Questionnaire (CFQ; Birch et al., 2001) that assesses controlling feeding practices. The
155 current study used only one of its three subscales: parental use of pressure to influence
156 their child to eat. The CFQ was adapted from present to past tense to be used
157 retrospectively. The 4-item pressure to eat subscale on the CFQ is scored using a 5-point
158 Likert scale for each item, and a total score is calculated by taking the mean, with higher
159 scores indicating higher levels of controlling feeding practices. Parents were encouraged
160 to recall their feeding practices at the time when their child was 5-10 years old. Parents'

161 pressure to eat scores demonstrated internal consistency appropriate for research purposes
162 ($\alpha = .76$).

163 Students also completed a retrospective version of the Kids' Feeding
164 Questionnaire for Children (KFQC; Carper et al., 2000), which measured their
165 recollections about their parents' controlling feeding practices when they were younger.
166 The current study used only one of its three subscales: parental pressure to eat, comprised
167 of seven items. The KFQC uses 5-point response items that range from (1) never to (5)
168 always, with higher scores indicating higher levels of parental control. The KFQC has
169 shown predictive validity for restrained eating and emotional eating (Carper et al., 2000).
170 Because the original KFQC was designed for use with young children, it was modified
171 for use with these college student participants. Students were prompted to "Think back to
172 when you were a child and your experience with food and eating. Please complete the
173 following questionnaire with the person in mind who was most often responsible for
174 feeding you." The KFQC pressure subscale demonstrated appropriate levels of reliability
175 in this study ($\alpha = .76$).

176 An overall pressure to eat variable was created from the two retrospective reports
177 of pressure described above. Students' self-reports of pressure were averaged with
178 parents' reports of pressure to create a single aggregated measure of pressure to be used
179 in the analyses for this study.

180 **Picky eating.** Parents completed a picky eating scale that has been used in
181 previous studies on childhood picky eating and has acceptable internal consistency ($\alpha =$
182 $.85$; Galloway et al., 2005; Galloway et al., 2003). The scale includes three items
183 designed to capture the parent's retrospective perceptions on their child's willingness to

184 eat during mealtimes. The items include: (1) “My child’s diet consisted of only a few
185 foods”; (2) “My child was unwilling to eat many of the foods that our family ate at
186 mealtimes”; and (3) “My child was fussy or picky about what he/she ate.” Each item is
187 measured on a 5-point Likert scale, with higher scores representing a higher level of
188 pickiness. Parents were asked to retrospectively report on their college student’s eating
189 behavior during middle childhood. The pickiness subscale in this study showed high
190 internal consistency ($\alpha = .88$).

191 **Intuitive eating.** The Intuitive Eating Scale (IES, Tylka, 2006) is a 21-item
192 questionnaire developed to serve as a measure for adaptive eating that consists of three
193 subscales comprised of seven items each: unconditional permission to eat, eating for
194 physical reasons, and reliance on signs of hunger/satiety. Total scores or subscale scores
195 may be derived from this instrument, but only total scores are used in the present study,
196 with higher scores indicating more intuitive eating and positive eating behaviors. The IES
197 has demonstrated strong construct validity and test-retest reliability (Tylka, 2006). The
198 IES was completed by the college student participants. The total IES score demonstrated
199 strong internal consistency in this study ($\alpha = .90$).

200 **Disordered eating.** The Eating Disorder Inventory (EDI-2) is a questionnaire that
201 measures psychological and behavioral traits historically associated with eating disorders.
202 It has high test-retest reliability indicating an acceptable stability over time (Andreas &
203 Thomas, 2006) and can be used as a screening tool for eating disorders (Nevonen &
204 Broberg, 2001). The current study used two of its eight subscales: Drive for Thinness and
205 Bulimia. College student participants responded to the two EDI-2 subscales on a 6-point
206 Likert scale ranging from “always” to “never.” We used untransformed (6-point) scaling,

207 which has demonstrated increased stability and reliability of the measure when using the
208 EDI-2 in nonclinical samples (Eklund, Paavonen, & Almqvist, 2005; Schoemaker, van
209 Strien, & van der Staak, 1994). Both the mean item scores and the mean sum scores were
210 calculated, with higher scores indicating more disordered eating. In this study, the EDI-2
211 demonstrated strong internal reliability on both the Bulimia ($\alpha = .80$) and Drive for
212 Thinness subscales ($\alpha = .91$).

213 **Data Analysis**

214 Descriptive statistics were calculated for each of the variables included in the
215 regression analysis along with other demographic information. A Total Pressure variable
216 was created to gain a fuller perspective of pressure by combining the student and parent
217 pressure scores and then calculating the mean. Preliminary Pearson correlations were
218 then calculated to examine the relationships between picky eating, pressure to eat and
219 BMI. Independent sample t-tests were used to explore whether there were significant
220 gender differences between males and females on pressure to eat, picky eating and BMI.

221 Three hierarchical regression analyses examined whether pressure to eat and
222 picky eating, as well as the personal characteristics of BMI and gender, were predictive
223 of each of the three eating-related outcomes: intuitive eating, bulimia, and drive for
224 thinness. The primary focus of this study is on the unique effects of childhood pressure
225 and picky eating on eating-related outcomes in young adulthood; therefore, these two
226 predictors were included first in the regression analyses. We were also interested in
227 examining a possible moderating effect between these two related constructs, so a simple
228 multiplicative interaction term was entered in the regression following the main effects of
229 pressure and picky eating. However, because important demographic variables such as

230 BMI and gender are often related to both positive and negative eating behaviors, we
231 sought to understand their role by entering BMI and gender as final steps in the
232 hierarchical regressions to examine their effects on the resulting models. Therefore, each
233 of the three regressions included five steps with the following variables added as
234 predictors: 1) the main effect of pressure, 2) the main effect of picky eating, 3) the
235 interaction between pressure and picky eating, 4) student BMI, and 5) student gender.
236 Following the analysis for intuitive eating, the same hierarchical predictors were also
237 analyzed to examine Bulimia and Drive for Thinness outcome variables. The mean item
238 scores for the EDI subscales were used in the regression analysis. The proportion of
239 variance explained and standardized regression coefficients (β) for each step of the
240 hierarchical regression models are shown in Table 2.

241 A post-hoc power analysis was calculated using G*Power to determine the power
242 of our current sample of 170 participants for a linear multiple regression. For an effect
243 size of $R^2 = .18$, with five predictors, and error probability of $p < .05$, we were able to
244 achieve a power of 0.99 with the current sample size (Faul, Erdfelder, Buchner, & Lang,
245 2010).

246 Results

247 Descriptive characteristics of the student-parent dyads ($n = 170$) are presented in
248 Table 1. There were some missing data on the reporting of parent gender ($n = 29$) but the
249 majority of reporting parents were mothers (132 mothers; 9 fathers) Correlations among
250 the predictor variables revealed a significant positive relationship between childhood
251 picky eating and recollections of pressure, $r(170) = .28, p < .01$. There was no significant
252 relationship between current student BMI and childhood picky eating or pressure, $r(170)$

253 = .00, $p = .99$ and $r(170) = -.12$, $p = .12$, respectively. Independent samples t -tests
 254 indicated there were significant differences in the picky eating scores between men ($M =$
 255 1.95 , $SD = 1.13$) and women ($M = 2.36$, $SD = 1.26$); $t(168) = 1.99$, $p < .05$, indicating that
 256 parents were more likely to identify daughters as picky eaters. There was not a significant
 257 difference for pressure between men ($M = 2.61$, $SD = 0.53$) women ($M = 2.62$, $SD =$
 258 0.75), $t(168) = 0.09$, $p = .92$, or for student BMI between men ($M = 24.54$, $SD = 4.94$)
 259 and women ($M = 23.71$, $SD = 4.53$), $t(168) = 1.06$, $p = .29$.

260

261 Table 1

262

263 *Descriptive Statistics for the Measures Used*

264

	Mean (SD)
Student Age (years)	19.75 (1.99)
Parent Age (years)	48.26 (5.87)
Parent BMI (kg/m ²)	27.71 (8.87)
Student BMI (kg/m ²)	23.95 (4.66)
Underweight (1.2%)	
Normal Range (68.6%)	
Overweight (21.9%)	
Obese (8.3%)	
Picky Eating	2.25 (1.24)
Parent Recollected Pressure	2.75 (0.73)
Student Recollected Pressure	2.49 (1.01)
Total Pressure Composite	2.62 (0.69)

Intuitive Eating	3.36 (0.61)
EDI Bulimia	2.02 (0.77)
EDI Drive for Thinness	3.08 (1.30)

265 *Note.* Picky eating, pressure, and intuitive eating were scored on a 5-point scale, and EDI
 266 bulimia and EDI drive for thinness were scored on a 6-point scale, and mean item scores
 267 are presented in the table. Mean sum scores were also calculated (EDI bulimia = 12.51,
 268 $SD = 4.82$; EDI drive = 21.52, $SD = 9.03$). BMI classification cutoff points were < 18.50
 269 = underweight; 18.50-24.99 = normal weight; 25.00-29.99 = overweight; ≥ 30 = obese.
 270

271 **Intuitive Eating**

272 As outlined in Table 2, in the first step, pressure was a statistically significant
 273 predictor of intuitive eating, but neither pressure nor picky eating were statistically
 274 significant when they were used together in Step 2. However, once BMI was entered as a
 275 predictor in Step 4, pressure was again a significant predictor of intuitive eating.
 276 Furthermore, pressure, BMI, and gender remained statistically significant predictors in
 277 the final model, which explained 24% of the variance in intuitive eating. Female college
 278 students who had higher BMIs and reported higher levels of pressure to eat during
 279 childhood were likely to be low intuitive eaters.

280 **Bulimia**

281 The findings for the regression predicting bulimia mirrored that for intuitive
 282 eating (see Table 2). In the first step, pressure was a statistically significant predictor of
 283 EDI bulimia scores, but neither pressure nor picky eating were significant in Step 2. In
 284 Step 4, pressure again emerged as a predictor and remained significant in Step 5, along
 285 with BMI and gender, demonstrating that female students with higher BMI and more

286 childhood pressure to eat had higher bulimia scores. The final model explained 19% of
287 the variance in bulimia.

288 **Drive for Thinness**

289 Neither pressure nor picky eating were statistically significant predictors of EDI
290 drive for thinness scores (see Table 2); however, the interaction between pressure and
291 picky eating was in Step 3. This interaction remained significant in Step 4 with the
292 addition of BMI, which also emerged as a predictor. However, only BMI and gender
293 remained statistically significant in the final model, demonstrating that women with
294 higher BMI reported a higher drive for thinness. The final model explained 27% of the
295 variance in drive for thinness.

296

297 Table 2

298 *Hierarchical Regression of Eating Behavior Outcomes in College Students*

	Intuitive Eating Scale		EDI ^a Bulimia Scale		EDI Drive for Thinness Scale	
	R ² or ΔR^2	β	R ² or ΔR^2	β	R ² or ΔR^2	β
<i>Step 1</i>	R ² = .029*		R ² = .029*		R ² = .000	
Pressure		-.17*		.17*		.02
<i>Step 2</i>	ΔR^2 = .039*		ΔR^2 = .042*		ΔR^2 = .016	
Pressure		-.142		.130		-.019
Picky Eating		-.103		.126		.130
<i>Step 3</i>	ΔR^2 = .004		ΔR^2 = .016		ΔR^2 = .030*	
Pressure		-.128		.104		-.055
Picky Eating		-.103		.127		.153
Interaction (PRxPE) ^b		-.068		.130		.178*
<i>Step 4</i>	ΔR^2 = .069**		ΔR^2 = .107***		ΔR^2 = .051**	
Pressure		-.167*		.152*		-.022
Picky Eating		-.093		.115		.124
Interaction (PRxPE)		-.050		.107		.162*
BMI		-.265***		.331***		.228**
<i>Step 5</i>	ΔR^2 = .132**		ΔR^2 = .024*		ΔR^2 = .176***	
Pressure		-.198**		.165*		.015
Picky Eating		-.030		.088		.051
Interaction (PRxPE)		.012		.081		.091
BMI		-.302***		.347***		.270***
Gender ^c		.375***		-.160*		-.432***
<i>Final Model</i>	R ² = .244***		R ² = .189***		R ² = .273***	

299 * $p < .05$. ** $p < .01$. *** $p < .001$; β = standardized coefficient300 ^a EDI = Eating Disorder Inventory. ^b PRxPE = Interaction between picky eating and pressure scores. ^c Gender = Female (0). Male (1).

301 **Discussion**

302 The limited research supporting the DSM-5's inclusion of the newer diagnosis of
303 Avoidant-Restrictive Food Intake Disorder (ARFID) in adult populations calls for further
304 study into the stability of picky eating beyond childhood and how picky eating and
305 parental feeding practices in childhood may predict eating behaviors in young adulthood
306 (American Psychiatric Association, 2013; Wildes et al., 2012). The purpose of this study
307 was to examine the recollections of pressure to eat and picky eating in middle childhood
308 as predictors of positive and negative eating behaviors in young adults. We found
309 parental pressure to eat in childhood predicted lower levels of intuitive eating and higher
310 levels of disordered eating behaviors associated with bulimia, but not drive for thinness,
311 in college students. However, childhood picky eating did not predict intuitive or
312 disordered eating.

313 Our findings for pressure support previous research indicating that parental
314 pressure to eat is associated with external, emotional, restrained eating, and disordered
315 eating (Batsell et al., 2002; Carper et al., 2000; Galloway et al., 2006), which is important
316 because parental pressure may have the unintended consequence of disrupting the
317 development of intuitive and adaptive eating styles. These results converge with Loth et
318 al.'s (2014) large correlational study that found a predictive relationship between other
319 parental controlling feeding practices (restriction & pressure) and extreme weight control
320 behaviors in adolescents using parent-child dyads. However, the cross-sectional nature of
321 our findings do not rule out the possibility that problematic eating behaviors prompt
322 parents to use more pressure and that the problematic eating continues into young
323 adulthood.

324 Although the literature has been inconclusive, there is some evidence that
325 childhood picky eaters tend to be of lower weight compared to non-picky eaters (Dovey
326 et al., 2008; Marchi & Cohen, 1990). We found no significant relationship between picky
327 eating in childhood and BMI in young adulthood; however, adult picky eaters have been
328 show to have weight statuses that are comparable to low pathology eaters (Wildes et al.,
329 2012). This lack of relationship could indicate that college students who were picky
330 eaters in childhood and of lower weight tend to reach weight levels more comparable to
331 their peers by young adulthood. Although a lack of variety in their diet may continue to
332 exist, their caloric intake becomes sufficient, which could be accounted for by having the
333 freedom to eat what they want without being confined to the foods prepared by their adult
334 family members.

335 Both BMI and gender were strong predictors of intuitive eating and disordered
336 eating behaviors, with lower versus higher BMIs and being male rather than female
337 associated with more positive outcomes. These results are consistent with previous
338 research in young adults that report similar associations between both gender and BMI
339 and the measures of drive for thinness and bulimia used in the present study (Lewisohn,
340 Seeley, Moerk, & Striegel-Moore, 2002). Considering their strong associations with
341 problematic eating, we included BMI and gender in the model to determine if picky
342 eating and pressure to eat would still predict positive and negative eating behaviors after
343 considering BMI and gender's contribution.

344 Picky eating in childhood did not predict disordered eating behaviors in young
345 adulthood, but recent research indicates that picky eating's long-term implications may
346 have greater pathological impact on social impairment (Wildes et al., 2012). Our findings

347 contradict previous research indicating links between childhood picky eating and young
348 adult disordered eating (Marchi & Cohen, 1990). Some picky eaters' effort to control
349 their food and eating environment or to follow certain food rules that govern what they
350 will eat may contribute to problematic social interactions. This "control" or regulatory
351 issue would also align with our finding that picky eating was not a significant predictor of
352 intuitive eating, considering low intuitive eating is associated with a disrupted ability to
353 internally regulate a response to hunger or satiety (Tylka, 2006). These findings, if
354 replicated, may be useful for practitioners to reassure parents that childhood picky eating
355 is not necessarily a predictor of long-term disordered eating behavior.

356 This study is unique in that it assessed the predictive quality of the interaction
357 between childhood picky eating and parental pressure to eat, and also looked at the
358 previously unexplored relationship between picky eating and intuitive eating. Most eating
359 behavior research focuses on negative outcomes associated with eating behavior;
360 however, understanding the predictors of positive eating behaviors, such as intuitive
361 eating, is important to inform the development of healthy lifestyles.

362 Although it is important to confirm these findings within additional adult
363 populations and utilize longitudinal designs, these data provide evidence that children
364 pressured to eat by their parents may be more likely to develop disordered eating patterns
365 in young adulthood. Due to the cross-sectional design of this study, it may also be
366 possible that children who evoke pressure from their parents tend to go on to engage
367 problematic eating behaviors due to reasons unrelated to parental pressure. Although
368 recent research supports the belief that controlling feeding practices can directly

369 influence child eating behavior, more research is needed to confirm the directionality of
370 this relationship (Kiefner-Burnmeister et al., 2014).

371 Despite these strengths, there are several limitations of the current study. The
372 retrospective nature of the study does not allow us to determine if college students were
373 accurately reporting their experience of being pressured to eat in childhood; however,
374 parental pressure is more overt than other negative parental practices, such as restriction
375 and monitoring, and family members show high reliability when reporting on pressure
376 (Pulley, Galloway, Webb, & Payne, 2014). The retrospective methodology also limits our
377 ability to determine if parental reporting on picky eating and pressure could be a reaction
378 to their child's current eating behaviors. This study utilized self-reported BMI for a
379 subset of participants, and although this approach has shown inaccuracies in comparison
380 to measured BMI in the general population, some research supports its validity in college
381 student samples (Quick et al., 2011; Rowland, 1990). Also, we did not directly obtain the
382 college students' recollection of picky eating and instead relied only on the parental
383 report of picky eating. The generalizability of our study is a further limitation, as our
384 sample was primarily white, female, and in the normal weight range. We do not know if
385 our findings would persist within more diverse populations.

386 While future research may be needed to confirm whether the development of
387 interventions for childhood picky eating is warranted, we believe that the literature
388 supports the need to develop interventions aimed at the reduction of parents' use of
389 pressure as a feeding practice. Recently, more evidence-based strategies are available for
390 parents and practitioners to prevent and treat common non-clinical feeding problems in
391 children. (Holley, Haycraft & Farrow, 2014; Mitchell, Farrow, Haycraft, & Meyer, 2012;

392 Wardle et al., 2003; Wolfenden et al., 2012). Straightforward strategies, such as merely
393 presenting a variety of fruits and vegetables for snacks (Roe, Meengs, Birch, & Rolls,
394 2013) may increase acceptance of fruits and vegetables and could, in turn, reduce
395 mealtime struggles and the use of coercive feeding strategies.

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Highlights

- Examined recollected predictors of adult eating behaviors.
- Parental pressure to eat associated with low intuitive eating in adulthood.
- Parental pressure to eat associated with disordered eating in adulthood.
- Picky eating in childhood did not predict adult eating behavior.
- Results support the need for interventions that promote positive feeding interactions.